Editorial Introduction

Robin Mackay

A new publication is obliged to justify its demands on the attention of a reader already besieged by countless specialist journals. This justification cannot appeal to the orgiastic logic of the filling of market 'niches'. With **Collapse** we have set out to achieve quite the opposite, aiming rather at a breadth and an openness found wanting.

That academic philosophy courts overspecialisation and a certain depression of the energy of thought is news to no-one. Whilst not wishing to denigrate the necessary and exacting work of scholarship, we wished to create a publication which communicated the passion for thought, and the excitement of thinking. The work we present here is unapologetically (and not unnecessarily)

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demanding: we conceived **COLLAPSE** as providing a home for conceptual work in progress, with all the rough edges this might imply.

COLLAPSE is an experimental entity, in that it has no fixed agenda, no institutional ties, no partisan position: nevertheless it will be clear that neither the Editor nor the contributors regard this experimental status as the declaration of an open season for ludic enthusiasms. But as much as we did not wish merely to collate flights of philosophical whimsy, we also sought to avoid grounding ourselves in the 'application' of overgeneralised theoretical tropes to specific issues in pursuit of that most dismal of goals, 'relevance' to the 'contemporary' reader.

What was clear from the start was that the way forward lay in rigorously challenging philosophical thought by confronting it with conceptual production from elsewhere (and not in a presumptuous relation of 'application'): there is no doubt that philosophy only stays alive by maintaining porous boundaries with its outside–this does not detract at all from its specificity and value as a discipline.

If part of the problem with philosophy today lies in its professionalisation, we hope not to offend any of the contributors to this volume by saying that we consider every one of them to be *amateurs* in the true sense: dedicated and enthusiastic lovers of abstract thought, each engaged in adventures of ideas, each refusing to contain these adventures within strict formal or disciplinary boundaries. It should go without saying that, even if the two are rarely found in pure form, we favour *de jure* mad scientists with their bubbling conceptual cauldrons over career academics with their meticulously cautious conference papers.

Finally, we envisage each volume of **COLLAPSE** as the intersection, in a multi-dimensional space, of diverse lines of thought; the optimum circumstance would be if each reader picked up **COLLAPSE** on the strength of only one of the articles therein, the others being involuntarily absorbed as a kind of side-effect that would propogate the eccentric conjuncture by stealth, and spawn yet others.

A note on form: in several of the articles collected in **COLLAPSE I** we have used the interview form, and hope to do so in future. At its best it offers a medium in which the play of concepts takes a natural course and order of exposition, allowing the reader in turn to be swept up by its movement, and to reconstruct its underlying consistency at their leisure and with their own resources. Such an interview should read lightly whilst its spontaneous discursive complexity will be conducive to repeated readings.

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Although we decided early on that eclecticism was neither to be scorned nor feared, a theme emerged, unbidden, during the long process of clarifying the journal's aims and collecting and commisioning work for this first volume. The working title was thus 'numerical materialism': an inquiry into the extent and nature of number's dominion over any philosophy calling itself a materialism; but also an inquiry into the materiality of number and numerical practices. Such a theme describes a realm exemplary in its liminal nature, not only connecting mathematics and philosophy but abutting onto every theoretical discourse with any aspiration to formal rationality.

We are privileged to have amongst our contributors ALAIN BADIOU, widely recognised as one of the most important philosophers alive today, and one who has consistently pursued this line of thought, often against the grain of philosophical orthodoxy. In our interview with Badiou we seek to clarify the consequences of a materialist thought which defines 'nature' through mathematics, determining 'history' in terms of its problematic 'outside'. We also succeed in provoking Badiou into addressing in detail some of the major objections raised against his doctrine, and into elaborating more precisely how he sees mathematics in its relation to other sciences. He also speaks of the new conceptual resources which his latest book *Logiques des mondes* brings to his ongoing work.

Although we have made clear our aspiration for the volume as a whole, this opening interview, together with the contributions of GREGORY CHAITIN and MATTHEW WATKINS particularly demonstrate the sort of conjunction we hope to effect with **COLLAPSE**: it would be difficult to find any other publication in which these could be found together. Here are three thinkers whose differences are not limited to their theoretical decisions but extend to their styles, and their respective conceptions of the nature of their subject. Despite this divergence, a number of common threads means that reading them together produces a combination that is more than the sum of its–already considerable–parts.

To say that GREGORY CHAITIN is well-known in his field would be to tell only half the truth: in fact Chaitin has for many years been something of a gleeful maverick. Whilst there can be no doubt as to his credentials as a 'serious mathematician' Chaitin not only enjoys communicating his mathematical discoveries to a wide an audience as possible, but he also never fails to draw from them (sometimes to the chagrin of fellow mathematicians) the most general speculative conclusions–just as did Leibniz, the very figure invoked in Chaitin's whirlwind review of 'Epistemology as Information Theory'.

Our interview with MATTHEW WATKINS is the very portrait of a thinker who defies categorisation. Watkins's singular talent at explaining complex concepts and his fluid, resolutely non-specialist speculative exploration of their significance makes of this interview a kind of conceptual cinematography, and made conducting it a genuine pleasure. As the engineer of a virtual agency which collects and catalyses material in an area of research which has only recently begun to condense, Watkins exemplifies well what was intended by the provocative subtitling of **COLLAPSE** as a 'Journal of Philosophical Research and Development': thought no longer takes place in the head–if it ever did–but involves the development of distributions and connections, a bio-techno-cognitive rhizome. Watkins also fiercely advocates the virtues of a marginal position which allows him the maximum space for reflection; as well as his substantive work we discuss the experiences formative of this conviction.

Badiou raises the question of the experiment: scientists continually set parameters and contexts for their experiments. Chaitin argues–and Watkins observations seem to support the thesis–that mathematics may also be, or may become, an experimental discipline. In NICK LAND's contribution, the meta-rational orthodoxies of experimental practice are themselves put to the test. Can the interrogation by an exotericised qabbalistics of the lexicographical element in which we are inscribed be denied the status of a science on the basis of utilitarian criteria? A delirious alphanumeric arithmetic…

The liberal media, with its indefatigable good intentions, has continually sought wholly to separate the ideology of terrorism from the tenets of a (poorly-defined) 'true' Islam. Whilst leaving no doubt as to the contingency of the circumstances, in his article for **COLLAPSE I** REZA NEGARASTANI describes the mutation, hybridisation and militarization of certain components of Islamic thought. The mongrel nature of this terrible conceptual assemblage makes it all the more remarkable that Negarastani ultimately refers it to a mathematical model; a veritable *mathesis* of fear.

The psychoanalyst and philosopher Lacan famously described his project as being that of a 'mathematisation of the unconscious'–a research programme that ended, if not in madness, certainly in an obscurity which endures to this day. In his 'Mathematics of Intensity' THOMAS DUZER picks up some of the threads of this project, inflecting it with an affirmative stance which militates against much of the psychoanalytical inheritance.

NICK BOSTROM heads an intriguing new research initiative where philosophical thought is put to work on issues formerly the quarry of inconsequential media panics and politicians platitudes; issues of truly unimaginable magnitude. Whilst such initiatives are no doubt to be applauded, we were interested to explore in our interview with Bostrom not only the work of his *Future of Humanity Institute* but also to ask whether philosophical thought must make compromises in order to break its traditional academic bonds.

KEITH TILFORD's graphical work draws on philosophical debates in poststructuralism: his 'crowd' drawings evoking especially the ongoing debates over the nature of multiplicity and individuation. 'INCOGNITUM' not only relates some intriguing details of numerical-cultural archaology, but has also compiled for us a selection of source materials in the shape of ABJAD diagrams. It was always our intention that **COLLAPSE** should not be purely textual, which makes these last two contributions are especially welcome.

It remains only to thank the contributors for their work and their patience during the assembling of this volume; and the reader for supporting this new venture.

In relating so expansively our aspirations for **COLLAPSE**, we do not dare to hope, nor do we mean to claim, that this first volume fulfills them all. At least the experiment is now underway; the Editor welcomes your responses and contributions for future volumes.

Robin Mackay,
Oxford, August 2006.

Philosophy, Sciences, Mathematics

Interview with Alain Badiou

Alain Badiou's radical equation of ontology–the traditionally philosophical 'account of being'–with mathematics claims to free philosophy for its contemporary task of interrogating the relation between the being which mathematics describes, and the events whose very 'impossibility' structures that being.

In the corollary distinction between the mere 'veridicality' of knowledge and the hazardous revolutionary decisions which found new truths, and in Badiou's account of the work of founding and remaining faithful to truth-procedures–in which humans finally become subjects–are rightly discerned a truly novel configuration of political thought.

However Badiou is also a penetrating and formidably knowledgeable philosopher of science and mathematics; and his meticulous dedication to following these disciplines' own 'truth procedures' has informed his work from the very beginning of his philosophical career through to 2006's Logiques des mondes[1].

Collapse asks Badiou to expand on the articulation of philosophy, mathematics and science his 'mathematical ontology' assumes; and what its consequences might be for the 'other' sciences.

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[1] Alain Badiou, *L'être et l'événement, tome 2: Logiques des mondes.* Paris:Seuil, 2006.

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Collapse: In an interview with Peter Hallward published in 1998, you say:

> In the last instance, physics, that is to say the theory of matter, is mathematical. It is mathematical because, *qua* theory of the most objectivised strata of the presented as such, it is concerned with being *qua* being in its mathematicity."[2]

If mathematics as science of being *qua* being provides scientific access to the presented, does that mean that mathematics provides the paradigm of 'scientificity'? And are we to understand that the degrees of objectification of what is presented ('being') correspond to degrees of mathematisation of scientific discourse?

Alain Badiou: It is undoubtedly more complicated than that. We must begin again from the distinction, which I have fully developed in *Logiques des Mondes*, between being and being-there, or between being and appearing. A world is structured not only by the pure multiples which appear in it (which 'are' in it), but by the logical organisation of that world, what I call its transcendental. So that every particular figure of what, in the 1998 interview, I called the 'presented', is the intersection of two formal rationalities. I propose to call "mathematical" ontological rationality–that rationality which concerns being *qua* being, that is, the indifferent multiple. Phenomenological rationality–that which concerns being *qua* appearing in a world–I call 'logical'.

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[2] 'Politics and Philosophy: An Interview with Alain Badiou' *Angelaki: Journal of the Theoretical Humanities,* Vol.2, No.3, 1998, p. 127.

Of course, this logic is itself mathematicised, as is every logic today. But the distinction remains, a distinction whose criteria I have proposed in several of the texts included in *Court traité d'ontologie transitoire*[3]. We can say ultimately that a kind of objectification, a becoming-object, of pure being is inscribed within a singular correspondence between mathematics and logic–which ultimately means: between set-theory and Topos-theory. It being understood that these *Topos* realise a transcendental indexation of multiples to a sort of intensity evaluator, which in the current state of science, might be a complete Heyting algebra–for which English logicians have found the inspired name (since it effectively concerns the 'site' of being) of 'locale'.

So we cannot simply say that objectification is proportional to mathematicity. The new concept that I propose of what an object is ('object' is a key concept in *Logiques des mondes*) combines a purely mathematical element and a transcendental element which relates to the singularity of the world within which the object figures.

C: Readers of your work might be forgiven for suspecting that you hold physics in far higher regard than biology, that 'wild empiricism disguised as a science'[4].

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3. Paris:Seuil, 1998. Translated by Norman Madarasz as *Briefings on Existence: A Short Treatise on Transitory Ontology*. NY: State University Press, 2006.

4. Mathematics and Philosophy: The Grand Style and the Little Style' *Theoretical Writings*, eds. R. Brassier and A. Toscano, London: Continuum, 2004, p. 16.

There follow two further series of questions from this.

Firstly, concerning the relations between your ontological 'Platonism' (given that the latter effects an unexpected transformation of orthodox Platonism) and epistemological 'foundationalism' or 'reductionism'.

Secondly, the relation between your Platonic/Cartesian 'rationalism' and the 'naturalism' of contemporary cognitive science which inquires into the genesis of intelligence; an inquiry whose ultimate ambition is perhaps the reinscription of rationality itself (and hence of mathematical intelligence) within the domain of natural being (if not biology *stricto sensu*).

(1) If you advocate a 'foundationalist' view on the unity of 'Science', with the set-theoretical axiomatic at the base, then mathematical physics, chemistry, biology, etc. embedded one after another on successive strata according to a decreasing order of 'mathematicisation', do you think that this unity requires the reducibility of these sciences either to physics, or even to mathematics in the last instance?

And do you consider physical phenomena to be more 'fundamental' than biological phenomena because of these decreasing degrees of 'mathematicisability'? If so, don't you run the risk of making the coherence of science depend ultimately upon the reducibility of superstructures to an infrastructure, whether physical or mathematical? As you know, this idea of reduction remains highly problematic even within the natural sciences (for example the well-known difficulties concerning the reduction of 'emergent' properties).

Or is it rather that this 'foundationalist' and 'reductionist' perspective only holds for you within mathematics, that is to say for the relations between set-theory (or category-theory) and other mathematical domains?

(2) In *Being and Event*[5], you say that the thesis affirming the identity of mathematics and ontology is 'a thesis not about the world, but about discourse.'[6] No 'Pythagorism', then. On one hand, it might seem that this thesis claims to undo all the false problems engendered by the empiricist presupposition of a representational relation between discourse, or science, and reality; but, on the other, can we content ourselves merely with 'sublating' the difference between discourse and reality *within* a discourse (which, in Being and Event, remains 'metaontological' or philosophical rather than 'ontological' in the strict sense) without falling into absolute idealism?

How can we account for the position of mathematical and scientific 'discourse' given that, for you, the latter is not fundamentally linguistic, and so is not merely an artefact of cultural provenance; nor a natural and/or divine faculty, as intellectual intuition would be?

Don't the Darwinian revolution and the emergence of cognitive science as a natural science treating reason as a material phenomena–even if the 'materiality' in question is perhaps not simply neurobiological–oblige us at least to try to take account of this scientific and mathematical 'discursivity'?

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[5] Alain Badiou, *L'être et l'événement.* Paris:Seuil, 1988. Translated by Oliver Feltham as *Being and Event.* London: Continuum , 2005.

[6] *Being and Event*, Introduction.

And in this regard, could it be that the 'sciences of complexity' or 'self-organisation', which try to apply mathematical modelling techniques to complex phenomena–vital, social, cultural, or even (above all) cognitive–could reduce the gap that you posit in *Being and Event* between the transitivity of natural sets, that is to say the homogeneity of nature, and the discontinuity of cultural situations, that is to say the heterogeneity of history? Wouldn't this ultimately be a way of assuring a maximum coherence between sciences and the science of being without the need for the impracticable ideal of reduction? Or does such a perspective seem far too Deleuzian-vitalist to you?

AB: First of all I would like to say that my perspective is not in the least 'foundationalist' or reductionist. From the ontological dimension of mathematics I draw no conclusion as to its superiority, its capacity to found the other sciences, or their status as the 'basis' for all scientificity. I say only that mathematics are the rational discourse on being *qua* being, or on the indifferent multiple thought as such.

Now, as you know, for me, a concept as general and essential for all thinking of the sciences as that of truth is not at all reducible to ontology as such. We must even admit that it explicitly contradicts certain of its formal axioms, just as Lucretius's clinamen contradicts the major axioms of atomist and materialist ontology.

In fact, I have often compared the absolute hazard of the event, subtracted as it is from the general determinations of being, to this clinamen, required for the assemblage of atoms to be thought as generic truth of worlds.

From all this, it follows simply that mathematics is a necessary formal dimension of all scientific discourse, if we understand by 'science', for the moment, the rational theory of those phenomena in the world which do not depend directly upon the conscious activity of man. Those phenomena pertaining, if you like, to the 'fossil argument', whose implacable rigour Quentin Meillassoux has deployed against every form of correlationism, or of the constitutive primacy of consciousness.[7] The mathematical exigency is formal, in so far as it supports, as to the intelligibility of these phenomena, their most abstract and most general strata, that which relates to their pure being, to their multiple composition. But, precisely, this strata cannot, in my view, represent that which is strongest and most 'true' in those sciences which are not purely mathematical. Take physics: the most elementary axioms of modern mathematical physics, let's say the principle of inertia as given by Galileo's formula, are not at all reducible to mathematical statements, even if they are obliged to take that form. A crucial point about physics is to present, to create concepts, so that they can be mathematically expressible, all the while retaining a relation to the world which means that they cannot be deduced from any mathematical corpus whatsoever. This is the case with the concept of uniform movement in the principle of inertia. Moreover, it is this irreducible worldly dimension which opens onto the possibility of experience, at the same time as mathematical formalisation guarantees the universality of experimental results, in the form of their always-possible repetition. All this, in my view, was thought in the most subtle and decisive fashion by Bachelard, and it is a great shame that anglophone epistemology has done such a thorough job of neglecting his work.

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[7] *See* Quentin Meillassoux, *Après la finitude : Essai sur la nécessité de la contingence.* Paris:Seuil, 2006

So: I neither believe that physics is 'reducible' to mathematics, nor do I believe that mathematics 'founds' physics. Between the two, there is a rooting of concepts in a determinate world, which the experimental method designates and delimits, in a gesture which is of a transcendental nature.

Nor do I have any reason to think that physics 'founds' biology, still less that mathematics could do so. That biology, to say nothing of the 'human sciences', are still not sciences, does not result from the fact that they are not yet in a position to propose mathematical formalisms appropriate to experimentation. This formal deficiency is only a secondary symptom. The root of the problem is that their concepts are wholly insufficient, that they fail completely to present the phenomena concerned in the register of eternal truths.

In the case of biology, the possible founding intuitions all go back to Darwin. Mendel's experimental expertise opened another path, albeit one that is limited unless it is inscribed in the vast Darwinian innovation, which no-one to this day has succeeded in doing, unless it be in pre-conceptual approximations, purely rhetorical combinations of chance and necessity. The veritable conceptualisation of all this is yet to come. Naturally, there exist within this domain countless instances of knowledge, which are translated into remarkable technical skills, particularly in the medical field. But there is no science. To turn this domain into a science, some unforeseeable events would be required, a second post-Darwinian foundation, whose shape we cannot anticipate. In the meantime, we can say that there exist two sciences which cannot be hierarchised: ontology, or pure mathematics, and physics, the science of those worlds accessible to our experience.

As for cognitive science, I would like to make three remarks. Firstly, it is a programme rather than a theory. Even more so than biology, it is just a mass of facts and techniques, devoid of concepts or adequate formalisms. The truth is that we remain totally ignorant as to the real functioning of the brain. From what I know of the current state of research in cognitive science, I feel justified in concluding that, despite an impressive technical arsenal, it is no more advanced in its understanding of the phenomena than was Gall's phrenology, at the time when Hegel said the latter thought it had proved that 'spirit is a bone'. Today we think we have proved that thought is a neuron…Cognitive science is hardly further advanced than the theory of cerebral localisations in Broca, even if the active zones appear today in bright colours, displayed directly onto screens.

Secondly, that human intelligence should be a 'material' phenomenon is in my eyes a mere truism. What else could it be? I am, if this is the issue, completely monist. I do not think that any principle of being can 'double' indifferent multiplicities. What's more, I always speak of the 'human animal' when speaking about us, including even our most sophisticated cognitive activities.

And this leads me to the third point. Let me repeat: the fact that intelligence, as a faculty, is a material assemblage is self-evident and of no interest. However, that the question of truths relates to intelligence, or to the 'cognitive' in general, is a philosophical (not at all a scientific) statement, and a statement I believe to be completely false. *Qua* generic localised process, a truth is not at all reducible to anything whatsoever which takes the form of a human capacity or property, in the sense of the human animal.

To claim that it does is to remain within the legacy of Aristotelianism, Kantianism and analytic philosophy, which would locate truth in the form of judgment, with the latter in turn being a product of cognitive mechanisms. Whereas, as the other tradition saw–the Platonic, Cartesian, Hegelian tradition–a truth cannot be encapsulated in the form of judgment at all. It is a complex process, completely transcendent to the mere animal capacity of cognitive judgment. In my own conception, this process combines, ontologically, the possibility of generic multiplicities, and phenomenologically, the intraworldly constitution of post-evental bodies (in fact, of sheaves, in the modern algebraic sense, sheaves which 'rise' from the transcendental logic of worlds towards the objective multiplicities engaged in the procedure).

Since every truth is in-human, we can hardly hope to understand its genesis by poking around in the neurons of our brains!

I would like to add that to reduce thought to nature is in general a tautology, or a contradiction. If you understand by 'nature' the material state of all that is, it is a tautology: thought is certainly a part of that state. If you understand by 'nature' that which, precisely, pre-exists all thought, then it is a contradictory reduction.

C: Finally, two questions bearing principally on your *Le Nombre et les nombres*[8] . The distribution of prime numbers appears to be one of the irrecusable 'ontological' characteristics arising immediately from the construction of the natural numbers, but to this day it has proven resistant to our understanding. The Riemann Hypothesis suggests that complex numbers provide a refractory element through which it becomes possible to understand the prime distribution as a type of order. If we are to speak of ontology in this context, doesn't this oblige us to extend ontological dignity to complex numbers? But when you speak of number, you explicitly exclude complex numbers, along with quaternions, from the properly ontological domain[9].

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[8] Alain Badiou, *Le Nombre et les nombres.* Paris:Seuil, 1990.

Historically, the affirmation of complex numbers *as* numbers, with all the consequences which followed, would seem indeed to be an example of a mathematical 'event'. Yet you reject it on the basis of its supposed intimate relation with geometry.

Now, even if (as is undoubtedly the case) it is precisely the geometrical and diagrammatic aspect of the complex plane which has inspired mathematicians and physicists, it is possible to conceive them independently of this usage. However, must we not consider the implication of physics, mathematics and geometry (or more generally, the diagram) from which the incontestable power of the complex plane arises?

It seems that the prime distribution is a profound mystery concealed within the apparently simple: the series of natural numbers. Alain Connes, among others, suggest that the apparent obscurity of the Riemann Hypothesis stems from as-yet uncomprehended aspects of the relation between simple addition and multiplication.[10]

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[9] *Le Nombre et les nombres,* Ch. XVI, n.5

Meanwhile, recent work indicates astonishing consonances between the theoretical models of physics and Riemann's zeta function[11]. This seems to suggest, again, that the relation between mathematics and physics is not simply hierarchical, and furthermore, that the most fundamental ordering mechanisms in the universe do not necessarily coincide with our most analytically elegant accounts of order.

So where does the ontological begin and end? If we apply your criteria of ordinal linearity, don't we risk a premature foreclosure of ontology in the interests of elegance and philosophical taste, whilst rejecting the structures of the real–sometimes of an intimidating complexity, refractory to all intuition, such as Connes' adele–but which, from a point of view which we might call abstract-empirical, are imposed upon us by fundamental research in the domains of theoretical physics and mathematics?

AB: We must immediately correct a misinterpretation, perhaps owing to ambiguities in my writing, but no less massive for that: I have never thought that numbers were the highest form of ontological 'dignity'! Even less have I underestimated the mathematical–and thus ontological–importance of complex numbers, of diagrams, of topology! Absolutely not! I even argued with Deleuze

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10,11. See 'Prime Evolution', in the current volume.

on this point, in our unpublished correspondence. He held that in 'reducing' multiplicities to sets, I reduced them to numbers. I replied to him that if numbers are all, in their being, sets, it would be quite wrong to conclude that all sets are numbers. The innate resources of set-theoretical multiplicity vastly exceed the concept of number.

As for complex numbers, I simply meant that they are exterior to the simple concept of number, which, in the sense I use it, includes order, comparison, and the notion of 'larger' and 'smaller', even when numbers are infinitely large or small. The fact that the field of complex numbers is not be an ordered field justifies this exclusion. Far from indicating a lack of dignity in complex numbers, this exclusion amounts to a further limiting of the properly numerical domain, and hence of further separating it from the ontological domain in its full extension. That complex numbers are sets, and hence thinkable as such in their being, is evident: it is a question, as we know, of the set of ordered pairs of real numbers.

I would like to add that when I say that the concept of number cannot be geometrical I am in no way–*heaven forbid!*–speaking against geometry! I have always indicated, from *Théorie du sujet*[12] onward, that the mathematical dialectic is that of algebra and topology, or, if one is Greek, arithmetic and geometry. And I know very well that today the most profound mathematics operates at the level of algebraic topology, a structural combination of the two great components of historical mathematics. And in fact this is the register frow which my new concepts ('transcendental', 'object', 'relation', 'evental field') draw their force. The results you mention which clarify number theory on the basis of the geometry of the complex plane or of highly sophisticated Analysis, perfectly illustrate this point.

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[12] Alain Badiou, *Théorie du sujet.* Paris: Seuil, 1982.

But I do not speak of the mathematics of numbers in *Le Nombre…*, but only of what philosophy might draw from contemporary mathematics as to what a generic concept of Number might be.

Meanwhile, let us note that mathematicians always prefer, in arithmetic, an 'elementary' demonstration to one that is not. And what is an 'elementary' demonstration? An immanent demonstration, more or less directly derivable from the concept of whole number, and the rules of its operational domain.

In this regard, I agree with Connes: the heart of the question of prime numbers is that the operational dialectic of multiplication and addition, however perfectly clear from the axiomatic point of view, has yet to arrive at its true concept. There is there a deficiency of thought on the algebraic side. That this opacity might be overcome by the diagrammatic or geometrical aspect is quite possible.

My own approach clearly shows that what is opaque in numbers is not at all their definition, which, as I believe I have demonstrated, is very simple, even if you take the most gigantic numerical domain. What is obscure lies on the side of operations. Now, the concept of 'prime number' is a typically operational concept. To which we must add that it is largely negative (to not be divisible by any number other than itself or unity). I would be happy to propose the following heuristic principle: in pure mathematics, what is most difficult is always linked to a restriction (and thus to a negation) of operational capacities.

I will conclude by giving you a very simple account of physics' retroaction upon mathematics. There is nothing unusual about this: presented with the mathematical formalisation of concepts which only make sense in relation to a world which is not that of pure mathematics (concepts such as: 'movement', 'speed', 'light', and so on), physics requires of mathematics a sort of internal torsion, which introduces into its world (for it is a singular world) pure conceptual analogies with that which, initially, does not belong in this register. The clearest contemporary example is undoubtedly provided by quantum group algebra, a totally abstract and very exacting discipline, which would neither have existed, nor found its name, without quantum physics.

Translated by Robin Mackay and Ray Brassier

Epistemology as Information Theory: From Leibniz to Ω

Gregory Chaitin

The following text was originally delivered as the Alan Turing Lecture on Computing and Philosophy at E-CAP '05, the European Computing and Philosophy Conference, at Mälardalen University, Västerås, Sweden in June 2005.

INTRODUCTION

I am happy to be here with you enjoying the delicate Scandinavian summer; if we were a little farther north there wouldn't be any darkness at all. And I am especially delighted to be here delivering the Alan Turing Lecture. Turing's famous 1936 paper is an intellectual milestone that seems larger and more important with every passing year. People are not merely content to enjoy the beautiful summers in the far north, they also

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want and need to understand, and so they create myths. In this part of the world those myths involve Thor and Odin and the other Norse gods. In this talk, I'm going to present another myth, what the French call a *système du monde*, a system of the world, a speculative metaphysics based on information and the computer.[1]

The previous century had logical positivism and all that emphasis on the philosophy of language, and completely shunned speculative metaphysics, but a number of us think that it is time to start again. There is an emerging digital philosophy and digital physics, a new metaphysics associated with names like Edward Fredkin and Stephen Wolfram and a handful of like-minded individuals, among whom I include myself. As far as I know the terms "digital philosophy" and "digital physics" were actually invented by Fredkin, and he has a large website with his papers and a draft of a book about this. Stephen Wolfram attracted a great deal of attention to the movement and stirred up quite a bit of controversy with his very large and idiosyncratic book on *A New Kind of Science*.

And I have my own book on the subject, in which I've attempted to wrap everything I know and care about into a single package. It's a small book, and amazingly enough it's going to be published by a major New York publisher a few months from now. This talk will be an overview of my book, which presents my own personal version of "digital philosophy," since each of us who works in this area has a different vision of this tentative, emerging world view. My book is called *Meta Math!*, which may not seem like a serious title, but it's actually a book intended for my professional colleagues as well as for the general public, the high-level, intellectual, thinking public.

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[1] One reader's reaction (GDC): "Grand unified theories may be like myths, but surely there is a difference between scientific theory and any other narrative?" I would argue that a scientific narrative is more successful than the Norse myths because it explains what it explains more precisely and without having to postulate new gods all the time, i.e., it's a better "compression" (which will be my main point in this lecture; that's how you measure how successful a theory is).

"Digital philosophy" is actually a neo-Pythagorean vision of the world, it's just a new version of that. According to Pythagoras, all is number – and by number he means the positive integers, 1, 2, 3, . . . – and God is a mathematician. "Digital philosophy" updates this as follows: Now everything is made out of 0/1 bits, everything is digital software, and God is a computer programmer, not a mathematician! It will be interesting to see how well this vision of the world succeeds, and just how much of our experience and theorizing can be included or shoehorned within this new viewpoint.[2]

Let me return now to Turing's famous 1936 paper. This paper is usually remembered for inventing the programmable digital computer via a mathematical model, the Turing machine, and for discovering the extremely fundamental halting problem. Actually Turing's paper is called "On computable numbers, with an application to the *Entscheidungsproblem*," and by computable numbers Turing means "real" numbers, numbers like *e* or $\pi = 3.1415926...$ that are measured with infinite precision, and that can be computed with arbitrarily high precision, digit by digit without ever stopping, on a computer.

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[2] Of course, a system of the world can only work by omitting everything that doesn't fit within its vision. The question is how much will fail to fit, and conversely, how many things will this vision be able to help us to understand. Remember, if one is wearing rose-colored glasses, everything seems pink. And as Picasso said, theories are lies that help us to see the truth. No theory is perfect, and it will be interesting to see how far this digital vision of the world will be able to go.

Why do I think that Turing's paper "On computable numbers" is so important? Well, in my opinion it's a paper on epistemology, because we only understand something if we can program it, as I will explain in more detail later. And it's a paper on physics, because what we can actually compute depends on the laws of physics in our particular universe and distinguishes it from other possible universes. And it's a paper on ontology, because it shows that some real numbers are uncomputable, which I shall argue calls into question their very existence, their mathematical and physical existence.[3]

To show how strange uncomputable real numbers can be, let me give a particularly illuminating example of one, which actually preceded Turing's 1936 paper. It's a very strange number that was invented in a 1927 paper by the French mathematician Emile Borel. Borel's number is sort of an anticipation, a partial anticipation, of Turing's 1936 paper, but that's only something that one can realize in retrospect. Borel presages Turing, which does not in any way lessen Turing's important contribution that so dramatically and sharply clarified all these vague ideas[4].

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[3] You might exclaim (GDC), "You can't be saying that before Turing and the computer no one understood anything; that can't be right!" My response to this is that before Turing (and my theory) people could understand things, but they couldn't measure how well they understood them. Now you can measure that, in terms of the degree of compression that is achieved. I will explain this later at the beginning of the section on computer epistemology. Furthermore, programming something forces you to understand it better, it forces you to really understand it, since you are explaining it to a machine. That's sort of what happens when a student or a small child asks you what at first you take to be a stupid question, and then you realize that this question has in fact done you the favor of forcing you to formulate your ideas more clearly and perhaps even question some of your tacit assumptions.

Borel was interested in "constructive" mathematics, in what you can actually compute we would say nowadays. And he came up with an extremely strange non-constructive real number. You list all possible yes/no questions in French in an immense, an infinite list of all possibilities. This will be what mathematicians call a denumerable or a countable infinity of questions, because it can be put into a one-to-one correspondence with the list of positive integers 1, 2, 3, ... In other words, there will be a first question, a second question, a third question, and in general an Nth question.

You can imagine all the possible questions to be ordered by size, and within questions of the same size, in alphabetical order. More precisely, you consider all possible strings, all possible finite sequences of symbols in the French alphabet, including the blank so that you get words, and the period so that you have sentences. And you imagine filtering out all the garbage and being left only with grammatical yes/no questions in French. Later

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[4] I learnt of Borel's number by reading Tasic's *Mathematics and the Roots of Postmodern Thought,* which also deals with many of the issues discussed here.

I will tell you in more detail how to actually do this. Anyway, for now imagine doing this, and so there will be a first question, a second question, an *N*th question.

And the *N*th digit or the *N*th bit after the decimal point of Borel's number answers the *N*th question: It will be a 0 if the answer is no, and it'll be a 1 if the answer is yes. So the binary expansion of Borel's number contains the answer to every possible yes/no question! It's like having an oracle, a Delphic oracle that will answer every yes/no question!

How is this possible?! Well, according to Borel, it isn't really possible, this can't be, it's totally unbelievable. This number is only a mathematical fantasy, it's not for real, it cannot claim a legitimate place in our ontology. Later I'll show you a modern version of Borel's number, my halting probability Ω. And I'll tell you why some contemporary physicists, real physicists, not mavericks, are moving in the direction of digital physics.

[Actually, to make Borel's number as real as possible, you have to avoid the problem of filtering out all the yes/no questions. And you have to use decimal digits, you can't use binary digits. You number all the possible finite strings of French symbols including blanks and periods, which is quite easy to do using a computer. Then the *N*th digit of Borel's number is 0 if the *N*th string of characters in French is ungrammatical and not proper French, it's 1 if it's grammatical, but not a yes/no question, it's 2 if it's a yes/no question that cannot be answered (e.g., "Is the answer to this question 'no' ?"), it's

3 if the answer is no, and it's 4 if the answer is yes.]

Geometrically a real number is the most straightforward thing in the world, it's just a point on a line. That's quite natural and intuitive. But *arithmetically*, that's another matter. The situation is quite different. From an arithmetical point of view reals are extremely problematical, they are fraught with difficulties!

Before discussing my Ω number, I want to return to the fundamental question of what does it mean to understand. How do we explain or comprehend something? What is a theory? How can we tell whether or not it's a successful theory? How can we measure how successful it is? Well, using the ideas of information and computation, that's not difficult to do, and the central idea can even be traced back to Leibniz's 1686 *Discours de métaphysique*.

COMPUTER EPISTEMOLOGY: WHAT IS A MATHEMATICAL OR SCIENTIFIC THEORY? HOW CAN WE JUDGE WHETHER IT WORKS OR NOT?

In Sections V and VI of his *Discourse on Metaphysics,* Leibniz asserts that God simultaneously maximizes the variety, diversity and richness of the world, and minimizes the conceptual complexity of the set of ideas that determine the world. And he points out that for any finite set of points there is always a mathematical equation that goes through them, in other words, a law that determines their positions. But if the points are chosen at random, that equation will be extremely complex.

This theme is taken up again in 1932 by Hermann Weyl in his book *The Open World* consisting of three lectures he gave at Yale University on the metaphysics of modern science. Weyl formulates Leibniz's crucial idea in the following extremely dramatic fashion: If one permits arbitrarily complex laws, then the concept of law becomes vacuous, because there is always a law! Then Weyl asks, how can we make more precise the distinction between mathematical simplicity and mathematical complexity? It seems to be very hard to do that. How can we measure this important parameter, without which it is impossible to distinguish between a successful theory and one that is completely unsuccessful?

This problem is taken up and I think satisfactorily resolved in the new mathematical theory I call *algorithmic information theory*. The epistemological model that is central to this theory is that a scientific or mathematical theory is a computer program for calculating the facts, and the smaller the program, the better. The complexity of your theory, of your law, is measured in bits of software:

program (bit string) → **Computer** → output (bit string)

theory → **Computer** → mathematical or scientific facts

Understanding is compression!

Now Leibniz's crucial observation can be formulated much more precisely. For any finite set of scientific or mathematical facts, there is always a theory that is exactly as complicated, exactly the same size in bits, as the facts themselves. (It just directly outputs them "as is," without doing any computation.) But that doesn't count, that doesn't enable us to distinguish between what can be comprehended and what cannot, because there is always a theory that is as complicated as what it explains. A theory, an explanation, is only successful to the extent to which it compresses the number of bits in the facts into a much smaller number of bits of theory. Understanding is compression, comprehension is compression! That's how we can tell the difference between real theories and *ad hoc* theories[5].

What can we do with this idea that an explanation has to be simpler than what it explains? Well, the most important application of these ideas that I have been able to find is in metamathematics, it's in discussing what mathematics can or cannot achieve. You simultaneously get an information-theoretic, computational perspective on Gödel's famous 1931 incompleteness theorem, and on Turing's famous 1936 halting problem. How?[6]

Here's how! These are my two favorite information-theoretic incompleteness results:

- You need an N -bit theory in order to be able to prove that a specific N-bit program is "elegant."

- You need an N-bit theory in order to be able to determine N bits of the numerical value, of the base-two binary expansion, of the halting probability Ω.

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[5] By the way, Leibniz also mentions complexity in Section 7 of his *Principles of Nature and Grace*, where he asks the amazing question, "Why is there something rather than nothing? For nothing is simpler and easier than something."

[6] For an insightful treatment of Gödel as a philosopher, see Rebecca Goldstein's *Incompleteness*.

Let me explain.

What is an elegant program? It's a program with the property that no program written in the same programming language that produces the same output is smaller than it is. In other words, an elegant program is the most concise, the simplest, the best theory for its output. And there are infinitely many such programs, they can be arbitrarily big, because for any computational task there has to be at least one elegant program. (There may be several if there are ties, if there are several programs for the same output that have exactly the minimum possible number of bits.)

And what is the halting probability Ω? Well, it's defined to be the probability that a computer program generated at random, by choosing each of its bits using an independent toss of a fair coin, will eventually halt. Turing is interested in whether or not individual programs halt. I am interested in trying to prove what are the bits, what is the numerical value, of the halting probability Ω. By the way, the value of Ω depends on your particular choice of programming language, which I don't have time to discuss now. Ω is also equal to the result of summing 1/2 raised to powers which are the size in bits of every program that halts. In other words, each K-bit program that halts contributes 1/2K to Ω.

And what precisely do I mean by an N-bit mathematical theory? Well, I'm thinking of formal axiomatic theories, which are formulated using symbolic logic, not in any natural, human language. In such theories there are always a finite number of axioms and there are explicit rules for mechanically deducing consequences of the axioms, which are called theorems. An N-bit theory is one for which there is an N-bit program for systematically running through the tree of all possible proofs deducing all the consequences of the axioms, which are all the theorems in your formal theory. This is slow work, but in principle it can be done mechanically, that's what counts. David Hilbert believed that there had to be a single formal axiomatic theory for all of mathematics; that's just another way of stating that math is static and perfect and provides absolute truth.

Not only is this impossible, not only is Hilbert's dream impossible to achieve, but there are in fact an infinity of irreducible mathematical truths, mathematical truths for which essentially the only way to prove them is to add them as new axioms. My first example of such truths was determining elegant programs, and an even better example is provided by the bits of Ω. The bits of Ω are mathematical facts that are true for no reason (no reason simpler than themselves), and thus violate Leibniz's principle of sufficient reason, which states that if anything is true it has to be true for a reason.

In math the reason that something is true is called its proof. Why are the bits of Ω true for no reason, why can't you prove what their values are? Because, as Leibniz himself points out in Sections 33 to 35 of *The Monadology*, the essence of the notion of proof is that you prove a complicated assertion by analyzing it, by breaking it down until you reduce its truth to the truth of assertions that are so simple that they no longer require any proof (self-evident axioms). But if you cannot deduce the truth of something from any principle simpler than itself, then proofs become useless, because anything can be proven from principles that are equally complicated, e.g., by directly adding it as a new axiom without any proof. And this is exactly what happens with the bits of Ω.

In other words, the normal, Hilbertian view of math is that all of mathematical truth, an infinite number of truths, can be compressed into a finite number of axioms. But there are an infinity of mathematical truths that cannot be compressed at all, not one bit!

This is an amazing result, and I think that it has to have profound philosophical and practical implications. Let me try to tell you why.

On the one hand, it suggests that pure math is more like biology than it is like physics. In biology we deal with very complicated organisms and mechanisms, but in physics it is normally assumed that there has to be a theory of everything, a simple set of equations that would fit on a T-shirt and in principle explains the world, at least the physical world. But we have seen that the world of mathematical ideas has infinite complexity, it cannot be explained with any theory having a finite number of bits, which from a sufficiently abstract point of view seems much more like biology, the domain of the complex, than like physics, where simple equations reign supreme.

On the other hand, this amazing result suggests that even though math and physics are different, they may not be as different as most people think! I mean this in the following sense: In math you organize your computational experience, your lab is the computer, and in physics you organize physical experience and have real labs. But in both cases an explanation has to be simpler than what it explains, and in both cases there are sets of facts that cannot be explained, that are irreducible. Why? Well, in quantum physics it is assumed that there are phenomena that when measured are equally likely to give either of two answers (e.g., spin up, spin down) and that are inherently unpredictable and irreducible. And in pure math we have a similar example, which is provided by the individual bits in the binary expansion of the numerical value of the halting probability Ω. This suggests to me a quasi-empirical view of math, in which one is more willing to add new axioms that are not at all self-evident but that are justified pragmatically, i.e., by their fruitful consequences, just like a physicist would.

I have taken the term quasi-empirical from Lakatos. The collection of essays *New Directions in the Philosophy of Mathematics* edited by Tymoczko in my opinion pushes strongly in the direction of a quasi-empirical view of math, and it contains an essay by Lakatos proposing the term "quasi-empirical," as well as essays of my own and by a number of other people. Many of them may disagree with me, and I'm sure do, but I repeat, in my opinion all of these essays justify a quasi-empirical view of math, what I mean by quasi-empirical, which is somewhat different from what Lakatos originally meant, but is in quite the same spirit, I think.

In a two-volume work full of important mathematical examples, Borwein, Bailey and Girgensohn have argued that experimental mathematics is an extremely valuable research paradigm that should be openly acknowledged and indeed vigorously embraced. They do not go so far as to suggest that one should add new axioms whenever they are helpful, without bothering with proofs, but they are certainly going in that direction and nod approvingly at my attempts to provide some theoretical justification for their entire enterprise by arguing that math and physics are not that different.

In fact, since I began to espouse these heretical views in the early 1970's, largely to deaf ears, there have actually been several examples of such new pragmatically justified, non-self-evident axioms:

- the P ≠ NP hypothesis regarding the time complexity of computations,
- the axiom of projective determinacy in set theory, and
- increasing reliance on diverse unproved versions of the Riemann hypothesis regarding the distribution of the primes.

So people don't need to have theoretical justification; they just do whatever is needed to get the job done. . .

The only problem with this computational and information-theoretic epistemology that I've just outlined to you is that it's based on the computer, and there are uncomputable reals. So what do we do with contemporary physics which is full of partial differential equations and field theories, all of which are formulated in terms of real numbers, most of which are in fact uncomputable, as I'll now show. Well, it would be good to get rid of all that and convert to a digital physics. Might this in fact be possible?! I'll discuss that too.

COMPUTER ONTOLOGY:HOW REAL ARE REAL NUMBERS? WHAT IS THE WORLD MADE OF?

How did Turing prove that there are uncomputable reals in 1936? He did it like this. Recall that the possible texts in French are a countable or denumerable infinity and can be placed in an infinite list in which there is a first one, a second one, etc. Now let's do the same thing with all the possible computer programs (first you have to choose your programming language).

So there is a first program, a second program, etc. Every computable real can be calculated digit by digit by some program in this list of all possible programs. Write the numerical value of that real next to the programs that calculate it, and cross off the list all the programs that do not calculate an individual computable real. We have converted a list of programs into a list of computable reals, and no computable real is missing.

Next discard the integer parts of all these computable reals, and just keep the decimal expansions. Then put together a new real number by changing every digit on the diagonal of this list (this is called Cantor's diagonal method; it comes from set theory). So your new number's first digit differs from the first digit of the first computable real, its second digit differs from the second digit of the second computable real, its third digit differs from the third digit of the third computable real, and so forth and so on. So it can't be in the list of all computable reals and it has to be uncomputable. And that's Turing's uncomputable real number![7]

Actually, there is a much easier way to see that there are uncomputable reals by using ideas that go back to Emile Borel (again!). Technically, the argument that I'll now present uses what mathematicians call measure theory, which deals with probabilities. So let's just look at all the real numbers between 0 and 1. These correspond to points on a line, a line exactly one unit in length, whose leftmost point is the number 0 and whose rightmost point is the number 1. The total length of this line segment is of course exactly one unit. But I will now show you that all the computable reals in this line segment can be covered using intervals whose total length can be made as small as desired. In technical terms, the computable reals in the interval from 0 to 1 are a set of measure zero, they have zero probability.

How do you cover all the computable reals? Well, remember that list of all the computable reals that we just diagonalized over to get Turing's uncomputable real? This time let's cover the first computable real with an interval of size $\varepsilon/2$, let's cover the second computable real with an interval of size $\varepsilon/4$, and in general we'll cover the Nth computable real with an interval of size $\varepsilon/2^N$. The total length of all these intervals (which can conceivably overlap or fall partially outside the unit interval from 0 to 1), is exactly equal to ε, which can be made as small as we wish! In other words, there are arbitrarily small coverings, and the computable reals are therefore a set of measure zero, they have zero probability, they constitute an infinitesimal fraction of all the reals between 0 and 1. So if you pick a real at random between 0 and 1, with a uniform distribution of probability, it is infinitely unlikely, though possible, that you will get a computable real!

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[7] Technical Note: Because of synonyms like .345999 . . . = .346000 . . . you should avoid having any 0 or 9 digits in Turing's number.

What disturbing news! Uncomputable reals are not the exception, they are the majority! How strange!

In fact, the situation is even worse than that. As Emile Borel points out on page 21 of his final book, *Les nombres inaccessibles* (1952), without making any reference to Turing, most individual reals are not even uniquely specifiable, they cannot even be named or pointed out, no matter how non-constructively, because of the limitations of human languages, which permit only a countable infinity of possible texts. The individually accessible or nameable reals are also a set of measure zero. Most reals are un-nameable, with probability one! I rediscovered this result of Borel's on my own in a slightly different context, in which things can be done a little more rigorously, which is when one is dealing with a formal axiomatic theory or an artificial formal language instead of a natural human language. That's how I present this idea in *Meta Math!*. So if most individual reals will forever escape us, why should we believe in them?! Well, you will say, because they have a pretty structure and are a nice theory, a nice game to play, with which I certainly agree, and also because they have important practical applications, they are needed in physics. Well, perhaps not! Perhaps physics can give up infinite precision reals! How? Why should physicists want to do that?

Because it turns out that there are actually many reasons for being skeptical about the reals, in classical physics, in quantum physics, and particularly in more speculative contemporary efforts to cobble together a theory of black holes and quantum gravity.

First of all, as my late colleague the physicist Rolf Landauer used to remind me, no physical measurement has ever achieved more than a small number of digits of precision, not more than, say, 15 or 20 digits at most, and such high-precision experiments are rare masterpieces of the experimenter's art and not at all easy to achieve.

This is only a practical limitation in classical physics. But in quantum physics it is a consequence of the Heisenberg uncertainty principle and wave-particle duality (de Broglie). According to quantum theory, the more accurately you try to measure something, the smaller the length scales you are trying to explore, the higher the energy you need (the formula describing this involves Planck's constant). That's why it is getting more and more expensive to build particle accelerators like the one at CERN and at Fermilab, and governments are running out of money to fund high-energy physics, leading to a paucity of new experimental data to inspire theoreticians.

Hopefully new physics will eventually emerge from astronomical observations of bizarre new astrophysical phenomena, since we have run out of money here on earth! In fact, currently some of the most interesting physical speculations involve the thermodynamics of black holes, massive concentrations of matter that seem to be lurking at the hearts of most galaxies. Work by Stephen Hawking and Jacob Bekenstein on the thermodynamics of black holes suggests that any physical system can contain only a finite amount of information, a finite number of bits whose possible maximum is determined by what is called the Bekenstein bound. Strangely enough, this bound on the number of bits grows as the surface area of the physical system, not as its volume, leading to the so-called "holographic" principle asserting that in some sense space is actually two-dimensional even though it appears to have three dimensions!

So perhaps continuity is an illusion, perhaps everything is really discrete. There is another argument against the continuum if you go down to what is called the Planck scale. At distances that extremely short our current physics breaks down because spontaneous fluctuations in the quantum vacuum should produce miniblack holes that completely tear spacetime apart. And that is not at all what we see happening around us. So perhaps distances that small do not exist.

Inspired by ideas like this, in addition to a priori metaphysical biases in favor of discreteness, a number of contemporary physicists have proposed building the world out of discrete information, out of bits. Some names that come to mind in this connection are John Wheeler, Anton Zeilinger, Gerard ’t Hooft, Lee Smolin, Seth Lloyd, Paola Zizzi, Jarmo Mäkelä and Ted Jacobson, who are real physicists. There is also more speculative work by a small cadre of cellular automata and computer enthusiasts including Edward Fredkin and Stephen Wolfram, whom I already mentioned, as well as Tommaso Toffoli, Norman Margolus, and others.

And there is also an increasing body of highly successful work on quantum computation and quantum information that is not at all speculative, it is just a fundamental reworking of standard 1920’s quantum mechanics. Whether or not quantum computers ever become practical, the workers in this highly popular field have clearly established that it is illuminating to study sub-atomic quantum systems in terms of how they process qubits of quantum information and how they perform computation with these qubits. These notions have shed completely new light on the behavior of quantum mechanical systems.

Furthermore, when dealing with complex systems such as those that occur in biology, thinking about information processing is also crucial. As I believe Seth Lloyd said, the most important thing in understanding a complex system is to determine how it represents information and how it processes that information, i.e., what kinds of computations are performed.

And how about the entire universe, can it be considered to be a computer? Yes, it certainly can, it is constantly computing its future state from its current state, it's constantly computing its own time-evolution! And as I believe Tom Toffoli pointed out, actual computers like your PC just hitch a ride on this universal computation!

So perhaps we are not doing violence to Nature by attempting to force her into a digital, computational framework. Perhaps she has been flirting with us, giving us hints all along, that she is really discrete, not continuous, hints that we choose not to hear, because we are so much in love and don't want her to change!

For more on this kind of new physics, see the books by Smolin and von Baeyer in the bibliography. Several more technical papers on this subject are also included there.

CONCLUSION

Let me now wrap this up and try to give you a present to take home, more precisely, a piece of homework. In extremely abstract terms, I would say that the problem is, as was emphasized by Ernst Mayr in his book *This is Biology,* that the current philosophy of science deals more with physics and mathematics than it does with biology. But let me try to put this in more concrete terms and connect it with the spine, with the central thread, of the ideas in this talk. To put it bluntly, a closed, static, eternal fixed view of math can no longer be sustained. As I try to illustrate with examples in my *Meta Math!* book, math actually advances by inventing new concepts, by completely changing the viewpoint. Here I emphasized new axioms, increased complexity, more information, but what really counts are new ideas, new concepts, new viewpoints. And that leads me to the crucial question, crucial for a proper open, dynamic, time-dependent view of mathematics,

"Where do new mathematical ideas come from?"

I repeat, math does not advance by mindlessly and mechanically grinding away deducing all the consequences of a fixed set of concepts and axioms, not at all! It advances with new concepts, new definitions, new perspectives, through revolutionary change, paradigm shifts, not just by hard work.

In fact, I believe that this is actually the central question in biology as well as in mathematics, it's the mystery of creation, of creativity: "Where do new mathematical and biological ideas come from?" "How do they emerge?"

Normally one equates a new biological idea with a new species, but in fact every time a child is born, that's actually a new idea incarnating; it's reinventing the notion of "human being," which changes constantly.

I have no idea how to answer this extremely important question; I wish I could. Maybe you will be able to do it. Just try! You might have to keep it cooking on a back burner while concentrating on other things, but don't give up! All it takes is a new idea! Somebody has to come up with it. Why not you?

APPENDIX: LEIBNIZ AND THE LAW

I am indebted to Professor Ugo Pagallo for explaining to me that Leibniz, whose ideas and their elaboration were the subject of my talk, is regarded as just as important in the field of law as he is in the fields of mathematics and philosophy.

The theme of my lecture was that if a law is arbitrarily complicated, then it is not a law; this idea was traced via Hermann Weyl back to Leibniz. In mathematics it leads to my Ω number and the surprising discovery of completely lawless regions of mathematics, areas in which there is absolutely no structure or pattern or way to understand what is happening.

The principle that an arbitrarily complicated law is not a law can also be interpreted with reference to the legal system. It is not a coincidence that the words "law" and "proof " and "evidence" are used in jurisprudence as well as in science and mathematics. In other words, the rule of law is equivalent to the rule of reason, but if a law is sufficiently complicated, then it can in fact be completely arbitrary and incomprehensible.

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The Militarization of Peace: Absence of Terror or Terror of Absence?

Reza Negarestani

INTRODUCTION

This essay explores the rise of a new wave of terrorism which exploits its own dissolution, making a weapon of the doctrine of Taqiyya *or strategic (dis)simulation, dismantling the theatrical aspect of the battlefield and selecting civilians as primary targets and 'molecular battlefields'. This tendency threatens not only global civilian survival but the very horizon of survival or living (in its most basic, abstract sense) in general. It makes survival itself a field of exploitation for extremist terrorism.*

When militarization ceases to be an exclusively wartime process and to belong only on the battlefield, then even peace–the temporary gap, the blank space of unfriction between war machines and collective survival –can be militarized. This does not mean taking

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advantage of peace as a temporary suspension which can be exploited, or as a depository in preparation for the militarization processes of future wars (who gathers the most forces when everyone else is resting?) Rather, and far more significantly, it means the endo-militarization of peace itself, wherein peace is directly used as a weapon, exploited as a new plane for invasion and insurgency, and for offensive strikes against enemy bases and/or their supportive lattices.

New modes of disseminating terror threaten the basic notions of survival in general, creating a generalized state of terror where death hangs over, regulates, every moment that is lived. Such *necrocracy* is the goal of heretical Islamic agencies of Terror such as *Jama'at-e Takfir*[1] and its *Takfiri* agents – a militant *Jihadi* movement believing in the absolute excommunication of infidels (*Takfir* originally means excommunication). These agencies have inspired a new wave of militant religious extremists and other obscure terrorist groups who are exploiting the endo-militarization of peace as a new mode of warfare. This new mode of warfare is one whose tactical lines are not aligned with (or configured by) the plane of conflict and visible military friction (battlefields, terrains for guerilla warfare, street-wars, etc.); Its tactical lines do not have the localizability which is a prerequisite for direct conflict and military formation; They are not positioned to cut, block or replace each other depending upon their different tendencies, transorientations and alignments; Their operations have a wholly oblique relation to the dynamic incompatibility which provides the basis for, and the matrix of, militarized conflictual engagement.

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[1] *Jama'at-e Takfir* (The Society of Excommunication) influenced by Qutb's Muslim Brotherhood emerged in Egypt as a fundamentalist group in the 1960s with Islamic fundamentalist and militant inclinations (the former being similar to extremist Salafism) enmeshed through decentralized and stealth operation networks. The group advocates any military course of action (whether armed battles or not) against Jews, Christians, apostate or moderate Muslims, in order to restore (or return to) the primal unity of the Islamic world order.

A *Takfiri* engages as a shadow terrorist in *White War* – the endo-militarization of peace, a state of hypercamouflage (best defined as *complete* and consequently symmetrical overlap between two entities on a mereotopological[2] plane). In this war, the cover of camouflage can never be penetrated or disrupted, and the defensive employment of camouflage (best mapped as *partial* overlap between two or more entities on a logical plane) is replaced by a wholly novel, highly offensive deployment, the space of hypercamouflage. The *Takfiri*'s favoured mode of warfare is to program a new type of tactical line which totally blends with the enemy's lines in such a configuration that it introduces radical instability and eventually violent fissions into the system from within. This happens in such a way that not only does recovery become impossible, but in addition any corrective or restorative initiative is ineluctably turned into a military subversion: like a chemotherapy gone awry or an excessive scarring in which healing and the process of epithalization, in the absence of a wound, corrode the organ in the form of fibroproliferation (a scarring process which transforms the local injury of the wound into a pervasive metastatic scarring), resulting in eventual lysis and decomposition. In attempting defence, the enemy can only necrotize and dissolve itself.

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[2] Mereotopology is a theory of topological relationships between parts and boundaries. See Barry Smith, "Mereotopology: a theory of parts and boundaries", in *Data & Knowledge Engineering*, Volume 20, Issue 3 (November 1996), Elsevier Science Publishers, pp. 287 - 303.

DEEP TERROR: THE DECLINE OF THE ENEMY AND THE RISE OF OBSCURE ALLIES.

Abdu-Salam Faraj's manifesto *Jihad: The Absent Obligation* – in which malevolent political pragmatics and tactical perversion are planted carefully in a context of evangelistic justification and theo-tyrannical apologetics – is a case study of this mode of warfare: White War or the militarization of peace, comprising aggressive *hyper-camouflage* as its primary engine.

Hypercamouflage aims to pursue to even the most attenuated extreme, a fighting and a surviving alongside the enemy. It invariably indicates a total withdrawal from the perception of friends and a dissolution into the enemy: the rebirth of a new foe.

In his book, Takfiri cultist and terrorist Faraj crafts a fetishized form of *Jihad*, suggesting that the incinerating head of *Jihad* must be introduced to everyone, to any entity, regardless of their position, geographic location, ethnicity, regardless of the relevance or otherwise of that entity to *Jihad*, Islam or infidelity – *Jihad* as a universal sweeping movement. The original title of the book, which in translation has become simplified into *Jihad: The Absent Obligation*, is *Jahad: Fariezato Ghaebata* (or *Jihad: Fariezeh Ghaeb*). *Fariezeh* means holy duty, but not a subjectively authoritarian duty as is demanded by *Huda* (Allah's guidance), the 'utter submission' (*Islam*) to Allah. *Ghaeb* means absent, but in Islamic texts and especially Shia books, it encompasses a huge hermeneutic potentiality which 'absence' cannot hope to translate; in fact, rather than mere absence *Ghaeb* indicates latent potentiality, in the sense, for instance, of the latent period of inactivity of a virus. This latency is to be distinguished from the actualized and visible, which is liable to distortion and change: Imam Mahdi (the 12th Imam and the harbinger of *Qiyamah*, the Islamic Apocalypse) is absent (*Ghaeb*) but affects Islam and its followers more than anything *actually* present; Mahdi represents a potentiality that never ceases to affect. In Faraj's book, however, this definition, which is a fundamental theological and eschatological platform for his argument, becomes eclipsed by a message at once more accessible and more divergent from this original meaning: *Jihad* becomes a holy responsibility which is not present.

Faraj's book adds a new twist to the tactics of heretical religious extremists such as the cult of *Takfiri*: the distortion and alteration of '*Taqiyya*' (*Taghieh*) from its original defensive and devout function in the dawn of Islam. Rather than a strategic (dis)simulation – a justified concealment of true beliefs in situations where harm or death will definitely be encountered if the true beliefs are declared[3] (the wider meaning of *Taqiyya* being "to avoid or shun any kind of danger.") it is reinterpreted as a silent and fluid military infiltration, a course of action which forms one of the elemental components of fetishized Jihadism.

Faraj's take on *Taqiyya* departs entirely from what in the dawn of Islam originated as a defensive or protective inclination, an evasive tactic. In *The Absent Obligation*, *Taqiyya* is reconstituted as a type of strategic simulation or dissimulation, in the name of a hostile politics of offence. However, both in its traditional form and in this new weaponized form, *Taqiyya* is strongly bound to the notion of survival. In the traditional sense this is so simply because by taking *Taqiyya* the believer survives in difficult circumstances. But in militarized *Taqiyya*, survival is transformed into a sort of highly-charged parasitical endurance which inherently threatens the catalysis of all those whose survival is afforded more easily. Survival becomes as risky as a contagious terminal illness. Faraj insists that *Jihad* cannot be separated from *Taqiyya*. Whereas crusades transgress boundaries in order to retake the holy lands, in Islamic tradition *Jihad* intrinsically cannot be transgressive; it must merely *defend* the holy lands, and Islamic properties (which are not necessarily associated with geopolitical agencies). But as revivalist figures like Sayyid Qutb[4] and Shukri Ahmad Mustafa have twisted the entire panorama of Islamic thought, heretical Islam's defence of its 'properties' has become a *universal* 'defence' encompassing massive waves of acentric assault and a military subversion pervaded by a complex tendency towards the exclusion of all beings except for the monopolistic wasteland of the Divine (the Desert). "The earth itself moves towards Allah by submitting itself to the 'exterior' Will of Allah; or in other words, is not Earth a part and property of Islam (utter submission to Allah) which must be defended?": Qutb turns the issue inside out, all of theological thought becoming ravaged by monopolistic dictatorship and monomania. The Earth itself becomes a part of the defensive politics of *Jihad*[5]. Ahmad Mustafa, one of the theorists of the original *Takfiri* cult, also suggests that "We are returning to Islam", and that this Grand Return involves surrendering to the Desert of the Divine: this is not a reactionary response to the infidels, he insists, but merely the path to Islam, which is condemned and met with overreaction by the rest of the world – a world whose entire horizon, moreover, is in fact already a part of Islam. Mustafa's discussion takes a twisted monotheism and heretically embeds it within the foundations of Islam – creating a retrograde movement back to a self-deluding, romantically-imagined phantasy of the original Islam. To this notion of *Jihad* which seeks to retake the Earth as a part of Islam (Earth as a part of the universe is on the route of *utter submission – Islam –* to Allah) Faraj cunningly adds the politics of *Taqiyya.* As Faraj himself confesses, this (re)taking of the Earth is not an easy task; hence the necessity of being armed with *Taqiyya* and its potential for insinuation and diffusion within the systems and peoples of non-Islamic countries.

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[3] "The believers never ally themselves with the disbelievers, instead of the believers. Whoever does this is exiled from GOD. Exempted are those who are forced to do this to avoid persecution. GOD alerts you that you shall revere Him alone. To GOD is the ultimate destiny." (The Quran 3:28)

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[4] Sayyid Qutb (1906-1966), one of the central theorists of Islamic Revivalism and an inspiration for later extremists such as Faraj; his *Ma'alim fi-l-Tariq* (Milestones) is perhaps the first theoretical work of modern extremist Islamism, integrating pragmatic exhortations with self-centered politico-religious doctrines. On Qutb, see Paul Berman's analysis of terrorism inspired by the caliph's militarism and heretical Islamic revivalism: Berman, P. (2004) *Terror and Liberalism*, W. W. Norton & Company.

[5] "The Islamic civilization can take various forms in its material and organizational structure, but the principles and values on which it is based are eternal and unchangeable. These are: the worship of God alone, the foundation of human relationships on the belief in the Unity of God, the supremacy of the humanity of man over material things, the development of human values and the control of animalistic desires, respect for the family, *the assumption of the vice-regency of God on earth according to His guidance and instruction, and in all affairs of this vice-regency, the rule of God's law (Shari'a) and the way of life prescribed by Him ...*" (Sayyid Qutb, *Milestones*); see Qutb (1991) *Milestones*, American Trust Publications, p. 286.

According to Faraj the new doctrines of weaponized *Taqiyya* can be enumerated as follows:

(1) *TAQIYYA* AS THE DISSOLUTION OF YOURSELF AND THE OTHER: *Taqiyya* becomes a politics aimed at drawing the war out of the battlefield (In this extremist *Jihad*, war must be put to work everywhere but the battlefield; war is external to the conventional battlefield. 'War is not a theater, you infidels', Faraj shouts). This is to be achieved by introducing the *Jihadi* entities to civilians and all other seemingly militarily irrelevant political economic or cultural entities, by blending with the crowd which exists far from the front lines. 'Towards the real omnipresence

of war which progressively effaces the theatrical platitude of the battlefield', the doctrine of Terror voluntarily transforms itself into a sinister movement of utter self-dissolution. The use of *Taqiyya* as a (para)offensive politics, however, is not the invention of Faraj, or the *Takfiri* cult, or even of Wahhabi extremists. It can be traced back to Hassan i-Sabah but it is not the invention of Hassan either (although he improved and strictly militarized it). The sole credit for *Taqiyya* as a (para)offensive *polytics* aimed at blending with the crowd (as opposed to *Taqiyya* as a dissimulating tool for evading harm, as devised in the early days of Islam) belongs to Abdullah ibn Maimun or Maymun (and his *Batiniyya* cult, one of the underground heretical Islamic societies and subversive movements which he founded and which later turned into *Isma'ilie* sects directed by Hassan i-Sabah): Maimun, the Persian occultist, political saboteur and conspiracist who undermined the reign of caliphs in Egypt (where the *Takfiri* cult also originated together with such influential figures such as Qutb, Mustafa, *et al.*) with a sudden debacle, and prepared the region for his ambiguous and mysterious allies *Al Fatemids* (*Fatemion*) who later became the most enthusiastic enemies of the caliphs and their conventional modes of militarism. Faraj, following closely Ibn Maymun's politics, suggests that *Taqiyya* should not be merely a deception, a hiding tactic; it should consist of seeking the highest degree of participation with infidels, with their civilians: "if they take drugs we must do the same, if they take part in every type of sexual activity we must drive those activities to the point of excess", etc. The *Jihadi* extremist must become as one with the civilians of what are called 'hardcore infidels'.

(2) *TAQIYYA* AS A (PARA)OFFENSIVE MILITARIZATION OF CIVILIANS: In reference to Faraj's politics of *Taqiyya* as an inseparable element of *Jihad*, the French counter-terrorist expert and President of the Paris-based World Observatory of Terrorism, Ronald Jacquard, brilliantly points out that a '*Takfiri* under *Taqiyya*' is himself a primed bomb, whether or not he ever sees action (is involved in a mission). When a *Takfiri* becomes as one with ordinary civilians – no longer dissimulating but moving and behaving like a true, unfaithful civilian in every aspect of his or her public and private life – then the weapon begins autonomously to be activated from the other side; the government (of a foreign non-Islamic country, for example) itself begins to filter, purge and hunt down its own civilians, curtailing their rights, confining them to economic, social and political quarantine to isolate or even purge the disease and its potential hosts at the same time. Each individual is potentially a *Takfiri* cell or niche, a site of infestation, a primary military target. So that the most offensive, active phase of a *Takfiri*'s life is not when he or she is on a high-profile mission like 9/11, but rather when he or she becomes a mere civilian, totally unarmed and dissociated from any line of command. A *Takfiri* levels himself with everyone and consequently levels everyone with himself; when it comes to hunting a *Takfiri*,

one ineluctably ends up exterminating non-military entities, far away from the battlefield, in the heart of one's own land.

(3) *TAQIYYA* AS A TRIGGER FOR WHITE WAR: *Taqiyya* unbalances the entire conventional dynamics between war machines, a dynamics which sees them clash with, hunt, and consume each other. This process of unbalancing does not serve to shift the battle along the diametric axis of 'victory or defeat', but rather to unbalance the communicative links between two tactical modes: *active military lines* at one pole and *virally latent (un)tactical lines* at the other. The *Takfiri* shuts down all his military potential, tactically 'dies' (not even being camouflaged anymore), and later is resurrected again in 'his' true form. The *Takfiri* war machines of extremist *Jihad* operate on transient and divergent tactical lines. As a result, they cannot be reached or communicated with: communication which is the prerequisite for the clash between war machines and entropically-based military conflicts, mechanisms considered by Deleuze and Guattari as the processes which fabricate the very machinery and space of War.

(4) TAQIYYA AS A DESERTIFICATION TOOL: Giving fetishized *Jihad* an epidemically omnipresent machinery, *Taqiyya* allows Faraj to open a new era in the imagining of mechanisms of extinction, sabotage and eradication fueled by the pyromaniac aspects of heresy and dangerously romantic theo-tyranny. Faraj discusses the fact that 'their' (he rarely even names his so-called enemies: the

US) military war machine relies heavily on the *megadeath principle* or as they put it DEATH FROM ABOVE (Overkill, Killing drones, High-tech airplanes, smart bombs, "Shock and Awe", MOAB (Mother of All Bombs), invisible missiles descending from nowhere). Faraj presents a *Takfiri* alternative to this megadeath machinery[6]: He discusses a new doctrine of hypercamouflaged terror which he calls 'Dieback machinery', a term borrowed from botany and agriculture[7]. What he defines as 'Dieback' can be applied to an entire 'civilization just as well as a Tree or any arborescent mode of collectivity': in order to introduce a Tree to extinction, a *Takfiri* terrorist never interferes with the roots, attempting to uproot the whole tree, as this would merely remove the taproot, leaving rootlets and other root parts in the soil that would eventually grow and give rise to many new trees. The terrorist or *Jihadi* extremist launches a *dieback* disease against the tree: to be precise, he starts to extinguish the most expendable and smallest leaves growing at the top of the tree and its branchlets, and continues his work to the rest of leaves, without damaging the main trunk or roots. By destroying leaves from top to bottom and by marring branchlets, the tree will wither: excommunicated and dejected, the tree will eventually be entirely incapacitated and will start to *(over)react autophagically* and *allergically* to the artificial dereliction effected by the dieback disease. *Taqiyya* provides *Takfiri*s with ample opportunity to use this dieback machinery, starting from the leaves (civilians or what they call 'expendable entities') and branchlets (small organizations, etc.), ultimately rendering the tree obsolete without ever having launched any direct attack against its main organs.

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[6] Questions of escalation and diffusion of conflict in time and space are of massive significance for both the western military campaign and Jihadism's terror-skirmishes. While Jihadism works with diffusion in its off-battlefield conflicts (through its petropolitical contamination of the global politico-economic systems, its reckless use of weaponized *Taqiyya*, working with strategy rather than tactics and contagious communication rather than transgression), the western techno-capitalism maintains a escalating position in the battlefield, a position connected to the propulsive body of techno-capitalism, its tactical precision and suprmacy. However, both of them share a common tendency in conflict: turning human agencies into molecular battlefields / warmachines; for Jihadism this molecularization of warriors takes an epidemically dispersive form: mainly through *Taqiyya*'s para-offensive plane and for the western front, it turns into re-nomadization (in the Deleuze-Guattarian sense of nomadic warmachines) of the State's army and miniaturization of an entire army and its specifications on and through the body of each soldier.

[7] A disease of plants characterized by the gradual dying of the young shoots starting at the tips and progressing to the larger branches.

When a tree is infected by dieback disease, only leaves and branches are destroyed; however, lacking leaves and branchlets, the tree gradually becomes prone (overexposed) to environmental factors and all of its systems become locked into malfunctioning programs, lowering its immune system and consuming the tree from within. Various stages in the dieback of a civilization would be: paranoia; lack of investment; civilians as primary targets for both fronts; dereliction. All of which result in a reactionary response from the infected tree which, rather than aiding recovery, is self-destructive. In a system this self-destruction (or malfunctioning self-recovery) can be defined as breakdown of the mechanisms responsible for self-tolerance, and the induction of an immune response against components of the self. Such a cataclysm leads to the reprogramming of the (immune) system to damage the self.

A '*Takfiri* under *Taqiyya*', then, is nothing but a civilian. By destroying himself and civilians he can apply the dieback mechanism to a system. Weaponized *Taqiyya* is not directly connected to the dieback mechanism; but it is a way in which a *Takfiri* can shift the role of *Taqiyya* from mere camouflage to a powerful logistical plane on which (para)offensive tactics and strategies can be converged and amplified. When a *Takfiri* extremist goes under *Taqiyya* he embeds his sabotaging mechanisms within civilians, *uses civilians as back-doors*. A *Takfiri* under *Taqiyya* is transposed from being a key operational figure in his own army to being a civilian; at this point, *Taqiyya* actually gains access not to important targets but to ordinary civilians (the primary tactic of the dieback mechanism), allowing the *Takfiri* an opportunity to effectively confound and twist all diagrams and maps which allow a civilian to be distinguished from a terrorist. Through this back-door, a *Takfiri* can both damage civilians (or expendable entities of the tree, as they are regarded) more effectively on a massive scale, and turn their protection systems against them by assimilating them within itself and by being assimilated by them.

The original doctrines of the *Takfiri* cult originate from the teachings of Qutb and Shukri Ahmad Mustafa. Faraj, under the influence of the doctrine of '*Takfir wal'Hijra*'

(Excommunication and Exodus) – imitation of the prophet who left Mecca and the House of Allah to live in a *purified desert* purged from any manifestation of idolatry – enunciates a new vision of desert and desertification alien to the conventional image of the Desert familiar to socio-political dynamics, and western social dynamics in particular. On several different levels, this desert encompasses all radical trends of Islam, from the ceaseless exteriority of Allah to Man, to desert as the mere functional plane of submission to this radical exteriority (Allah who will be never disclosed), to the original desert-nomadic ingredients of *Jihad*. A desert nomad does not migrate, as it is minimally under the influence of climatic factors; it burrows tunnels of its own, making its own niches within the desert, crossing the dimensions of holey and smooth spaces, exploiting and betraying them equally. Scorpions are burrowers not architects, they do not build upon compositions of solid and void, nor do they move restlessly, they devour volumes and snatch spaces; for them the holey space is not merely a dwelling place, a place to reside (a niche for occupation) but more than that, it is the Abode of War (*dâr al-harb*), the holey space of unselective hunting. Mustafa hysterically introduced the machinery and the notion of the desert into all threads of his thought to such a degree that his cult was mockingly called 'The desert flogging society'. It is rather ironic to reveal Mustafa's real profession: he was a very talented agronomist.

Take a Russian forest bordering the tundra, whose trees are emptied of life because they have been hit by black-rot and winter dieback; In a *Takfiri* sense, deserted trees are no different from a desert without trees: dieback purifies, desertifies, the infidel organism, bringing the Earth within the compass of the utter desolation of the Desert of the Divine.

In the wake of militarized *Taqiyya*, the *Takfiri* is no longer the problem; it is the original civilians of the country, rather than immigrants, who pose a terminal security threat. There is no more radical act of war than fighting in molecularized and expendable battlefields whose potentiality for conducting conflict has already been incapacitated.

LOGICAL INVESTIGATION OF HYPERCAMOUFLAGE VS. NOMADIC CONFLICT.

"In the past one took a more *defensive* attitude," wrote Koch, referring to miasma theory. "We have now moved away from this defensive point of view and have seized the *offensive* ... We must be prepared, first, to detect the infectious material easily and with certainty, and second, to destroy it" (Koch 1903, 8, 10). For Koch, taking the offensive meant actively seeking the parasites not only in those obviously ill but also those "suspected" of carrying them (*die Verdächtigen*) and in "the apparently healthy."[8]

Every warmachine or tactical line occupies a niche (whether in wartime or peace), a space through which it can move, feed and function; it is not only defined by the distinctive properties of a tactical line or warmachine but also by its enemies, the incompatible dynamism of other tactical lines, types of predators, the exposure to environmental factors, its threshold for receiving data from the environment, the types of data it receives and its propinquity to what it pursues or probes (there is a common misunderstanding that attributes solid or crisp boundaries to niches; but niches are assembled wherever an entity economizes a portion of its environment and survives / functions in that economized space[9]). At a given time *t*, the entity *r* occupies a unique[10] address (or set of addresses) as $r_t(x)$; its movement can be simplistically expressed in terms of the niches it occupies at successive intervals of time. This address is encoded and set apart by the niche which the warmachine or tactical line occupies.

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[8] Otis, L. (1999) *Membranes: Metaphors of Invasion in Nineteenth-Century Literature, Science and Politics*, The Johns Hopkins University Press, pp. 34-35

The functions of a niche are not merely disjunctive and exclusive (for example, directing competitions *i.e.* selective movements which result in exclusion of other portions of the environment or lines of movement) but also connective/conjunctive. In fact niches mobilize their occupant entities with their characteristic types of dynamism, associating them with other niches based on the affordance necessary for following a tendency or a plane as well as sharing it with other niches and their inhabitants. The programming of its niche is the first basic operation of engineering or recomposing an entity. Therefore the significance of investigating niches or niche types (rather than token niches or occupants) progressively increases with the development and emergence of new dynamic lines, power formations, traffic spaces and planes of communicative conjunctions. The State and its grid of dominance identify the movements of an entity (*r*) in a niche (whether quantitative – metron-based [measurable, scalable] – or qualitative) by the series of addresses it authenticates and registers as it travels:

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[9] In fact, some monitoring systems basically concentrate on niches with fiat and vague boundaries to screen and guide their occupants (tenants). Air traffic control systems constantly analyze the volume of protected or restricted airspace – defining a circumspace or the volume enclosing a flying object – for collision avoidance, alert systems and translocations of aircrafts. The volume of protected airspace is a modified term for niche in traffic management, a simulation of the niche that exists in flying or migrating birds.

[10] This uniqueness is characterized by the definitive properties / qualities that the address attributes to an entity in space-time but to have an address does not mean to be the exclusive owner of it.

$$r\ (x_1,x_2,x_3,\ldots,x_n)$$

For the State, the dynamism geared by warmachines, the way that each warmachine perpetuates its itinerant line, can only be traced and numerically tagged through the logic of boundaries, the programming of dwelling/accommodating systems and (dis)locations that the State is able to monitor by monitoring niches and their dynamic addresses. By means of overseeing boundaries through which entities pass, investigating the temporal effects on (or alteration of) the forces of territoriality that moving entities leave behind, their types of localization, and their behaviors towards mereologic economy (the economy of the whole), the State can fabricate a *cogito* (a non-human cognition) not only to realize but also to classify the movement of entities and the dynamism of warmachines whose immoderate nomadic itineracy means that they cannot be directly apprehended or sensed by the State. This is the *cogito* required for appropriation of warmachines under the State's military protocols and forms. Bound to (semi-)rigid segmentarity, dynamic boundaries, affordance-based connections and static or dynamic localizations (or more accurately, in-place and outside-place localizations), the State examines the dynamic space of each entity and its activities – those activities corresponding to its functional, territorial and mereologic regions – not only to read the characteristics of an entity but also to locate it on (or according to the proximity of the entity to) its grid of dominance. The State and all configurations of Survival Economy track entities through the niche(s) that they inhabit or populate. For the State's military Overwatch, investigating and tracing the niche is the primary and central task; the itinerant line of an entity or a warmachine, its communications and functional traits are all deciphered by scanning the niche the warmachine occupies and its type. The advanced reading-machines of the State are even capable of extracting the quiddity of a warmachine or an entity by analyzing the specifications of the niche which is intrinsically bound to affordance, dynamic forces of boundaries, and eco-logical principles.

However, as niches are connective entities (entity-as-event in a Deleuzian sense); they do not exclusively belong to one entity or one tenant. Multiple entities can share one niche and niches can form nested niches (territorial forces diminish – but never disappear – in grouping bonds) linking to each other, being connected in various modes. Modes of connection between niches are divided for the most part into two asymmetrical correlations:

a. Abutment (**A**)

b. Overlap (**O**)

In the Deleuze-Guattari model of the nomadic warmachine, the warmachines are external to the State's effective boundary, restlessly eroding it, gnawing at the consolidated borders of the State. Logical modeling of the interactions between the exterior nomadic warmachines and the State is complicated mainly by the following problems:

(a) Both the State and the warmachine retain a relative

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11. Affordance is an economical network (in the sense that it is connective and reciprocal) by which openness can be exploited as a groundwork for survival, accommodation, dwelling and regulating communication.

The term affordance as used here diverges in certain respects from the original term coined by James Jerome Gibson (based on the works of Ingarden, Brentano, et al.) in his eco-cognitive studies. The regulations by which an entity can maintain its dynamic position (in a whole, *i.e.* mereologic address) and survive in its environing horizon originate from a deeply meshed economic-based network of interactions, connections and regulative participations, all knitted on mutual affordability between the entity and its environment. Whole can only survive when entities can afford each other, every type of openness on mereologic levels is demarcated by mutual affordability 'between' entities. Affordance does not exclusively belong to one pole of the economical communication but is distributed between at least two mereologic entities. 'I am open to you as long as I can afford you' otherwise: (a) you must be repulsed (b) attracted by being regulated and appropriated (c) partly filtered (d) I should appropriate myself to 'accommodate' you. Therefore, the plane of being open to is intrinsically constructed on affordance or economical affordability/communication. Through affordance, openness cannot escape movement to each other (each dynamic on its own plane of tacticity) which makes the State's militarized machines and nomadic warmachines slippery entities with a progressive displaceability increasing as attacks and counter-attacks are escalated at the borders of the State.

(b) The rise of the clandestine State, that opens itself to the nomadic warmachines to either absorb them within its military formations by continuous contacts with nomadic warmachines (such contacts are essentially bound to contaminative potentials for both the State and the nomads) or reinvents nomadic warmachines as its mercenaries, dynamic lines for extending the State beyond its border, a new dynamic boundary providing the State with the opportunity of accommodating (colonizing?) or economically affording (affordance[11]) the Outside instead of being cracked open by the Outside.

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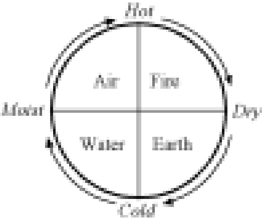
survivalist and economical regulations; it mainly works as the dynamic capacitator of Whole. Possibly the most elucidating (yet simplified) 'model' of affordance is Aristotle's Tetrasomia (Rotation of the Elements).



The rotational movement between elements sustains a refining dynamism for the whole. Each phase of rotation is based on dynamic metrons (measures, scales) and affordance (here, economical openness or mutual affordability) between elements. Elements are open to each other either diametrically or diagonally, but they can

Focusing on the spatiogeographic aspect of the warmachine (necessarily interconnected with its affective aspect) – or, more precisely, investigating a mereotopological model of the nomadic warmachine and the State through their distinctive but general mode of connection which can be grasped as abutment or external connection – might be the primary task for diagramming the affect-space and the lines of movement generated between concrete nomadism and the State. This modelling, both spatiogeographic and mereotopological (and thus necessarily indicating an immanent affect space) of the nomadic warmachine and its positioning relative to the State's boundary elucidates the processes at work in the emergence of anomalous nomadic states (as in the case of the 'guerilla-state' and its connection with ethnonationalism in Iran or the Bedouin nomad-tribes and their strong but ambiguous bonds with the Saudi government in

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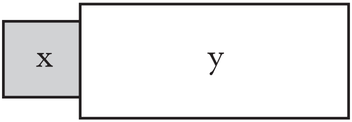
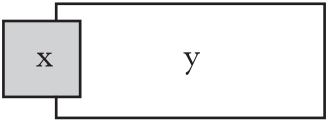
never entirely overlap or radically communicate with each other; they need a mid-state to form rotational nexuses and maintain their Wholeness. These mid-states are valid only in a particular location of the whole rotational panorama; although they provide the system with a propulsive *polemikos* or cyclic dynamism, they function locally (as a result of the elements' affordability to each other and, at the same time, to the whole system of Tetrasomia). For example, Earth and Water need Menstruum (living mud) to communicate. This living mud is a communicational entity but also a dynamic boundary which transforms/appropriates the earth and water before opening them to each other; it can only work locally between earth and water and not at any other location in the model of Tetrasomia. The Whole uses these economical communications to consolidate itself and to afford Life (to survive).

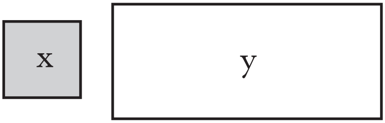
"I assume that affordances are not simply phenomenal qualities of subjective experience (tertiary qualities, dynamic and physiognomic properties, exc.). I also assume that they are not simply the physical properties of things as now conceived by physical science. Instead, they are ecological, in the sense that they are properties of the environment relative to an animal. These assumptions are novel, and need to be discussed." (J. J. Gibson)



Abutment



Partial Overlap



Disjunction

Fig. 1

Saudi Arabia) as well as the increasing risk for nomadic warmachines engaging clandestine states or states with an obscure boundary.

POSITIONING OF THE NOMADIC WARMACHINE ON A MEREOTOPOLOGICAL PLANE.

Abutment (fig. 1) is an external connection, with minimum trade between niches or entities (the least contagious connection, given its tendency towards dissociation). It is demarcated by its intermediacy before partial overlapping and after disjunction, by its tangential contact and boundary overlap.

What was once the frontier of the State's defence is continuously eroded by the reckless tidal or updrift movements of nomadic warmachines. The operational significance of this mode of connection (Abutment) has been significantly decreased with the emergence of symbiotic and manipulative warmachines and covert militarization processes on the one hand, and advanced reformations of the State towards the accommodation (or colonizing) of the Outside on the other. The latter are rooted both in the introduction of territorial climatologic factors[12] to the dynamism of nomad-packs and in the development new modes of survival. Now, the state knows well how to save its foundations, even if it means assembling spaces susceptible to the erosion of nomadic warmachines, attracting or diverting the incoming nomadic incursions to specified and preprogrammed regions to protect its critical terrains and vulnerable mechanisms, or transforming its macropolitics into a *viable* micropolitics which are open at one end and grounded at the other end.

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[12] On Climate and Nomadology: Following the so-called Hydraulic and Agricultural Revolution in Iran (similar to that which Wittfogel associated with the Chinese Empire, as well as Homer-Dixon's more recent theories on Hydropolitics), during the reign of Mohammad Reza Pahlavi (Shah), an hydraulic plan – highly recommended by American consultants – was developed and proposed as a catalyst for economic development in Iran; one of multiple objectives of this plan was to solve the problem of nomads in Iran. Apart from putting into effect a program of hydraulic restructuring of the diverse geography of Iran (a geography with innate potential for the forging of diversifying lines of nomadic movement), one of the stratagems of this hydropolitical program of reform was to originate a system for monitoring and domesticating Iranian nomads who played key roles in resistance against the centre or induced geopolitical disintegration of the State's territory via their ethnonationalistic movements. The plan was neither a method for drawing the eastern and central nomads to the governing center nor a project for forcibly accommodating them in a sedentary sphere through the monopolization of water-networks and direct military impositions. Rather, it suggested accompanying them, interlocking with them and replacing their dynamism with the State's fluxional lines of tactics, its dynamic boundary and territorial forces. The project's objective was to construct a soft climate (klima: zone) or a

In a typified connection C_τ, abutment can be mapped on the Euclidean plane R as:

$$A_\tau(x,y) =_{df} C_\tau(x, y) \wedge \neg O_\tau(x,y) \quad \text{(x abuts y)}$$

(Where O_τ is a typified boundary overlap.)

Or let T = {X, cl} be a topological space, where X is the set of points and cl is the closure operator. Let *I* be any index set that includes 0. The domain, *D*, of a Layered Model is a nonempty set of ordered pairs $x_i = \langle x,i \rangle$ where $\emptyset \neq x \subseteq X$ and $i \in I$. (x_i will be used for $\langle x,i \rangle$).

$$A(x_i,y_i) =: x \cap y = \emptyset \,\&\, (cl(x) \cap y \neq \emptyset \text{ or } x \cap cl(y) \neq \emptyset) \quad \text{(abuts)}$$

Since Abutment links entities on a tangential plane (*confinium*), the state can effectively resist any arriving onrush of nomadic warmachines on this mode of connection with minimum attrition damage on its critical interior (the plane of logistics and lines of command). In fact, clandestine states seek to channel all the cumulative damage induced by nomadic warmachines (as the postulate of the obtrusive danger) on this mode of connection. This is achieved by deflecting any fundamentally contagious, manipulating and undermining threat towards distributive and recoverable eroding processes; these latter can even be programmed to transport the State out of its rigid segmentarity and despotic bond with territoriality, prolonging the survival of the state in a fluxional mode in a manner of an abrasive machine of the *fluvius* (river) that erodes solidity in order to transport it by the dynamic conservative vector fields of sedimentary processes – capturing fecundity and irrigation in detrition. With warmachines tirelessly gnawing at the State's *textum*, incising and liquidating its crisp boundaries, the State begins to leak out, but this does not only express the collapse of the State but also the dangerous exposure of the nomadic warmachine to the underlying grid on which the State is assembled and which holds its interwoven space, a network of grounding processes, mechanisms of territorial regulation and economic repression.

The Installation of the operational cutting-edge of nomadic warmachines on the State in the absence of any ungrounding machineries (which incapacitate the dominant grounding, territorializing and moderating functions of the State) is a similar case to that of the premature line of deterritorialization which facilitates either the unconventional establishment of new immunologically-enhanced States or a suicidal flight. Persian history, over a long period of time (from the Achaemenians to the Qajar dynasty (1779-1925), more than two thousand years), narrates such a continuous conversion of nomadic forces into State forces, before being again replaced by another nomadic population (cyclic nomadic uprisings against the ruling regime with a nomadic germ-cell still active but privatized as the State's elite, versatile military institution). Such premature nomadic detritions of the

State have progressively given rise to more powerful (in terms of gravity, immunity and parasitic resistance) yet more unstable States, causing politico-economic poverty; inclination towards being colonized by other States; lack of an autonomous nervous system and polarization of different populations without the possibility of positive diversity; constant vulnerability to schisms, civil-wars, and ethnonationalistic fault lines deleterious to an entire country or geopolitical sphere.

When abrasion processes of nomadic warmachines continue to hold their eroding positions – essentially characterized by transporting dynamism of friction (*tactionis*) and the process of mass-wastage – over a long duration on the borders of the state, hyper-active territorial nexuses between the State and nomadic warmachines emerge, increase and expand. Once such nexuses are established (boundary overlap), the underlying ground economy of the State (or its territorial forces), its entities and even the State's internal machineries directly leak out into the space traversed by nomadic warmachines, to such a degree that they pervade the nomadic space and

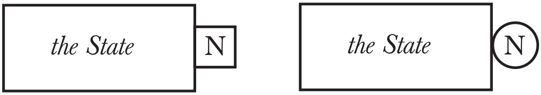

Fig. 2. Boundary Overlap with the State (diagrammed as a square) and Nomadic Domestication (left), Tangential Contact (diagramed as a circle) and Nomadic Effectivity (right)

turn it into a dynamic extension of the State[13]. In this case, the State's functional or territorial entities cannot be effectively enveloped and carried away by nomadic warmachines (as in the case of tangential contact) anymore. They cannot be cut from the State's grid of dominance, liberated and radically dispersed to the Outside (fig. 2).

The hazardous contact of nomadic warmachines with the State, exposing them to the state's regulating functional/territorial spheres, can eventually lead to the emergence of a nomadic-state on the one hand and an ethnonationalistic nomadism (identical to the State's patriotic policies) on the other. Probably one of the most significant examples of such anomalies triggered by the over-exposure of nomadic warmachines to the State is that found throughout Persian history.

(b) Overlap:

If, in a simplified approach, P stands for parthood and O for overlap:

$$O_{\tau}(x,y) =_{df} \exists z(P(z,x) \wedge P(z,y))$$

And

$$Oxy{=}{:}\exists z(Pzx \mathbin{\&} Pzy) \text{ (}x\text{ and }y\text{ overlap)}$$

Then the following Axioms apply:

$$\textbf{AP1}\ P(x,y) \leftrightarrow \forall z(O(z,x) \rightarrow O(z,y))$$

$$\textbf{AP2}\ \exists x(\phi(x)) \rightarrow \exists x \forall y(O(x,y) \leftrightarrow \exists z(\phi(z) \wedge O(z,y)))$$

Any participation (either *methexis* as survival-based participation or base-participation) happens through overlapping connections. Therefore, the majority of

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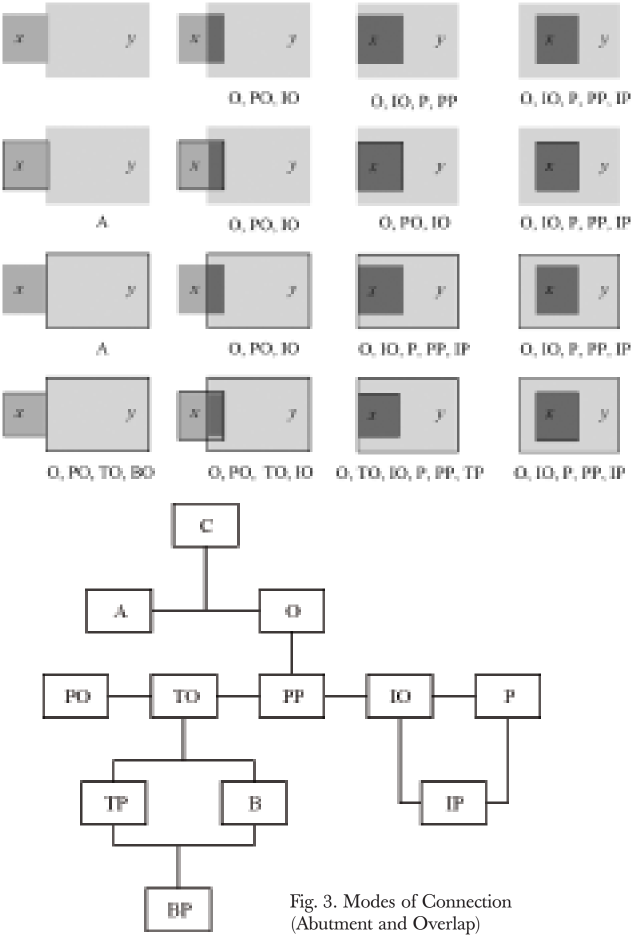
[13] A cache for the later movement of the State's macropolitics towards its micropolitical reformation


x
y
O, PO, IO
O, IO, P, PP
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A
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O, IO, P, PP, IP
C
A
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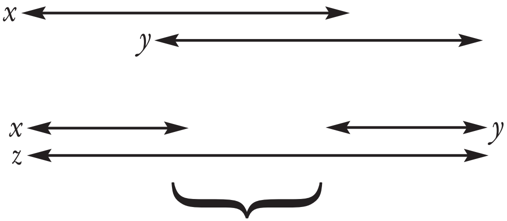
Fig. 3. Modes of Connection
(Abutment and Overlap)

combined connections (Tangential, Parthood, Interior, etc.) are effectuated by different possibilities educed by overlap between entities. Overlap draws lines of coincidence between two events or entities by specifying an address that two entities partly or completely share in a spatio-temporal or a functional region. Both the State's appropriations and counter-state *insurgencies* happen through this mode of connection. Whilst it is exploitable by the State and by affordance, this does not mean that 'overlap' cannot also be the main source of insurgency – it is the connection-domain through which warmachines leave their border-eroding externality and directly arrive at the State's grid, either to be specialized by the State apparatus and turn into *military formations* or to be reinvented as contagious, endo-symbiotic and parasitic entities *coinciding* with the State and its machineries and consequently discovering a wide array of clandestine



Not overlapped:
The zone of evacuation and withdrawal from the camouflaged position or the escape-route.

Fig. 4. Partial overlap and its interval relations in Camouflage:
(1) Between two entities; (2) Between two entities and the third entity

and manipulative functions.

On a more technical plane, all camouflage exploitations are essentially consistent because they all involve the use of 'overlap' (or, more accurately, coincidence, as the question of overlap between entities here is the question of overlapping niches which these entities occupy[14]). Furthermore, they turn it from a mode of connection into a politically-operational positioning that violates both the symmetry of a niche with the address it writes (programs) for an entity and the divisors (events, entities, etc.) which separate and discriminate the addresses or niches of two entities in space-time coordinates. However, this violation (that necessitates the activation of camouflage) cannot remain durable and unchanged, because predatory/military camouflages always employ partial overlap, with a part constantly accessible as 'not camouflaged' (either belonging to the camouflaged entity x or the entity which it should be overlapping *i.e.* y[15] [See

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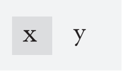
[14] Two entities will be said to overlap when they share parts in common: two entities coincide when they occupy *overlapping* regions of space.

[15] An example of the *not camouflaged* part (not overlapped) solely belonging to *x* or *y:* When the 'not camouflaged' part merely belongs to *y* (in a typified connection):



x internally overlaps *y*. When:

$IO_\tau(x,y) =_{df} \exists z\ (IP_\tau(z,x) \wedge IP_\tau(z,y))$

x is an interior part of *y*, and when

$IP_\tau(x,y) =_{df} P_\tau(x,y) \wedge \neg\, TP_\tau(x,y)$ and

$TP_\tau(x,y) =_{df} P_\tau(x,y) \wedge \exists z\ (A_\tau(z,x) \wedge A_\tau(z,y))$, *x* is a tangential part of *y* fig. 4]). This not only makes tracing and handling of the camouflaged entity possible on a tactical level but also provides the camouflaged entity with an escape-route or a space for instant evacuation and withdrawal from the camouflaged position. (An escape-route can also be unlocked when an entity *z* – a third party – connects to both *x* and *y* with different overlapping positions for each one (See fig. 4); here, the escape is channeled through another camouflage, a new camouflaged participation extracted neither from *x* nor from *y*.) This 'not camouflaged' or 'not overlapped' part inhibits the camouflage from being durable or constantly undetected, but also makes camouflage controllable; the camouflaged entity can move out of the camouflage at any moment.

All types of camouflage draw a disruptive function from the overlapped part (which mainly occurs on a fragmented level) by conducting the address or niche of another entity (for example, the prey) to the camouflaged entity (hunter) and consequently disrupting the mereologic (part-whole) correlations at work with regard to what should be camouflaged, making it temporally and partly untraceable, camouflaged. Such disruptions (which generally target a reference-point or a reference-link by which an entity is detected) can produce cognitive-glitches as well as the subversion of some specific environing bonds that pass through both the camouflaged entity and its object (its prey). Motion camouflage uses a particular type of tactical dynamism (in cases where the prey is also in motion, the movement of the shadower or the camouflaged predator moves on the path of a chaotic pursuit; the movement can be modeled by projecting its pursuit curves onto the Rössler attractor) or dynamic overlap to disrupt (i.e. shadow) its distance and displacements from the prey (the shadowed) by moving on a path that connects it to a fixed point (used by the shadowed as a reference-point – a constant unit vector) while the motion by the target is met by the motion from the aggressor. In motion camouflage, then, the shadower remains stationary for the target. In the most common military camouflage – disguise by covering objects (soldiers, vehicles, artilleries, launch pads, etc.) – with Disruptive Pattern Materials, disruption happens through surface modifications of a camouflaged object on which the visual sensory organ focuses as a reference-link between different types of surface patterns in its surrounding space, resulting in the ignoring of the object as a part of the safe environment. Invisibility (as a retreat

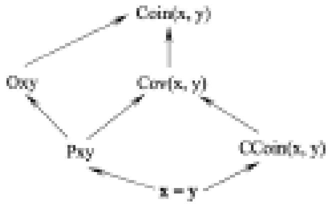


Fig. 5. If **Coin** stands for coincidence, **O** for overlap, **P** for part, **Cov** for cover and **CCoin** for complete coincidence.

from visual sensors), too, employs and modifies partial overlap as an occlusion by obscuring surfaces, interiorizing, positioning the camouflaged (cloaked) entity where boundaries intersect (obscuring boundaries), etc. The primary drawback of the invisible warmachine is the danger of being traced by semiotic regimes of the State which are more obsessed with what is missed than with what exists.

As the result of partial overlap, all disruptions and subversions of mereologic bonds are subjected to eventual disclosure; and each time a camouflage is spotted, it progressively loses its potential; any entity using such a camouflage will be more prone to detection and forestalling counter-measures than it usually is; this is a symptom of the holistic connections between partial overlap and 'localization' which has not been functionally incapacitated and spatially effaced yet. This is why camouflage is rarely implemented as a primary action or an offensive tactic but mostly as a logistic process or a mis-ordering transitional space between different tactical and operational lines. Transient characteristics and stringent operational restrictions obstruct radical weaponization of camouflage.

A *Takfiri* under *Taqiyya* (Islamic hypercamouflage) does not occupy a niche to replace another entity, or dwell as a hidden agent; he pushes the connection with his environment toward a complete overlap, an unbroken field of connection and correspondence, a complete coincidence with its target, *i.e.* a complete overlapping of its niche with the niche of its target. He entirely overlaps his prey and its niche and thus remains silent.

$$\mathrm{Coin}(x,y) \leftrightarrow \exists z(\mathrm{Cov}(z,x)\ \&\ \mathrm{Cov}(z,y))$$

(*x* and *y* coincide if and only if there is some *z* that is covered by both *x* and *y*; *z* standing here for niche. While **Cov** is a transitive and reflexive relation, **Coin** is symmetrical and reflexive. The relation of coincidence is of course broader than that of overlap, since there are pairs of coincident objects or even processes that do not share parts. The same question of relation arises for a *Takfiri* under *Taqiyya* and a civilian.)

For a *Takfiri* under *Taqiyya*, occupation is neither a military goal nor a tactic; since occupation is *exclusive localization* tethered to the mappings of co-localization and parts-whole connectedness – that is to say, the despotism of Whole – the occupier is vulnerable to environmental forces; it can be easily distinguished, located, isolated and finally terminated *i.e.* undone at the minimum attrition cost of its environment and surroundings. Where occupation is bound to visibly militant and escalating modes of warfare and exclusion, weaponized *Taqiyya* is maliciously diffusive. In mereologics (the discourse of part-whole modes of connectedness) we would call the positioning of *Taqiyya complete overlap*: the *Takfiri* constitutes a sinister survivalism whose basic function is to extinguish survival itself. In complete overlap (see Fig. 6), every region, function or part of the hypercamouflaged entity or predator, the '*Takfiri* under *Taqiyya*' (X) can correspond with its identical region, function or part of the prey/host/civilian (Y). Therefore if every *x* (part or function of X) homologizes its corresponding *y* (part or function of Y) or more precisely, if every *x* corresponds with its *y* 'on all levels' then every function of X (the tactical movement of the *Takfiri* under *Taqiyya*, or hypercamouflaged predator) can be transferred to Y and they mutually fulfill each other.

$$x=y \leftrightarrow \forall z(Oxz \leftrightarrow Oyz)$$

(Any two members of the domain that overlap the same entities are identical.)

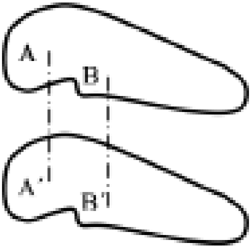


Fig. 6. Complete overlap and symmetric fulfillment
(Symmetry: Let $\boldsymbol{S}$ be the symbol for symmetry where $\boldsymbol{n}$ is an integer, $\boldsymbol{d}$ is the class descriptor and $\mathit{comp}\boldsymbol{d}$ is the complement of $\boldsymbol{d}$: $\boldsymbol{S} = \{\boldsymbol{n}(\boldsymbol{d}) \wedge \mathit{comp}\boldsymbol{d}\}$)

But the most horrific dimension of this arrangement is revealed when the process is reversed: if every *x* fulfills its corresponding *y*, then by way of the 'exact connecting-corresponding' space that complete overlap and complete coincidence ($\mathbf{CCoin}(x_i, y_i) =: x = y$)[16] provides, every *y* (i.e.

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[16] Complete coincidence can be expressed in terms of covering (**Cov**):
$\mathbf{Ccoin}(x,y) \leftrightarrow \mathbf{Cov}(x,y)\ \&\ \mathbf{Cov}(y,x)$
(*x* and *y* completely coincide if and only if *y* covers *x* and *x* covers *y*)

every function or positioning of the prey Y, which would comprise for the most part normal survival functions and ordinary individual or social activities) can be transferred to its corresponding *x* and eventually fulfill it too. By seizing any *y*, a corresponding *x* is triggered and covertly unleashed; and since we are dealing with complete overlap, the very *survival and communication* of Y deploys, activates and fulfills the menacing body of X, the *Takfiri* under *taqiyya*. On the one hand, the survival of the prey/host/civilian thoroughly agrees with the sinister enthusiasm of the terrorist; and on the other hand, peace is generally conceived as the state of collective survival. So that the survival of both the terrorist and the civilian yields nothing but the (interminable?) endo-militarization of peace, a global threat against civilians, the rise of White War and the threat that, fuelled by the infinite thirst of heretical Jihadism, the contagion of war might expand unchecked, even to fill the immensely significant horizon of survival and *living* in general.

Now that the survival of Y or the host/civilian (together with its communication and modes of connection through and with its *environment*) fulfills the political and military body of the '*Takfiri* under *Taqiyya*', the mere existence of the civilian is weaponized against both itself and the immune system of the system that accommodates and protects it to such a degree that auto-phagic overreaction looms as the only logical solution for the system. It is the military culmination of Taqiyya to deduce irrevocable insanity from the minimum essential logic required for basic survival.

EXEGETICAL CONCLUSION.

"The trends explored here will obviously be decided 'on the battlefield' - but that increasingly means everywhere. The centrality of hypercamouflage to Jihadi strategy is already having immense consequences, inducing a wave of 'retro-militarization' in State war machines, where 'teeth' flow back down the 'tail' in a process without obvious terminus (short of the fanging-up of the entire social body).

Saddam Hussein's auto-disassembly of his own war machine in the interests of a latent insurgency exemplifies this trend from one side, whilst the moves to harden up US logistics formations through armoring of vehicles and combat training for all personnel complements it from the other.

Human rights concerns about killings of civilians could relevantly be extended from the empirical level to that of the transcendental, where the eradication in principle of all civilian populations is taking place. The very concept of 'the civilian' is becoming distinctly dated. (Virilio's analysis – despite betraying a somewhat antiquated perspective through terms such as 'endocolonization' – seems to have anticipated this trend).

The US is especially interesting because it remains a 'peripheral' (even 'third world') society in certain respects, marked by a low domestic index of State monopolization of violence, thus allowing retro-militarization from the State pole to connect with an endogenous paramilitarism already rooted in the 'civilian' population (armed vigilantism and militia movements). As far as militias are concerned, the world ain't seen nothing yet."[17]

COLLAPSE VOLUME I Erratum

. p76 Note 12 should continue as follows:

…The project's objective was to construct a soft climate (klima: zone) or a zone of hydraulic conductivity (corresponding to the State's Hydropolitics) which would autonomously accommodate nomads, making them move through itself, and thereby ease the whole process of monitoring, domesticating and tracking nomads. This climate being finally transformed into a tremendously dynamic network of anti-nomadic movements, would employ its hydraulic head to configure nomadic dynamism according to the State's geo-politics, economic convergence and military dynamism (an accessible space for the State's military entities especially during insurgencies); the State was seeking to breed its own territorializing (rather than territorialized) nomadologic lines. This climate was actually to consist of 'artificial rivers' which were supposed to be distributed over the country. The work of construction of these rivers was to be undertaken over a period of years, in a country that has always suffered from a lack of water in its central and eastern regions. Such fluid, rich and dynamic zones or hydraulic lines (for instance rivers and their tributaries) spread over the country would gradually attract (on the pattern of gravity) nomads, rendering a preferable but precisely mapped climate for their migration; a climate which would actually be an autarkic monitoring machine rendering its inhabitants predictable and expanding a fluid domesticating sphere for the Iranian nomads.

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[17] This exegetical conclusion to the current essay was contributed by Nick Land.

Prime Evolution

Interview with Matthew Watkins

Matthew Watkins' Web-based Number Theory and Physics Archive *and its speculative twin* Inexplicable Secrets of Creation[1] *– hosted by the mathematics department of Exeter University in the UK where Watkins is an honorary research fellow – have grown into a unique resource. The archive brings together work from the plurality of disciplines contributing to an as yet unnamed field of research concerned with the startling connections between number theory – particularly the Riemann Hypothesis on the distribution of the prime numbers – and the physical sciences. Watkins talks to* **COLLAPSE** *about his rôle in, and motivations for, catalysing and disseminating the field, about the latest developments in the search for the hypothetical 'Riemann dynamics', about the nature of discovery in mathematics and its academic and cultural status.*

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[1] *At* http://www.maths.ex.ac.uk/~mwatkins/. Dr. Watkins has kindly assembled a 'primer' for the mathematical concepts discussed in this interview: at http://www.maths.ex.ac.uk/~mwatkins/zeta/collapseglossary.htm

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http://www.urbanomic.com

Collapse: The primes have perennially been hailed as ‘mysterious’. In modern mathematics this mystery has condensed around the problem which Riemann's Hypothesis concerns. We can find primes as we count along the number line, but we have no way of predicting in general where and how densely they will occur. A lack of determinable global order, then.

Matthew Watkins: But first there’s a major question concerning what is meant by ‘order’. I’m often asked, is there a pattern in the primes, is there an order, but what does that mean? If you try to reformulate these questions very precisely, you’re forced to consider what it would it mean for there to be order, or a pattern. I mean, there are patterns like wallpaper patterns, where you have a block of something repeating. Well, almost by definition the primes can’t do that. But what sort of pattern could there be, what sort of order could there be? The idea that there might be a pattern, the importance of there being a pattern in the primes – these aren’t things you can rigorously pin down.

C: Couldn’t you use an information-theoretical definition of pattern?

MW: You could come up with a definition, one of an endless number of possible definitions, from information theory or some related discipline, of what a pattern is, and then apply it. But I think there's still the basic fact that when people who aren't familiar with any of those definitions are asking 'is there a pattern?' they don't mean anything that such a definition could capture, they mean something else – they don't really know quite what, but it seems important to them that there should be; whether or not there is a pattern in the primes they see as an important question. And it struck me when I was thinking about this that it's more *feeling-based*, it's not a rational question they're posing. You can try to construct rational questions around it. People have, and such questions have given rise to a large part of that body of work we call number theory.

C: But initially it's more like the expression of an instinct for pattern recognition?

MW: Perhaps. As Jung said – almost as the culmination of his work on archetypes – the set of positive integers, taken as a whole, corresponds to the *archetype of order*. So, in a sense, all notions of order, of something coming before something else, of things being in a sequence, all of that ultimately can be linked back to our instinctive grasping of there being a number system underlying our experience. Now that number system turns out to have embedded within it an enigma, a problem bordering on the paradoxical: is there order in the way this thing's put together or not? We feel there should be, but we aren't entirely sure how to ask the question – basically, we don't really know. So we start by asking whether there's order in the number system, and the unintended result of our probing into this matter is that what we ultimately mean by order *in any sense* gets indirectly thrown into question.

People also frequently ask about the existence of a *formula* – is there a formula for the prime numbers? Well, again, that's difficult because, yes there is, there's the Riemann-von Mangoldt explicit formula, which effectively generates exactly the distribution of prime numbers as 'output' – but you need the complete set of *Riemann zeros* as input. This is an infinite set, and to produce it you effectively need the complete set of prime numbers, so there's a circularity. So it's a formula, but not the kind of formula which people who ask this question have in mind. There are also algorithms – rigorous procedures – which can systematically generate the primes. One could arguably call these 'formulas', but they're basically methods of computation, and the computations quickly become intractably huge…so we're not talking about anything that can systematically spit out primes one after another in the sense that people might have in mind when they ask about the existence of a formula.

C: As the years have gone on, mathematicians' ingenuity and the employment of new technologies have seen an acceleration in the conquest of the critical line of Riemann zeta zeros. But does the fact we've got, say, one billion of the zeros make it any less mysterious than when we had a hundred? Does the apparent success of the Riemann Hypothesis (RH) militate against the conception of the primes as mysterious?

MW: First of all, you can't really talk about RH being 'successful', it's still a hypothesis. RH doesn't predict the primes as such, but the theory of Riemann's zeta function, from which it emerges, allows us to understand the distribution of primes much more deeply. At the heart of this theory is the peculiar sequence of 'zeros' now known as 'Riemann zeros', 'Riemann zeta zeros' or sometimes just 'zeta zeros' – these are what RH directly concerns.

What's happened really is that RH has displaced the mystery. The primes are no longer mysterious, you could argue – we now know that they are exactly governed. Initially, it was found that they're governed by a logarithmic distribution, a sort of gradual thinning out, in an almost statistical sense – that provides reliable but approximate information about the primes. Riemann later found that the logarithmic distribution is 'modulated' by an infinite set of waves, where each wavelength corresponds to one of the Riemann zeros. We're in the realm of proven mathematical results here, and these *precisely* pin down the primes, so in that sense, all mystery is gone; but in actuality the mystery has been pushed back, or displaced. The mystery now is, *where the hell did these Riemann zeros come from*? We can calculate hundreds of billions of them, we've got a vast, intricate body of precise mathematical results concerning them which ultimately brings us to a big, important, question about whether they'll all lie on the 'critical line' – that question is RH. But ultimately, what *are* they?

Since the seventies, this idea that they might be *vibrations of something* has taken root and has now been more-or-less universally accepted, on the basis of a lot of computational evidence together with a mysterious, suggestive mathematical 'coincidence' involving something called the Selberg Trace Formula – and that ties in with certain unexpected connections with physics.

So if we've got vibrations of a mysterious 'something' underlying the number system, in a sense the primes are no longer the mystery, the primes have been taken care of, the mystery has been displaced. The primes are our obvious way into the mystery, but ultimately it's a mystery about the system of positive integers, about 'order', and arguably even about *time*.

C: To return to the question of order, are the zeros any more ordered than the primes?

MW: The set of primes and the set of Riemann zeros are in some sense 'dual' structures. There's a variant of what's called a 'Fourier duality' between them. To put it simply, you can use the zeros to generate the set of primes: if you have just the zeros and the explicit formula, you can effectively ‘put the zeros in and get the primes out’. And it also works in the opposite direction. So the two generate each other. In a sense the primes are more well-behaved in that they’re all integers, they all fall on this nice ‘grid’ of positive integers. The primes can be explained to a schoolchild, a five-year-old is capable of understanding the idea of prime numbers. They are there among the familiar positive integers, the usual counting numbers, and counting is a ubiquitous part of our everyday experience.

They’re dual, so in some sense the two could be seen as equally important, two sides of the same coin. However, the Riemann zeros are very different – they’re not integers, they’re what we call ‘transcendental’, irrational numbers; you need a degree in mathematics before you can even begin to understand the definition of them, and relative to the total population, only the tiniest handful of people have any real understanding of what is currently known about them. And they appear to have absolutely nothing to do with ordinary everyday experience.

C: We could say that the zeros are not a solution to the problem, but the problem itself, expressed in a domain that’s more difficult for us to access; the exact nature of this domain then becomes the real focus of interest.

MW: Yes, the zeros are the problem, and thus the problem's been displaced to somewhere we're much less familiar with. Counting, you know...Ancient Greeks and earlier people could count pebbles out on the ground, subdivide them into piles and contemplate different types of numbers – 'perfect numbers', 'triangular numbers', prime numbers – and they were able to develop a certain amount of theory. But that's just one side of the coin. On the other side, there was no way they could have contemplated the Riemann zeros: (a) you need a theory of 'functions of a complex variable', and (b) in order to calculate more than the first handful of them you need a pretty powerful computer.

It reminds me of the central image in the film *2001*: It's as if we've dug this monolithic thing up, it's been there for aeons, as a structure it's overwhelmingly impressive, and everyone concerned is flabbergasted, asking themselves how did *that* get there, you know: it comes from *somewhere* else, somewhere beyond, and it induces a sense of almost religious awe.

One suspects that if a mathematical structure underlying or 'explaining' the Riemann zeros were to emerge – that is, if in fifty or a hundred years someone comes up with something new which 'explains' the zeros in the way the zeros 'explain' the primes – then that new structure is just going to open up another even deeper mystery. Paul Erdös, who published more mathematics papers than anyone else ever, and who was primarily a number theorist, said that it's going to be at least a million years before we understand the primes, and even then we won't really understand them.

C: Is it a properly transcendental problem, relating to the limits of our thought: the more that we think, the further the problem moves away from us?

MW: Well, again, we don't know that yet: it may be, but then who knows – maybe it'll all neatly tie up somehow. But it *feels* to me that the problem has a quest-like quality. The fact that the metaphorical image of the Holy Grail has been invoked a few times in the literature, as well as a lot of language poetically invoking the feminine and generally suggesting an 'otherness', suggests that I'm not the only one thinking like this. I've had an interesting dialogue with some Jungians about this aspect of RH.

The problem of the primes isn't just different from other mathematical problems, it *precedes* them. All other mathematical problems rely on the fact that there are positive integers. Without the set of positive integers, those other mathematical problems couldn't exist. So the problem of the primes is *the* problem in a sense, it's beyond the most basic, it's there before all the others are there. As soon as you've got counting, as soon as you've got any notion of repetition, then the problem of the primes is there waiting to be discovered.

If we don't understand the prime numbers, we don't understand the positive integers. And if we don't understand the positive integers, then I don't know if we understand anything at all, because all science is entirely built on measurement, and you can't measure anything until you can count. All our rational scientific thought relies on these very basic ideas of order and counting.

One of the most important quotations that I've reproduced on my website is this, from Gerald Tenenbaum (Institut Élie Cartan):

> As archetypes of our representation of the world, numbers form, in the strongest sense, part of ourselves, to such an extent that it can legitimately be asked whether the subject of study of arithmetic is not the human mind itself. From this a strange fascination arises: how can it be that these numbers, which lie so deeply within ourselves, also give rise to such formidable enigmas? Among all these mysteries, that of the prime numbers is undoubtedly the most ancient and most resistant.[2]

So, in probing the mystery of the prime numbers we're effectively on a sort of journey to the centre of the mind, or of the collective human psyche, and ultimately to the point where that interfaces with the physical world which it finds itself inhabiting. That quote perhaps best conveys some feeling as to why I'm so gripped by this stuff.

C: The story of the modern theory of primes begins

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2. G. Tenenbaum and M. Mendès France, *The Prime Numbers and Their Distribution* (AMS, 2000) p.1

with Gauss's initial success in predicting approximately the distribution of primes. How do we get from there to the pioneering interdisciplinary work that your web-archive charts?

MW: Gauss – although he didn't publish, he supposedly got there first – Gauss and Legendre noticed that there was at least a 'statistical' thinning out of the primes that you could quantify. Riemann later uncovered the zeros of his zeta function – the Riemann zeros – and so was able to pin it down much more rigorously. But there's a fifty-year gap where...actually, I don't know what mathematicians felt during that time. Practically, they were trying to refine the approximations; Chebyshev and others improved the approximation of how many primes you'll find in any given chunk of the number line. But whether there was an expectation that eventually someone would find a way to make this exact, or whether there was a general feeling that 'this is the best we'll ever do', I don't know, and I can't recall seeing anything in the literature of that period where feelings about this matter were expressed. Once Riemann's work came along then no-one was really interested in what people *used* to think. The history of mathematical ignorance isn't as well documented as the history of mathematical discovery.

There are some parallels with the situation we're in now, where there's a mystery about this proposed 'Riemann dynamics', this hypothetical dynamical system underlying the Riemann zeros.

C: The complex plane is the most important mathematical support of RH itself. And here already a transformation takes place – de Sautoy[3] talks about it as a sort of magic mirror we step through – which seems to unfold things we thought we knew, in a completely different space – as it turns out, very fruitfully for mathematics and the physical sciences alike.

There's obviously something very powerful about the complex plane itself which, at the very least, corresponds in some way to physical reality, and so the fact that it was also the complex plane which facilitated Riemann's insight into the prime distribution is itself suggestive.

MW: The complex plane appears to have a life of its own. Complex numbers are absolutely necessary to describe quantum-mechanical phenomena. Electricians use the complex unit *i* just to work with AC electricity, so something as 'nuts-and-bolts' as the National Electricity Grid depends on the complex plane. And yet it is this supremely mysterious thing. I mean, all those fractals that started to circulate in the 1980's – a lot of people don't realise what they're looking at, but those are things that naturally inhabit the complex plane. Without the complex plane you wouldn't be able to see such objects, that's their natural domain. And then the Riemann zeta function, with all its strange properties; Riemann's big step was to take a function which Euler had looked at and ask, what would that do if we extended it into the complex plane? And what it was found to do then spawned the great mystery of the Riemann zeros.

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[3] De Sautoy, M. *The Music of the Primes*. London: HarperCollins, 2004

Another strange thing worth mentioning: One tends to think of temperature as existing on a linear scale, a one-dimensional scale. But in statistical mechanics, by constructing a function of temperature, the 'partition function', and extending it out to the complex plane, you find that it has a set of 'singularities', off the familiar real number line, in this other two-dimensional region that doesn't seem to have anything to do with temperature or any other aspect of practical measurable physical reality. Yet these singularities correspond to *phase transitions* of the system. Without the complex plane you'd never have known they were there. The same thing happens with the zeta function, it's got a set of singular points in the complex plane, the Riemann zeros off the real line. From the behaviour of the zeta function *on* the real line, you would never have guessed they were there.

Various people have put forward models of two-dimensional time – imaginary time certainly gets used, complex time. Such models can be used in attempts to explain otherwise inexplicable phenomena, but none of this can be applied to our normal experience of reality, you can't really do anything with it. I would say that the complex plane is still deeply mysterious. It's 'behind the scenes' of reality as we experience it.

C: And historically, complex numbers had been discovered long before there was any sense of their ultimate utility. Only later did it became evident that something which seemed to have been a mathematical fiction, was hugely important to work in these fields.

MW: Absolutely, the word imaginary, you know – you've got the 'real' numbers and the 'imaginary' numbers – it's a very unfortunate name, but it's simply because of the history of the thing. For quite a while, no-one thought these things had any 'reality' to them, primarily because they didn't correspond to anything experiential in the way 'real' numbers were seen to.

C: It's difficult to ignore this experimental evidence that complex numbers relate to something in reality: we have to take account of these things which just impress themselves upon us. The traits of the complex plane are obviously real, but they don't correspond to any actual object, any actual thing we can get hold of. They're distributed through reality itself.

MW: Yes, the system of complex numbers is there, I don't know 'where' it is, but it's not just something we *invented*. And, interestingly, it's most directly evident at the subatomic level. As I said, the theory of AC electricity relies on it, but then ultimately that's a quantum-mechanical phenomenon, scaled up to the level where we can, say, run a toaster on it. Functions of a complex variable get used in statistical mechanics, aerodynamics, *etc.*, but those are fairly indirect manifestations of something very deep, I feel. The fact that the complex plane relates so closely to quantum mechanics means that in macroscopic reality, it permeates everything, as you say, and yet nobody had a clue it was there until relatively recently. Even after it had been mathematically brought into consciousness it was still seen as just a fiction.

As for the primes, you can't understand the distribution of primes until you've grasped the Riemann zeros. And the Riemann zeros live on the complex plane, inarguably. The 'nontrivial' zeros, the ones RH concerns, inhabit a narrow vertical strip in the complex plane. The RH simply says that they all – the entire infinite set of Riemann zeros – lie on the 'critical line' which runs up the middle of this 'critical strip'.

Now, to prove RH would be an exact mathematical task, so RH gets a lot of press – there's the whole fame-and-fortune thing, literally a million-dollar prize, this idea of something like winning the ultimate intellectual gold medal, you know – but you've either done it or you haven't, it's very clear-cut. But I'm more interested in the less clear-cut questions – what *are* the Riemann zeros, from where do they originate?

To answer this we may need something else as new

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4. See http://www.claymath.org/millenium/

and unexpected as the complex plane was when it was first introduced, something we haven't thought of yet, a new mathematical 'environment' in which these things will become perfectly clear. But that may well lead to another body of questions which are even more baffling.

But "from where do the zeros originate" – what does that mean? They're seemingly vibrations of something, but what? What is that thing going to be – is it going to be a mathematical model of a dynamic system that people may or may not be able to physically manifest? If it is possible to physically manifest it and someone does...what then are we confronted with?

One gets a very strong feeling that until we understand the what the zeros 'are', we won't be in a position to prove RH. These two issues are tied together. But the former isn't yet a precise question, whereas 'is the RH true' *is*.

C: It is said that in mathematics a question isn't even a question if you can't formulate it precisely: mathematics is the art of formalising problems, so if you can't do that then in a sense it falls outside of mathematics.

MW: Yes, and so something with this kind of quasi-mathematical character is generally regarded with a certain suspicion; it's neither one thing nor the other.

C: A mystery rather than a problem, then.

MW: Yes, and I suppose I tend to be attracted to the mysteries.

C: Practically speaking, how does the hypothetical positing of a Riemann dynamics change the nature of the search for a proof of RH?

MW: It brings other people in, it brings the physicists in. Before, you had analytic number theorists hammering away at this problem. And now probability theorists, geometers and physicists are all contenders, and they all have pieces of the puzzle. It's broadened the scene, if you like, of people concerned with the problem. But it also has given a deeper sense of what's at stake; again, if there is a dynamic system underlying the Riemann zeta function, well then it underlies the number system; if it underlies the number system then it underlies everything, or at least everything that rational scientific thought concerns itself with. And so, again, we're force to ask what is it, where does it 'live', what does it 'do'? And perhaps the most important question is, *what is the time parameter*? Because a dynamical system always has a time parameter according to which it 'evolves' – so what kind of time are we talking about in this case? So it basically opens a whole new can of philosophical worms. It makes me think of what Hilbert said, when he was asked about RH, he said that it isn't just the most important problem in mathematics, it's the most important problem. And I think a lot of people might just think, yes, that's because he was a mathematician, he was biased...but I think he knew what he was talking about. He and Pólya first proposed that there might be a 'Riemann operator', that the zeros might be a spectrum of something. They didn't suggest a dynamical system as such, but they could be said to have laid the groundwork for that. So I think Hilbert may have sensed something very big going on there, which he was trying to express in that pronouncement.

C: The first steps towards elaborating the nature of the Riemann dynamics comes with Julia's interpretation of the zeta function as a thermodynamic partition function. What is a partition function, and in what sense can one speak of the primes as a numerical gas – Julia's 'free Riemann gas'? Is it simply a useful metaphor taken from thermodynamics, or is there a more substantial link?

MW: Well, firstly, Julia's work doesn't directly address the issue of the Riemann dynamics, although there may well be a deep connection there.

Your last question is difficult to answer, but it would be hard to deny that there's a sort of a metaphor here, in that there's a strong resemblance between certain aspects of the zeta function and the theory of thermodynamic partition functions. But it goes deeper than a superficial resemblance. There are enough corresponding elements, that Julia included what he called a 'dictionary' in the paper he first published about this.[4] It consists of two columns, with number theoretical structures on one side and corresponding thermodynamic structures on the other. And the correspondences are such that, if you're sufficiently familiar with number theory and statistical mechanics, you can't deny there's something...there's a very strong link there. So you could call this a metaphor, but I would maintain that it's more than just a metaphor in the familiar sense, *i.e.* a useful way of explaining what something is by means of something else which isn't directly related to it.

Now what is a partition function, in statistical physics, or statistical mechanics? Well, in classical mechanics, a billiard table is often used as an example: you've got a finite number of billiard balls bouncing off each other, bouncing off the sides, they're colliding, energy is being transferred between them, there are various angles, positions and momenta involved. And the idea is that you've got a sufficiently simple system that you can keep track of each individual object and what it's doing. But a problem arises when you've got something like a box of gas: that's effectively like a giant three-dimensional billiard table, but there are too many components to keep track of what each one is doing. You're not actually going to be able to do anything in that way, so you're going to have to study it in the sort of way sociologists study society – they can't possibly consider all the specifics of each individual person, so they must look at overall statistical trends in the population.

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[4] Julia, B.L. 'Statistical theory of numbers', in M. Waldschmidt, et. al. (eds.) *Number Theory and Physics*. Springer Proceedings in Physics 47 (Springer, 1989)

Suppose you had a quantity of gas particles in this room, and they were all roaming freely. It would be very surprising to find them all clustered up in one corner. One expects a more uniform spread. But, *there's no real reason they can't do that.* It's like if I toss a coin fifty times, I'd be very surprised if I got fifty heads or fifty tails, but there's no reason why that can't happen. That would be no more unreasonable than any other outcome of fifty coin-tosses, it's just that it's extremely *improbable* because, unlike any other outcome, *there's only one way of arriving at it.* Similarly, there are proportionally few possible configurations of those gas particles where they're all squashed in one corner, compared to the vast proportion of configurations where they're more-or-less uniformly distributed.

Now suppose you have a box of gas, and the gas consists of particles which can jump between different energy levels in an effectively random way. This time you're concerned, rather than with the spatial distribution, with the *total energy* of the system – that's simply what you get when you add together all the individual particle energies. You can ask about the probability of the system having a particular total energy, and it turns out to be rather like the situation with the spatial distribution. That is, the system tends towards a mid-range total energy on the whole, while the highest and lowest ranges of *possible* total energy are much more improbable – because their occurrence requires something akin to a huge number of coin-tosses producing almost all heads or almost all tails.

So what you're looking at with thermodynamics is the probability that you'll find a box of gas or some similarly complex system in one state or another. And the partition function takes a unit of probability and 'partitions' or subdivides it, so that you end up with a curve describing in precise terms the relative probability of finding the total energy of the system at any particular level. So the partition function will basically return probabilities that a system is in one of any number of possible states. The partition functions Julia refers to are functions of temperature – as the temperature of the system varies, the probabilities also vary, and the partition function is able to provide a precise probabilistic distribution of possible total energies at any given temperature.

Now partition functions, it turns out, are the key to understanding statistical mechanical systems; they 'encapsulate' such systems. The partition function in this context is a function of temperature, and temperature would naturally be seen as a variable which varied on the real line – on the *positive* real line, if you're working with absolute temperature. Well, nineteenth century mathematics suddenly allowed the possibility of extending such a variable to the complex plane, regardless of what a complex-valued temperature might actually refer to. You take your partition function which is supposed to be returning probabilities of a system being in some energy state or other based on a real-valued temperature variable, extend it to the complex plane, and you find there are singularities hidden out there which tell you about the possible existence of phase transitions in your system. These are very important for understanding the system, but, as I said earlier, you wouldn't see them if you didn't have access to the complex plane.

Now Julia wasn't the first – George Mackey got there first, although it wasn't widely noticed. Julia discovered it independently and then Donald Spector, a couple of years later – they all noticed that if you treat the primes as your basic particles, and each prime *p* is thought of as having as its 'energy' the natural logarithm of *p* – that logarithm turns out to be very important, logarithms show up everywhere in analytic number theory – then the Riemann zeta function very naturally falls into the rôle of being the partition function of an abstract numerical 'gas' which is made of this set of particles – what Julia calls the 'free Riemann gas'. Imagine a fluctuating integer, where prime factors are coming and going all the time, joining and leaving, so the energy of that integer is going up and down, the more prime factors there are the higher the energy, and the less prime factors the lower the energy. The zeta function naturally becomes the partition function of such a system. The 'pole' of the zeta function – this unique singularity of the zeta function at the point 1 in the complex plane where the zeta function isn't defined, where it effectively becomes infinite – corresponds very naturally to something in thermodynamics called a *Hagedorn catastrophe*, a phenomenon involving the energy levels crowding together so the system hits a critical state and shifts into an altogether different mode. So the pole of the zeta function is associated with this 'catastrophe', and based on what I was just saying, the Riemann zeros also become linked to phase transitions, in a way that no-one entirely understands. And there's more...those are just the basic points, there are further subtleties which suggest that, in some sense, thinking of the zeta function as a partition function goes beyond mere metaphor. It's a metaphor, but it's a metaphor that goes deep enough to suggest to me that *the number system has some sort of quasi-physical quality*.

C: How are we to interpret this? There's a perplexing quality to these propositions, one is never sure whether what's being revealed is a progression, or simply a restatement of the same problem in different terms.

MW: Possibly, but you see, the mathematics that's come out of studying things like boxes of gas, *that that should be applicable at all* to studying something as fundamental as the positive integers, to me comes across as sort of *uncanny*. I think that's a good word to capture how a lot of people have reacted to these discoveries. It's hard to see how it's simply a reformulation of the problem.

You'd never have got there if you hadn't studied the boxes of gas in the first place. When you ask how we can best interpret this, the only answer I can come up with is I honestly don't know. To me it points to something fascinating which we haven't yet entirely understood or taken into account.

Now, interestingly, Alain Connes' (College de France, IHES, Vanderbilt) model involving what's called a *C*-dynamical system* – his attempt to try and describe the Riemann dynamics, which hasn't yet fully succeeded, although it's certainly opened up some new vistas – was inspired by Julia's paper, but Connes uses the partition function in a somewhat different sense. The partition functions I've been describing, the ones associated with boxes of gas, *etc.*, could be called 'classical partition functions' as they belong to 'classical statistical mechanics'. But there are also partition functions used in *quantum* statistical mechanics, which take some of the same concepts down to the quantum level.

Connes takes certain elements of quantum statistical mechanics and applies them to the zeta function, treating it as a partition function, and this reveals certain things which again push the metaphor, in my mind, so far that it can't be regarded as *just* a metaphor.

C: So there is a direct link between the quantum-mechanical interpretation and the thermodynamic?

MW: I think there must be, although it's not yet entirely clear what it would be. Of the two most extensive pages in my web-archive, one deals with the spectral interpretation – Hilbert and Pólya's suggestion that the Riemann zeros might be vibrational frequencies of something and Michael Berry's (Bristol University) physics-inspired work concerning what that 'something' might be. Berry and his colleague Jon Keating have outlined a whole set of dynamical properties characterising this hypothetical Riemann dynamics. And the other page deals with the thermodynamic or statistical mechanics side of things – you've got Julia, Spector, Mackey, who all put forward the idea that the zeta function is a partition function, which would suggest that the zeros are in fact phase transitions of something. So these two currents of research are seemingly different approaches, not obviously compatible. Alain Connes has begun to bridge the gap, though. He has taken Julia's suggestion about zeta as a partition function, shifted it into the realm of quantum statistical mechanics, and then brought in *p*-adic and adelic number systems, and a lot of other very deep mathematics including something called noncommutative geometry, which is about as difficult as current mathematics gets. He's managed to describe a dynamical system, or at least sketch out the beginnings of one, which produces the Riemann zeros as vibrational frequencies, but where the zeta function is also playing the rôle of a partition function, so there is a link there.

C: Connes' *adele* is an infinite-dimensional space in which each dimension is folded, so to speak, with the frequency of each prime.

MW: Yes, that's almost it. An adele is a generalised kind of number which contains an infinite number of co-ordinates, one associated with each prime number, effectively, and then an extra one, which corresponds to the continuum of real numbers.

The adelic number system embraces all of the different *p*-adic number systems – 2-adic, 3-adic, 5-adic, 7-adic, etc. *p*-adics and adeles constitute yet another aspect of number theory finding its way into physics, thereby suggesting that things aren't the way we thought they were.

The Archimedean principle, the basic principle of all measurement, is based on rational numbers, on ratios. If you have a line segment and a longer line segment, by taking the shorter line segment and joining it end to end a finite number of times, you will always be able to exceed the longer line segment. That seems obvious – it's the basis on which I can take a ruler and measure this room. If I kept joining it end to end and I never got to the end of the room, then measurement wouldn't work very well! So, the universe at the macroscopic scale is Archimedean: the Archimedean principle applies. And the number system we generally use, the continuum of real numbers, is an Archimedean system.

Now, the real number continuum is based on a particular arbitrary choice of how we 'close' the system of rational numbers. The rational numbers are fairly simple, well-determined, or given, if you like – canonical. You've got your integers, and then you start taking ordinary fractions and that fills in the gaps – it doesn't fill in *all* the gaps, but it densely fills in the number line. The 'holes' that remain are the irrational numbers, which can't be expressed as ratios of integers, $\sqrt{2}$ being the one that, it's widely believed, was first discovered, and π being undoubtedly the most famous. But there's not just a handful of exceptions, these irrational numbers are in some sense *more common* than the rational numbers.

The question is, given the system of rational numbers, how do you fill in the holes, how do you seal the whole thing up? Well, the method we've ended up adopting produces the system of real numbers, which is a system in which the Archimedean principle applies. And that's based on defining the holes, the irrational numbers, as the 'limits' of sequences of rational numbers. But to define the limits, you have to have a sense of distance; put simply, a sequence *converges* when its elements get closer and closer to something, and the notion of 'closer' requires some sense of distance. The sense of distance we use to define the real numbers is the obvious one: the distance between any two rational numbers on the real number line is what you get when you subtract the smaller from the larger. But that's an arbitrary way of defining distance. It turns out that, within the logical constraints which apply, there are an infinite number of other meaningful, consistent ways you can define what distance is, and each leads to a different notion of 'closure' and hence to a different number system. So you're still starting with the rationals, but the way you 'fill in the holes' is completely different, and you end up with a different kind of mathematics. Now this was discovered by Hensel in the late 1890's, and very quickly the possible ways of closing the rationals were classified. It turns out that there are infinitely many of them, and that they correspond to prime numbers: there's the 2-adic system, the 3-adic system, the 5-adic system, the 7-adic system, all the way up, and then finally there's the ∞-adic system, which corresponds to the usual system of real numbers, and which suggests the existence of what's called the 'prime at infinity', a deeply mysterious thing, which an Israeli mathematician called Shai Haran has written a whole book about[5].

But the point is, in a 2-adic, 3-adic or 5-adic number system, the distance between two rational numbers has nothing to do with the traditional distance between two points on a ruler anymore, rather it's about arithmetic relationships involving divisibility of numerators and denominators by the prime p which characterises the p-adic system in question. So things that would look very close together on a ruler could be huge distances apart, and vice versa, things that are vast distances apart in a normal Euclidean sense could be very close together in a *p*-adic sense.

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[5] M.J. Shai Haran *The Mysteries of the Real Prime*. London Mathematical Society Monographs, Oxford: OUP, 2001.

C: And the adelic system is built up of all these?

MW: An adele is a generalised number which has an infinite number of co-ordinates. One's a 2-adic number, one's a 3-adic number, one's a 5-adic number: one for each prime. They're usually written as:

(2-adic number, 3-adic number, 5-adic number...; real number)

so you get one of each. When, at the end of the nineteenth century, these *p*-adic number systems were discovered, it was realised that we've been doing all our physics on the basis that time and space are like the real number continuum. That's the assumption; all the Einsteinian, Riemannian, Minkowskian manifolds, space-time manifolds, were based on real numbers extending in different dimensions. But why should we assume the universe is 'real', in that sense? You could formulate a 17-adic manifold and do space-time physics in it, or a 37-adic manifold; but then, why pick one prime rather than another? Hence the idea arose, why not chuck them all in, create a system which involves all of them at once – this is the adelic approach, described in very crude terms. Hence *p*-adic and adelic physics – there are people developing models of *p*-adic physics where the *p* is just left as an arbitrary *p*, where it would work for any prime, basically re-building physics according to these new number systems. So you've got *p*-adic models of time, *p*-adic models of probability. A lot of it really turns your ideas of the world on their head.

Now Connes has come up with a dynamical system on a space of adeles, which generates the spectrum of Riemann zeros. The problem is that the system he's starting with has already got the prime numbers built in to it, so some people would say, well, he's really only reformulated the problem. But I suspect there's a lot more to it than that. It's not quite the dynamical system that is being sought in connection with RH, but it is widely seen as a valuable step in the right direction.

Even more interesting than Connes' work, from my point-of-view, is that of the lesser-known Michel Lapidus (University of California-Riverside), another Frenchman with a staggeringly broad view of mathematics and physics. I recently had the privilege of proofreading his latest book – I hope it will come out this year, it's been a long time in the pipeline. It's called *In Search of the Riemann Zeros* and it brings all of these ideas together. And he's taken Connes' idea even further. He's got a set of ideas involving quantum statistical mechanics, *p*-adics and adeles, dynamical systems, vibrational frequencies, partition functions, it's all in there, but also fractals, string theory...

C: The adele already intuitively brings to mind string theory, because of the way everything seems to be bound up with the nature of these peculiarly convoluted spaces.

MW: There's been a lot of work done on p-adic and adelic string theory, but that's not quite what you mean. Lapidus has actually come up with a fascinating connection. He was working on something he called 'fractal strings', but these didn't have anything to do with the 'string theory' physicists study, it was just the name that he had given to these particular mathematical objects. And then he generalised them to something called 'fractal membranes'. But since he came up with that, oddly enough, he's found that aspects of string theory relate directly and unexpectedly to the mathematics. His model involves a dynamical system, a *noncommutative flow of fractal membranes in a moduli space*...

C: Which sounds wonderful!

MW: Yes, at a very naïve level, I just enjoy all the extraordinary language. But, more seriously, I have a certain emotional investment in Lapidus actually being onto something, because if he's correct, it turns out that his 'flow', this very strange, highly counterintuitive, noncommutative geometrical 'flow' projects down into a simpler realm, into the number system, as a flow of 'generalised prime numbers' on a line. This is very close to some strange speculative ideas I made public back in

1999[6]. Lapidus contacted me a few years ago to say this, as it had come to his attention when I first put it up on the Web. Now, it's not that I influenced him, it's almost as if I caught a glimpse of some future mathematics which will follow from his current work. I don't know how I can explain what happened… it's as if I caught a glimpse of something which was coming, but I didn't have the language to describe it accurately, so I just described it as well as I could in this rather naïve way. And so in a way I now feel somewhat vindicated concerning my slightly crackpot idea, because of Lapidus' work.

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In some ways, I think all this intellectualising and mathematics isn't really that good for me, and isn't really what I 'should' be doing. But part of me can't entirely detach myself from it. The speculation I just mentioned, which now appears to be at least partly vindicated, gripped me in a profound way. This event had a precedent a few years earlier when I became *convinced* there was some connection between the Gaussian probability distribution and the prime numbers: that was driven by a sort of compulsion that was, looking back, was quite...not psychotic – it didn't lead to any sort of negative behaviour – but it did rather take over my psyche.

I was one of those kids who, it was obvious fairly early on, could excel at mathematics, and being a fairly scrawny, unattractive young person, one latches on to anything one is good at – it provides a sense of importance. It was as simple as that, it wasn't any sort of noble motive for seeking the truth or anything. I was living in the States as a teenager, starting to get interested in things like radical art movements and philosophy. If circumstances had been different I'd have probably studied something else, but I wanted to get out of the States, that was quite a big thing for me then, so to get into a British university my best bet was to apply to do a maths degree, which I did. And then I sailed through that, and got offered a place on a PhD programme, which seemed like a great idea – effectively being paid to explore ideas which I found quite interesting and which I seemed to have an aptitude for exploring. So that was all fairly accidental, and there was no real motive behind it, if you like. It was just the way my life unfolded. But by the time I was doing the PhD I was starting to engage with a lot of other non-mathematical ideas and people, and there was a real sense that, hang on, where is this going, is this really what I want to be doing? At that point I was more interested in 'seeking the truth' – it sounds a bit grandiose, but I wasn't interested in a stable career, and the idea of deriving some sort of self-esteem from being an accomplished mathematician, that no longer seemed to be of any importance. So I started thinking, if I'm seeking the truth, is the truth to be found here, is this really what I should be doing? And then the disillusionment set in. After a year of being on a Royal

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[6] *See* http://www.maths.ex.ac.uk/~mwatkins/isoc/evolutionnotes.htm

Society European fellowship, there was a distinct sense that modern mathematics was becoming irreparably fragmented, and I felt like I was being made very comfortable in an ivory tower, in a vast field of other ivory towers, between which there was relatively little communication. And then there were all sorts of personal factors, just the way my life was going, people I knew, a sense of imminent global catastrophe...

This was 1995, so perhaps there was a touch of millenarian hysteria involved! There was a sense that, as a mathematician, I was part of the problem rather than part of the solution. A lot of my friends were involved in ecological activism and things like that, and I started to formulate a worldview wherein science had become the new, unacknowledged, religion of industrialised society, and mathematics was the inner priesthood of science. To put it in very simple terms, Western culture runs on science, and science runs on maths. So I saw myself as being trained up for this priesthood which was unconsciously steering the world to complete destruction and meaninglessness. And so there was a sense of guilt, almost, that I was involved in this. So I just broke out and floated around doing all sorts of interesting things for a few years, had a great time – I don’t regret that at all. I never imagined that I’d get involved in mathematics again.

But then certain ideas about prime numbers started to percolate in my mind. I’d never really looked at number theory in any detail, had just a very basic number theory course as an undergraduate. But shortly after I 'dropped out', I started thinking about prime numbers and the fact that they have a sort of 'random' quality…and at the same time thinking about the Gaussian distribution, the bell curve, and the ubiquity of that, the fact that almost anything that you can name, count, measure, and gather data on tends to scatter along this particular ideal exponential curve. I remember posting a question on an Internet newsgroup back in 1995, trying to get somebody to explain to me why this thing shows up everywhere: not just in the biological realm, but in much more convoluted 'cultural' realms – I expect that you could count the number of appearances of a letter of the alphabet on the front page of a newspaper over so many years or months, and you'd find the same thing. And the purely mathematical explanations put forward made sense to some extent, but I still felt there was some huge mystery lurking behind the Gaussian distribution, the fact that it shows up everywhere. I scribbled all sorts of half-baked ideas down, some of which seem ridiculous now, some still of great interest. But I became convinced – and I still don't know where this came from – I became *utterly* convinced that the distribution of prime numbers in some sense was very deeply linked to this, to the ubiquity of the Gaussian distribution, that they were two sides of something.

And what's strange is that almost seven years later, I discovered there was something called the *Erdös-Kac theorem*, which was proved in 1940, and which I'd never even heard mentioned before. This was the beginning of *probabilistic number theory*, and it basically states that the distribution of prime factors of large integers follows a Gaussian distribution. Obviously, the larger the integer, the more prime factors it is likely to have, but you rescale in a way that takes that into account, so you're dealing purely with the seeming randomness in the fact that some numbers have got lots of prime factors and some numbers have only got one – and you end up with a bell curve. And not just an approximate one, this is what really struck me: if I was to measure the population over time of sparrows in the garden out there, or the way that those sunflower seeds fall on the ground [*pointing to bird-feeder hanging in a tree*], if I had large enough numbers I may well get very nice approximations of the bell curve. A high-resolution computer image might even match the ideal mathematical bell curve in every detail. But they're *always* approximate; in fact all use of statistical inference in science is based on finite amounts of data, which give rise to approximate bell-curves or other distributions. With the Erdös-Kac theorem on the other hand, the *n*, the number of elements in your data set, *actually* tends to infinity. This is what really struck me about all this: *n* can tend to infinity only when you have an infinite amount of whatever it is you're dealing with. And integers are the only thing, effectively, which we have – at least theoretically – access to an infinite amount of.

So, I haven't fully delved into this, but there's a problem with the use of infinity in statistics and probability theory. It's fine in some sort of abstract Platonic sense, but when you start applying it to the world, *there is no infinity*. But it does apply absolutely, precisely – and this is the theorem which Erdös and Kac proved – that as *n* tends to infinity, the distribution of prime factors tends to this distribution. So, in some sense, that's the only 'true' Gaussian distribution there really is, the 'oldest' one, the most primordial. As soon as you've got positive integers, that's hidden there within them. Any other instances of the Gaussian distribution, you know, bird populations or currency fluctuations or anything else like that, not only are these approximate, but they require all sorts of complicated categories and definitions. So, anyway, I still can't quite explain why I was so gripped by this idea of the prime numbers and the Gaussian distribution being linked, but I was, and it's as if I was somehow unconsciously aware of something and couldn't manage to pin it down, you know. I tried endlessly to find some way of relating these things and failed. Had this been 2005 rather than 1995 I probably would have quickly found out about the Erdös-Kac theorem using web-searches.

So as a result of this unresolved compulsion, I had a certain amount of prime number-related activity going on in my mind. Then, in the winter of 1998 I went back to the States to visit my parents who were still out there, and I had a lot of free time. I found a long thin piece of cardboard and drew a number line, circled all the prime numbers, and then started drawing arcs between the prime numbers and their multiples. So every number was connected to all of its prime factors by arcs emanating out from that number to the left. The number fifteen would have two arcs emerging from it, one going to number three, the other to five. And a prime number would have no arcs going to the left, only arcs going to the right. Now obviously you can never draw the complete thing, but I drew enough of it that you could get a sense of there being something, a connectedness, a 'messy' connectedness, like a nervous system, or mycelium, or...I don't know, I can't quite describe it, but I just spent a long time looking at this, I had it up on the bedroom wall. And as a result of internalising that image, I started to think that it was perhaps the gaps *between the primes* that were most important…but I was somehow naïve enough to think that possibly no-one else had thought of that, whereas in fact quite a lot of work has been done on the gaps between the primes and yes, they are important. But I started thinking that maybe the gaps, suitably rescaled, are the things which distribute in a Gaussian way. I tried to run some computer models, to calculate the gaps and analyse their distribution – but not having access to the necessary computational power, that wasn't really going anywhere.

And then this image of the interconnectedness of the primes, the whole number system as a single connected entity, with each prime as a sort of 'nexus', the whole thing exploded in my mind – it was something very sudden, and the initial impression I got was that the primes themselves were imbued with a sort of 'charge'...I think I'd read somewhere that average gaps between consecutive primes are logarithmic, that is the average gap between a prime p and the next prime is log *p*, the natural logarithm of *p*. Obviously the gaps can vary wildly from this average, but the average is a precise mathematical result, becoming increasingly precise as we allow *p* to tend to infinity. I was suddenly gripped by this idea that the primes themselves were imbued with a kind of charge, something like an electrical charge, and that that log *p* was the clue, that was the charge of the prime *p*. At the time I was unaware of Julia's thermodynamic approach which associates with each prime *p* the energy log *p*, and also that certain proposed dynamical schemes involve 'orbits' with period log *p* associated with each prime *p*.

C: So the magnitude of the gap before the prime would be its charge?

MW: Well, for sufficiently large primes *p*, the gap before and the gap after would both be approximately log *p*. And I had the idea that these primes were in some sense repelling each other and that the bigger the prime, the greater the charge and the stronger the repulsion, hence the bigger the gap. This all came tumbling in as a single thought, really – the account I'm giving now is an attempt to reconstruct and coherently describe it. But rapidly following this initial impression was the idea was that, well, if there's that kind of repulsion involved then what I'm looking at is a *frozen image of something which was previously in motion* – this is what I got a very strong inner-visual sense of. I try to describe it to people like this: imagine attaching a wire to a wall and then stretching it away from the wall, effectively off to infinity, and then marking out with tiny white dots equal spaces representing the integers, and then imagine little tiny magnetic beads, mutually repulsive particles, positioned along the wire at positions 2,3,5,7,11, *etc*., that is, at the positions of what we call the prime numbers. Now set up a camera, and then subject the whole area to a huge fluctuating magnetic field, causing the beads to move up and down the wire, driven not just by the field, but by their mutual repulsion. Film that, and then run the film backwards. What you'd see is all these particles moving around on the wire and repelling each other, responding to each other, and then eventually coming to rest at the positions we associate with the primes. That's the image.

Now I was well aware of the obvious question: how do we interpret the time parameter here? This is a huge problem – we're not talking about time in the familiar clock sense, not in the historical sense. I certainly wasn't under any illusion that anything like this had 'happened' at any point in the past. I was suggesting that the system had a 'past', but that it wasn't part of the *historical* past, rather of some other time-like dimension. And rather than thinking, that's ridiculous, I won't think that, I tried to suspend disbelief and see where it would take me. So the basic thought then was, okay, if what we're looking at is a frozen image of something which was previously in motion, the motion must have subsided for some reason – so what we're looking at must be something in a state of equilibrium. So, what kind of equilibrium? Well, I came up with a crude notion of 'arithmetic equilibrium': Why have the magnetic beads come to rest where they are? Well, if we freeze the motion at any moment, so you've got an infinite sequence of tiny beads whose positions don't necessarily correspond to positive integers – they could be any real numbers – and then generate all possible finite multiplicative combinations of those numbers, that would produce something analogous to the positive integers. The positive integers, recall, can be generated as the set of all finite multiplicative combinations of the primes. But these new 'integers' would not be anything like the familiar integers, they'd generally be all over the place. They wouldn't be nicely arranged, equally-spaced. But if the particles ever happened to reach the point where they collectively inhabited the positions associated with what we now call the primes, the 'integers' they'd generate would be equally spaced. So, I thought, it's *equal-spacedness* which is a key to this 'arithmetic equilibrium' which, according to my scheme, has been achieved in the number system.

C: Something like an entropic sequence, heading towards an attractor.

MW: Something like that, I was thinking in terms of all sorts of ideas I had partial understanding of – my understanding of physics is very piecemeal, it was even more so then. So many ideas were feeding in. I started to think, how would it begin? Maybe something like a big bang, where you've got all the particles squeezed together at the wall, at the end of the wire, but with something like an infinite magnetic field produced by the wall, and then you let go, and they all explode outwards. At any moment you could freeze the image and generate all the finite multiplicative combinations, the set of 'integers' that they generate: I called these 'generalised primes' and 'generalised integers'. Well, it turns out that Arne Beurling, a relatively obscure Norwegian mathematician, had come up with this idea of generalised primes and generalised integers many decades previously. To better understand the familiar primes he'd started looking at the question, suppose we 'change' the primes, what can we then say about the associated integers and their asymptotic distribution? Martin Huxley (Cardiff University), who's quite an eminent number theorist, got in touch with me as a result of my original website, to say, oh yes, there is actually a name for those, they're called 'Beurling generalized primes'.

C: The distinction being between the primes as we know them and, as it were, a generalised function of 'priming' by which a number system is generated.

MW: Yes, it's a bit like that, taking the idea of the primes not as indivisible integers, but as a set of generators. But the idea of them flowing or moving, no-one as far as I knew had ever put that idea forward. And so I came up with what I decided was almost a 'creation story', some sort of strange mythological mathematics – the creation story behind the number system. Whether there was this 'big bang' thing at the beginning or not, I wasn't sure...but the idea was that, okay, these generalised primes were somehow set in motion. Remember, there are these generalised prime particles, and then there's a kind of invisible set of generalised integers that they're embedded in, that they're generating, which are also in motion. And, at any moment, the 'heterogeneity' of these generalised integers, their lack of equal-spacedness, is creating some kind of 'tension' which is affecting the particles' charges. The idea of fixed log p charges gave way to the idea of fluctuating charges, governed by the spacing within the generalised integers at any given moment. So you can almost think of the distribution of these generalised integers trying to space itself out by 'influencing' the generalised primes and their charges so that their mutual repulsion eventually leads them to a stable configuration, an attractor point – that would be the arithmetic equilibrium. Having reached that – the familiar configuration of primes – the generalised integers would be nothing but the familiar positive integers 1,2,3,... The perfect equal-spacedness of these would result in all forces on the generalised primes dropping away, and the number system has then 'come into being'.

That was the 'story' I came up with, that all came a bit later, trying to make sense of this image that I originally had of the primes being charged, mutually repulsive, and in motion – or having *been in motion*. At the time, it had felt like, this is profoundly important and I have to act on it, I was being somehow compelled to act on it. It felt like the most important...certainly the *strangest* idea ever to enter my mind. And, insofar as I can grasp what is meant by 'numinous', it was charged with a numinous quality.

I was hoping to be able to actually describe the scheme in serious mathematical terms, to reveal that there was some mathematical integrity behind it, but that never happened...So all I had was this nebulous idea about an evolutionary dynamical system underlying the primes. And it was an idea which seemed very strange, I can't emphasise that enough – I couldn't really justify it using any sort of logical or mathematical reasoning, and yet it gripped me psychologically with such force that I couldn't let go of it, I was driven to try and make sense of it. And that led me to create a website...you know, this is what you do in 1998, you create a website, and then you start emailing various eminent mathematicians and physicists to try and get them to look at what you're doing. And as a result of that, a few people were quite helpful and responsive, I was sent some relevant literature, and I started to realise that actually, there are a lot of strange, unexplained connections between number theory and physics. These things seemed to me to be circumstantial evidence supporting my strange insight, whatever it might have been, or whatever value it might have had. They too suggested the number system had some mysterious 'quasi-physical' character. This may have been wishful thinking on my part, but the material was undeniably fascinating in its own right, so I started compiling it into a web-archive, intended to, at least indirectly, back up my idea. Eventually, though, my original idea began to become a bit of an embarrassment to me – it seemed quite nave and ill-informed. So, as the archiving took on a life of its own, and I became fascinated with all this serious maths and physics that I had become aware of, I gradually buried the original idea inside a vast web-archive. But I never entirely removed it, somehow still sensing, or hoping, that there was something of value there.

All my attempts to come up with a mathematical model, a dynamical system that would correspond to that image, had failed. I had struggled because I didn't have anything like the mathematical abilities that would be required for that. And in fact, I now feel vindicated in that it's not that I wasn't capable enough to do it; in order to describe anything like a flow in this space of Beurling prime configurations wherein what's called the classical prime configuration, the usual primes, constitutes some kind of dynamical equilibrium – in order to describe anything like that you need to do what Michel Lapidus has done, and introduce a noncommutative flow on a moduli space of fractal membranes. And there was no way in 1998-9 that I could have had access to those ideas. So – and again, this isn't a serious proposition, but the only way I can make sense of this for myself – it was as if I'd caught a little precognitive glimpse of some future mathematics, sensed the importance of it, tried to get it down, but didn't have the language to get it down, did the best I could, and put it out on the Web. This then led on to me putting a lot of time and effort into what was effectively public service web-archiving for a few years, which has been quite fulfilling, but it was initially just a consequence of the original 'flash', and the compulsion it induced in me. Now I'm feeling somewhat vindicated that someone appropriately qualified has shown that there does appear to be something like this underlying the number system.

C: Is there an analogy between what you're describing and what happened historically with non-Euclidean space – could it be seen as an arithmetical version of that, with the unknown time parameter as something as unanticipated as the curvature of space?

MW: Yeah, in the sense that you're breaking out of what is considered to be the only possible version of something, into a whole range of possible versions, and that initially seems ‘mad’ to many onlookers.

C: At the time, the idea that space could be folded or that space could be curved seemed insane. Nevertheless, such new generalisations are arguably the very movement of science itself.

MW: I think it was Gauss, Boylai and Lobachevsky who simultaneously came up with the same basic idea of parabolic geometry, and at least one of them was afraid to even mention it to anyone. If I had still been involved in serious mathematical research in 1998-9, if there had been a career at stake, my guess is that, having had the same experience, I may well have thought twice about going public with these ideas. Whereas as it was, it didn’t really matter.

C: An interesting example of how being embedded in a discipline, having a reputation, and no doubt having funding depending on it, would actually stop you from saying something – there wouldn’t be any channel through which to get it out.

MW: In a way, I was in a perfect position to just have a go, to push it out there.

I’ve read accounts of mathematicians trying to describe how they made certain great conceptual leaps. The big difference is that the leaps they made were into something that could actually be mathematically described, and ultimately, you know, were incorporated into legitimate mathematics. Whereas I just had a sort of mad flash, a glimpse of something which, as yet, is not legitimate mathematics, it's just a vague impression.

C: Yet the structural detail in which you described it makes it something more than simply a vague idea.

MW: Well I'm not sure that the *detail* of what I've described adds any validity. Had it not been for Lapidus' work coming along, I probably would have entirely disowned it by now. But at the time, there was a conviction that there was *something* in it, but it was hard to know what to call it. There was an awkwardness because, it falls between the usual categories...I suppose it could be called phenomenology or something, there's probably a legitimate-sounding name that someone could come up with. But when I put it out on the Web I was quite careful, because I was well aware of all sorts of cranks on the Web ranting about how they've discovered this or that revolutionary idea, or proved Einstein wrong, or whatever. And I so I tried to be very understated in how I presented it – you know, I've had this idea, and I don't know what it means, it may well be meaningless, but I invite people to either show me why it's meaningless, or else indicate what it might lead to. And gradually it began to happen. But I don't know if it really contributed to anything. I think Michel Lapidus would probably have reached the same conclusions regardless. Perhaps it did influence him, I don't know, but I don't think so. So in a way, if I did catch a glimpse of some sort of future mathematical discovery, it would have occurred anyway, so what's the value of what I did?

C: At least, it does lead one to think about mathematics not in terms of the points at which people draw everything together, make it into a formal system, but rather these discontinuous moments when, inexplicably, things move, things split apart and something new opens up?

MW: A crack opens up and something doesn't quite make sense.

C: From what you know of the mathematical community, is it the case that the sort of research you are pursuing is not accepted, that they're not interested in it?

MW: There's a small enclave of perhaps slightly more open-minded, more unusual mathematicians, who are prepared to discuss these sorts of things privately. The vast majority are slightly bemused or just not interested, they're too busy with their own work to stop and think about what it all might mean. Mathematicians aren't generally encouraged to think about 'meaning'. They don't really need to, they've got a very exact discipline, they've got theorems to prove and things like that. Basically, what I'm doing, I couldn't call it mathematical research. You've called it fundamental research...you could call it that, I know what you mean. The way I see it I'm just trying to raise certain questions and generate discussion, and I'd say the vast majority of the mathematical community just isn't going to engage with that, which is okay. Because I'm not actually doing mathematics, I'm not engaged in mathematics research in the way they are; I'm playing a different game, asking questions about what mathematics means, what it is, how we relate to it. But at the same time I'm not part of the philosophy-of-mathematics community either, which is involved in something much more rigorous and disciplined than what I'm doing.

I suppose because I've got more time I'm in a better position to just stop and think: what's the point, why are we looking at this stuff anyway, what does it mean? Professional mathematicians these days tend to be extremely busy, they've got to theorems to prove, papers to publish, conferences to attend. They need to keep their careers afloat, and so they've got a lot less time to think about what this stuff might *mean.*

But the thing about the Web – and this is quite an important factor in what I'm doing – is that it's possible for me to say what I think and to discuss it with large numbers of other people in the academic world, without having any formal academic status and without having to get anything published. And I can change it as I go along – there's no final document, that's the other thing. I don't publish articles, I can just put together vague rambling webpages and then keep changing them as my ideas change.

C: This is a striking aspect of your research – the presentation of it is very open: no need to hold back until you've got an completely solid hypothesis and then put it online tentatively as a preprint. The site is continually updated, and you're creating this network which connects together all these scientists who it seems are working on related problems but don't always know of each other: in some cases you're actually notifying them of each other's work.

MW: I've spent a lot of time emailing relevant researchers and alerting them to the existence of new articles or preprints which they may well be interested in. And it's difficult to quantify, but I do seem to have stimulated a certain amount of interdisciplinary work. I've created a rôle for myself which hasn't really got a name yet, and as far as I know, no-one's prepared to fund me, but I'm doing my bit to weave together these threads of research.

Part of what caused my disillusionment with mathematics, which caused me to drop out in the first place, was...well, the overriding impression was the biblical image of the Tower of Babel. It occurred to me that if you were to put the names of all professional research mathematicians in the world into a hat and pick out two, the chance of there being any real overlap in their research interests would be quite small, and this continues to get smaller. It was as if mathematical research was getting so fragmented that there was no longer any effective communication possible. So in a way, I suppose what's needed, if one wants to try and fix this, is people who are not specialising, but rather trying to get an overall picture and to weave it all together by creating lines of communication. I didn't come into this with that intention, but that seems to have been the rôle I've created for myself. I haven't got any answers at all. I just feel that there are questions that are important and which aren't being asked – possibly because there just isn't the language in which to ask them coherently yet. But at the same time, because there are no real constraints on me, I don't have to prove myself to anyone, publish anything, or stay within any particular boundaries, I can just throw out certain ideas, get people thinking about things, suggest connections between things in such a way as to indicate the existence of something which we can't yet pin down perhaps, but which will come into focus the more we look at it.

In the mathematical community, at least the proportionally small number of people I've communicated with, I do get a sense that there's a sense of wonder there which is something unquantifiable, something that you couldn't prove a theorem about, but which is nonetheless there. It's something to do with these individuals' emotional, psychological or even spiritual orientations, I suppose. But a lot of mathematicians, I'm afraid, do tend towards the familiar stereotype of socially inept, almost mildly autistic people who have very little time for the unquantifiable aspects of life. And so there is an almost scathing disregard from some quarters. I think – I feel – that anything that's vague or a little bit ephemeral, they see that as worse than useless, perhaps because their own self-esteem and status is tied up in a self-image of being the guardians of some sort of absolute inarguable exactitude and truth.

C: Your guiding thread is a fascination with how mathematics relates to reality, rather than with mathematics *per se*.

This seems to be related to the fundamental problematic which appears right at the very origin, you could say the co-origin, of mathematics, philosophy and natural science: with the Pythagoreans, who realised that operations carried out on numbers applied – rigorously, but for them somewhat magically – to natural phenomena, and so put forward the idea that reality was actually nothing but numbers, reality was structured by number. In a sense they put forward a type of mathematical empiricism, *i.e.* the idea that you could go out and explore the world, and what you would expect to find was relationships between numbers, and you could understand the natural world like that. Now this came to a catastrophic end with the discovery of irrational numbers...

MW: Yeah, the legendary drowning at sea of Hippasus of Metapontum – it's fascinating stuff, a pivotal event in human history...

C: Certain aspects of the natural world were shown to exceed number – or number as it was conceived then. Certain quantities which can be mathematically described (the diagonal of a square with side length 1, the area of a circle with radius 1, the golden ratio) cannot be expressed as ratios of integers, they are 'alogos' or, as we now say, irrational.

After a long period under the influence of Aristotle's instrumentalism, for which every sublunary physical phenomena was subject to an inevitable degradation, meaning that exact mathematics was applicable only to astronomy, the celestial and sublunary worlds were (blasphemously) reunified, most of all by Kepler, under a single mathematical physics, reinvigorating the Pythagorean dream of a mathematical natural science.

Then in the nineteenth-century mathematics seemed to exceed its reference to the real world, to claim its own autonomous consistency, and any necessary link with the natural sciences was removed, mathematics asserted its independence from any application; its applicability to the physical world even seemed to become a sort of mathematical ghetto.

Now, in the work you're looking at, it seems that we return once again to a Pythagoreanism but with a strange twist...

MW: Yes, something's been turned on its head. I've been fascinated by Pythagoras and the Pythagoreans for a long time. Sometimes I think, you know, in a way I'm acting a bit like a 'neo-Pythagorean'…but as you say, there's a strange twist there. I think a lot of people forget, when Pythagoras is discussed as 'the first mathematician', that he had one foot in mathematics and another one in a sort of shamanic, mystical-type reality.

C: Whereas the Pythagoreans discovered in numbers the semi-divine property of rigorously elucidating nature, we have this experimentally and theoretically-vindicated body of method and knowledge taken from natural science, with whose aid we're trying to illuminate what now seems like a somewhat opaque and mysterious numerical realm; and there are these things within number which still don't really make sense. Mathematicians such as Chaitin [*see article in the current volume–ed.*] have said that mathematics must now become a quasi-empirical practice – this is in relation to his own work, but it might perhaps equally be applied here.

MW: Some of the quotes I have on the site agree: Martin Gardner said something about how some problems of number theory might be undecidable and might need a sort of mathematical 'Uncertainty Principle'. Timothy Gowers wrote that the primes somehow *feel like experimental data*, but at the same time he's well aware that they are rigidly determined.

We find ourselves in a situation where Michael Berry, studying spectra of quantum mechanical systems, can take techniques he's developed to classify or better understand certain types of physical systems and apply them to the Riemann zeros, in order to produce a hypothesis that we will get a particular 'number variance' in the far reaches of the spectrum of Riemann zeros – then years later, you know, computer power reaches the point where zeros can be calculated at that scale, the 'number variance' computed...and the graphs match up perfectly. It's the first time I'm aware of when a physicist was able to tell pure mathematicians something new based entirely on his familiarity with physical systems.

C: Does the field then become *de facto* an experimental one? You have the a hypothetical physical system which will produce the system of vibrations which the Riemann zeros seem to correspond to. And the only way to find out whether there's really any system which is adequate to that would be by experimentation – in the same way that the Higgs Boson hypothesised to glue together the results of quantum physics must now be sought experimentally – hence the construction of CERN's much-anticipated Large Hadron Collider. Does someone have to *build* the Riemann dynamical system?

MW: Michael Berry has said he's absolutely convinced that, if such a thing is physically possible, someone will make one of these things in a lab, and then the Riemann zeros will actually come out on the instrument readings. But at the moment there's no-one actually conducting any experiments which are getting anywhere near that, or even attempting to. You do have physicists taking certain ideas – largely mathematical models intended for physical systems – and applying them to aspects of the zeta function. There is an experimental branch of study of course, you've got people looking at the Riemann zeros themselves, which contain a wealth of data – we've got, I believe, hundreds of billions of them calculated now – this is being done with grid computing[8]. The gaps between them and all kinds of other things you can measure when you've got a set of seemingly random real numbers, are being analysed using a variety of statistical methods, random matrix theory is being applied. So these are, to some extent, experimental studies. Marek Wolf (Institute of Theoretical Physics, Wroclaw) experimentally detected a widespread physical phenomenon called '1/*f* noise' in the distribution of prime numbers.

The prime numbers continue out to infinity, we've known they go on forever since Euclid, but we can only calculate them up to a point. We tend to think our current computers are 'powerful' , and we think we can find 'big' prime numbers – you know, now and again one will even make it into the news. But *there's no such thing as a 'big' number*, this is what I always try to get across to laypeople – because the number system goes on forever, however far we look, proportionally it's still an infinitesimal step into an infinite unknown .

C: And, of course, in consequence, no matter how many zeros are found, one never comes any closer to a *proof* of RH.

MW: Yes, exactly. There's the duality between Riemann zeros and primes, and so the same idea applies with the zeros. We can never calculate more than an infinitesimal proportion of them. Sometimes I use the analogy of large telescopes: you're looking out into space, and the more you can see, the more you can deduce about the nature of the universe you live in. Analogously, we can 'see into' the number line a certain distance, what we think is a 'long way' – but again, it's meaningless, really, to say a 'long way' or a 'big number'. Of course we can see further than we've ever seen before, so we can detect certain apparent patterns which can give rise to hypotheses that we can then attempt to prove. Similarly we can look further than ever up the critical line now, and with hundreds of billions of Riemann zeros we can test certain hypotheses and generate new ones. So there's an experimental element in that. But as far as the hypothesised Riemann dynamics goes, the quest to try and pin down something like a Riemann dynamics isn't really being furthered by experimental science as such, rather the progress seems to be coming from mathematicians like Connes, Lapidus and Christopher Deninger (University of Münster). But these people – well, certainly Connes and Lapidus – do have a very broad interest in large areas of both mathematics and physics, which is what makes their work so interesting.

It would be misleading to suggest that mathematics has become an empirical science, since exact formulations are still possible – even in these more hazy areas – at least we can't rule out the possibility of exact formulations. But an empirical approach has become potentially useful. In connection with this, I should mention the emergence of probabilistic number theory, which in itself raises huge questions. Probabilistic number theory effectively started in 1940 with the Erdös-Kac theorem which I mentioned earlier, the discovery that the number of prime factors in 'large' integers has a kind of random distribution which follows the Gaussian distribution or bell curve. That discovery led to a whole outpouring of theorems and conjectures which have collectively become known as probabilistic number theory, where you apply the methods of probability theory, and make use of the key idea that divisibility by a prime p and divisibility by a different prime q are 'statistically independent events', one has absolutely no bearing on the other. When you deal with probability you deal with this idea of independent events – *well, these are arguably the most independent 'events' there can ever be.* Physical events in any well-prepared experiment, you might think they are independent; but ultimately every particle of the universe is gravitationally pulling on every other particle, everything is linked, although the effects are generally negligible and impossible to quantify. The only place where things are *totally* independent is in the number system – the divisibility of an integer by two different prime numbers. So here is a place where you can apply probability theory, where everything is *entirely* exact, where you can let your n tend to infinity and that actually refers to something. Probabilistic number theory allows you to *prove* things about prime numbers and about the number system generally, using the techniques of probability theory, and that seems highly counterintuitive. The fact that it works at all raises questions which are more like 'mysteries' than formal mathematical problems.

There are three separate areas worth mentioning here: the emergence of probabilistic number theory, the effectiveness of the analogy with statistical mechanics – partition functions, *etc.* which I described earlier – and then the rôle of random matrix theory, which was developed for modelling subatomic phenomena, but then was accidentally found in the 70's to apply directly to the theory of the Riemann zeros. So you've got three separate areas of randomness-based thinking, stochastic disciplines if you like. They deal with large systems which have too many components to keep track of individually – these components must be treated almost sociologically, as populations, and subjected to probabilistic or statistical thinking. All three areas have been effective in furthering our understanding of the number system. Now, again, mathematicians would tend to focus on at most one of these things, see what could be achieved and perhaps make a few sober remarks on what it all might mean. But to me, the fact that you've got these three areas, all of a stochastic nature, shedding light on the primes and the Riemann zeros, points to something very strange. We've got primes, the most basic things in the universe as we experience it – the sequence of prime numbers is the most basic non-trivial information there is, it's the one thing you can't argue with anyone about, it's the one thing all lifeforms in the universe could potentially relate to. And yet in some ways they seem to be best understood using a type of analysis more appropriate to weather systems, roulette wheels, boxes of gas, *etc.*

I've always thought of probability theory as a slightly 'tainted' branch of mathematics for three reasons: Firstly, it's origins are not entirely honourable – I seem to recall that it has its roots in an historical accumulation of gambling techniques which got distilled into a formal theory by Pascal. Secondly, it deals with 'events', repeatable 'events', which are categories of physical phenomena, 'occurrences' of one type or another which can be quantified, measured, counted, numerically analysed, *etc.* whereas truly 'pure' mathematics doesn't rely on anything in physical reality in quite this way. Finally, by its very nature, probability theory tends to deliver imprecise information – there's always a margin of error. And yet this system of thought, which has been developed in order to deal in an approximate way with large, complicated physical systems, seems so perfectly applicable to something which is so fundamental, which is characterised by an absolute precision, and which underlies everything else – the distribution of primes! It's as if we've got something back-to-front. It's similarly interesting that probability should have such a fundamental rôle in quantum mechanics: an ultra-simplified account of what QM tells us is that, insofar as it can be understood as being made of particles, the universe can also be understood as being made of 'fields of probability' . Probability theory in a casino, yes; or in a meterology lab... But prime numbers? The fundamental level of matter? These are things we instinctively feel should be totally deterministic and rigid. And to me, this suggests we're looking at something the wrong way 'round – something's been turned on its head. It's as if 'randomness', or some essential, almost esoteric quality associated with randomness – that quality evidenced in our failure to really understand what we mean by 'randomness' – is emanating up from these fundamental realms. We've been dragging it down from the macroscopic scale, the casino scale, down to this micro-level, in a numerical and physical sense, and finding that it helps us understand something. But I feel something's back-to-front there.

A mathematician called R.C. Vaughan states in one of my archived quotations that it's obvious that the prime numbers are random, but we don't know what randomness is. And there is a real problem with defining randomness. There are several definitions, information theorists, probability theorists, have put forward definitions of what it means for something to be random. The definitions overlap to a large extent, but ultimately, when is a string of digits random? If I give you a block of a thousand 0's and 1's, it might *look* completely random, it might even pass numerous tests run on it for randomness…but then I could reveal, well actually, no, it's a thousand digits of π starting from the two-millionth digit. And then it's not random anymore. So there's the whole question of what randomness is. This is one of the central themes that fascinates me: where does this notion come from, where does it lead us in our understanding of the reality we inhabit, and why does it tie in so closely with both the fundamentals of the number system and of particle physics?

And then there's the difficulty of talking about having two of anything, that in order to have two of anything you have to have a category which those two objects both belong to. But the categories are always imprecise. We have to partition spacetime into blocks with 'fuzzy' boundaries, and then attempt to match aspects of these blocks up with some ideal which exists in a sort of mental hyperspace, a Platonic realm of sorts. So we're projecting these categories onto the universe which actually aren't intrinsic in the universe; we're setting out these boundaries, but the boundaries are blurry. Yet, despite the possible problems this blurriness might cause, on a practical level we're able to then extract data which fits remarkably well against certain probability distributions. The most ubiquitous and I think the most important one is the Gaussian or bell curve – and this, as we can see from the Erdös-Kac theorem, has a mysterious and fundamental relationship with the number system we're using to count members of our fuzzy-boundaried categories in the first place.

The effectiveness of statistical inference in the hard sciences and the social sciences – I'm sure this would be widely disputed, but I feel there is a mystery there which isn't really being acknowledged, and it has to do with how we can name and count anything, and how, when we do name, count and measure things they seem to collectively accord with these ideal mathematical blueprints or templates. That says more about the way our mental hyperspace is being mapped onto the physical universe than about anything *intrinsic* in the physical universe.

C: When you look at the local you expect to find precision, whereas with the global you're happy with statistical data. Here we're looking at these local, precise conditions and there seems to be randomness 'built into' them in a way that's not immediately comprehensible: After all, they're not statistical aggregates in any obvious sense.

MW: Yes, the set of positive integers is in a category of its own, *there's just one number system.* Yet, it's as if this entity – if we take the positive integers, the primes and the zeta function as aspects of a single thing, different aspects of the same entity – rather than being a carved-in-stone, unique thing, is actually just one example of a class of things, and we're able to apply statistical analysis because of that. This is why, when I started finding out about these things, I felt my 'prime evolution' thing might have something in it, this idea of the number system being a frozen state of something which had previously inhabited many different states. I've had certain quite critical, serious-minded people react to some of my more sensational suggestions by saying, well all this number theory and physics, there's nothing mysterious at all – the universe follows mathematical laws, so of course we'd expect certain aspects of number theory to show up in the physical world. If they'd look a bit deeper into this, they'd see what I meant: yes, it's not surprising, given that maths underlies all of physics, that we might get, say, particular values of the zeta function showing up in string theory, or the theory of integer partitions relating to Bose-Einstein condensates or whatever: you get these odd little instances of number theory/physics correspondence; I've catalogued a lot of these in my web-archive. But that's not the really interesting stuff. What's much more surprising is the way physics seems to be pointing the way for understanding the zeta function, and often this is statistical or stochastic physics, as if the zeta function – and in some sense, then, the number system – is just one example of a more general phenomenon. And I don't think anyone disputes the spectral nature of the Riemann zeros now. But it's not one archetypal ubiquitous spectrum we see showing up all over physics. If we saw 'the zeta spectrum' – as it might be called – everywhere, then it would somehow feel a lot less mysterious. We'd probably feel quite comfortable with such an affirmation of the old idea that the number system directly underlies the structure of the physical universe. But the Riemann zeros take the form of an almost disconcertingly arbitrary-looking spectrum, never known of by humans prior to the late 1850's. In the very recent past we've been confronted with the fact that it has all the fingerprints of membership in certain classes, very wide classes, of very specific physical systems, as if it's just one element of a whole class, a population of things. So it's a bit like the way you might be able to, based on the postcode of a UK resident, predict certain things about his or her attitudes, abilities, tastes, whatever – because you've got statistical information about the population, you can make plausible hypotheses about this specific individual.

And it's as if the primes-zeta entity, whatever you want to call it, despite its seemingly fundamental, unique status, is just one individual in a wider class of things. But the space in which that class exists is something we haven't even begun to imagine might exist, or we haven't got any access to.

So we have this image of a frozen system, something congealing into a state, and then…it's as if you walked into a concert hall and caught the last note of a symphony, and everybody's applauding ecstatically and you're wondering, what's all the fuss about? You didn't witness the process that led up to that last note, and it's like, with the prime numbers, we're just walking in on the last moment, the culmination of something. As if there was a whole 'symphony' that led up to that, and humanity may be on the verge of revealing it.

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C: All of the foregoing seems to suggest that what we think of as simple and elegant foundations may in fact be the eventual product of something which is rather complex, even beyond our comprehension. So we'd have to separate out what seems simple and elegant to us, from what is actually fundamental in the universe, and this is another sense in which mathematics mirrors the condition of theoretical physics, in which, characteristically, the further we go towards the fundamental, the stranger things become (string theory being a case in point).

Rather than defining the primes on the basis of the supposedly fundamental and simple number line, in fact it seems that, when we look through this complex theoretical-mathematical prism you have described, there's actually something more fundamental about the primes. The primes themselves produce...

MW: ...the number line, yes, you can see it that way. I came up with this naïve idea, before I really learned any of the more serious stuff, this was after I had been thinking about the Erdös-Kac theorem, the primes and the Gaussian distribution, but before I 'experienced' the dynamical aspect of the primes. I was thinking about how we tend to construct the primes. We're taught to construct the number line starting with one and then using the Peano axioms, you know, there's an axiom that basically says, whatever number you arrive at you can always add another one to it. And I thought, hold on, where does this come from, this idea that you can always add another one, and I started to question that as something that might not be as obvious as it first seems. There's some hidden assumption there about order, time or something, I felt.

And I thought, well, there's an alternate approach we could adopt here, we could start with an infinite alphabet of meaningless symbols, an infinite alphabet of meaningless yet distinct symbols, and then create the dictionary of all possible words of finite length out of that alphabet.

This alphabet of symbols would correspond to the prime numbers. By combining the symbols in all finite possible combinations, you generate the set of words in your infinitely-long dictionary – this corresponds to the fact that if you combine the primes in all finite multiplicative combinations, you get the set of positive integers. Except now *there's no sense of order*: Because we're not starting with the positive integers, we don't need to think of one prime number as being 'greater than' another. The primes are not embedded in the positive integers yet, they're just these free-floating abstract symbols. So I used to try and conjure up this image of bubbles floating in an imaginary space, each with an exotic glyph, a symbol from our 'alphabet of primes' on it. The idea is that you can then join any number of these bubbles in any combination, including repeats. All possible such bubble-clusters are to be found floating somewhere in this space. Some are larger than others in the sense that there are more bubbles in the cluster – that is, more prime factors – but there's no sense of a cluster coming 'before' or 'after' another cluster. It's only when you cross the Rubicon of deciding which alphabetic symbol is going to be your '2' that you start to create some sense of order.

So I had these hints and intuitions – I couldn't really pin them down to anything very rigorous – that we've been thinking about randomness and the fundamentals of reality in a back-to-front way. We've got ourselves into a kind of confusion where everything seems immensely complicated when we delve down to the fundamentals of either the number system – which seems at least partly to inhabit the realm of psyche – or of the physical world, the world of matter – just open a textbook on analytic number theory or quantum mechanics and you'll see what I mean. I felt this issue could be addressed if we examined some of our 'obvious' assumptions. We think we've taken the obvious construction – that is, you start with one, then you add one, and then you add another one, this idea you can always add another one. Rather, what if we start with the primes, and build the number system up that way? The whole 'order' thing then becomes more of a 'phenomenon' than something axiomatic...

C: Coincidentally, the 'legendary' Dr. Daniel Barker also devised a notation system for the positive integers based upon prime factorisation, which is very close to what you're talking about here.[7] You have these inseparable lexicographical units from which numbers are composed, and they could be in any order. He was interested in place value as a culturally-repressive numerical practice, and this was a way of doing away with place value completely. Each number would just be like a collection of boulders or something.

MW: The lexicographical approach, yes. I've tried to get this across to some lay-people I've talked to. There's the

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[7] *See* http://abstractdynamics.org/005047.html

COLLAPSE VOLUME I Erratum:
p162 Note 7 should read http://hyperstition.abstractdynamics.org/archives/005047.html

fundamental theorem of arithmetic – literally *the most important thing we know about the number system.* And no more than 0.1% the population have even heard of it, I'd guess. It basically says that every integer breaks down uniquely into prime factors. And we've got this strange situation where almost nobody knows this, this simple fact, the most important thing we know about the number system. This is straying into other territory, but to me, humanity's relationship with number is rather unhealthy, because we've built this entire civilisation around the mathematical sciences, and yet the ordinary population knows nothing of the basics, and often finds mathematics a source of fear and unpleasantness. I try and conjure up this image of these bubbles, the fact that the clusters can be as large as you want, you can have huge 'planets' of prime factor bubbles joined together – *there's no upper size limit.* And so something like the greatest common divisor can then be explained very simply, it's just the intersection, literally where the two clusters intersect. The least common multiple can be similarly explained. Prime numbers distinguish themselves from non-prime integers because they are individual bubbles. The integer 1 is *the absence of any bubble*, the empty background space, the blank page in the "dictionary" I mentioned earlier…

And then you imagine stringing the entire set of clusters out in a line according to this 'order' thing, and you start to see that there's a counterintuitive variation in the sequence – you get small clusters, huge clusters and single bubbles all intermingling according to no sensible scheme. And this is the sort of thing that I'd eventually like to push further out into the public domain just to see what sort of effect it would have, when people start looking at their supposedly familiar number system in this new light. Because people tend to think of the number system like a row of boxes of cereal in a supermarket, just identical units stacked together, a sort of homogeneous featureless thing that just goes on: each number is just the previous one plus one, there's nothing much there, nothing of interest. And it was Frank Sommen, a really remarkable, imaginative Flemish mathematician who I worked with during my PhD studies, who once said to me, every positive integer is a different animal. I came to see exactly what he meant: each one's got its own 'anatomy', every one's a different story, and that starts to become apparent as soon as you realise that each integer factors in a unique way into prime numbers.

C: This is a basic intuition that one finds in 'primitive' numerological systems.

MW: Yes, and in children as well, with their favourite numbers, and feelings about each of the first few positive integers – ethnomathematics and children.

C: Something that gets beaten out of people by mathematics: when people start learning mathematics, it's as if the first task is to extirpate any idea that numbers have quality. Mathematics is in fact often seen as constitutively opposed to any such intuition.

MW: Yes. Marie-Louise von Franz, one of my favourite writers, who studied under Jung and wrote a lot about number archetypes, she talked about number having both quantitative and qualitative aspects. The quantitative is obvious, we all use numbers to count. Cultures who revere certain numbers and have mystical beliefs about them which we might laugh at, they still use them to count with and to trade, they recognise that they have a quantitative aspect. This is the aspect of number that has given rise to economics and technology; but equally, perhaps even more importantly, there's the qualitative aspect that only survives in our culture in children having favourite numbers, some adults having lucky numbers, not wanting to sleep on the thirteenth floor of an hotel, the way they might choose lottery numbers, that sort of thing. But, you know, in 'serious' society numbers are supposed to be *entirely* quantitative. Von Franz wrote about a traditional Chinese story involving eleven generals who, faced with some very difficult military situation, took a vote as to whether they should attack or retreat. Three voted to attack and eight voted to retreat. So what did they do? They attacked, because three was a more favourable number – it wasn't a *bigger* number, but it was a number associated with unanimity, or some other favorable quality like that. And the attack was a success.

So it's interesting that they could build a civilisation that was able to have a functioning economy and military and to govern millions of people – clearly they were intensely aware that number had a quantitative aspect – but there was also a serious engagement with the *qualitative* aspect which is dismissed in our present culture as entirely superstitious. Now I'm not encouraging people to engage in completely arbitrary numerology, I mean, I've looked at a lot of that new age numerology literature, and the problem is, nothing can be verified: someone can write a book saying a particular number means something, and someone else can write another one saying it means the complete opposite. It just confuses matters, as there's never any consensus or certainty in these interpretations. That's why professional mathematicians would almost unanimously just react against it and say it's all rubbish.

C: But is there any way to talk about it which doesn't get into that morass of mysticism?

MW: There are two approaches: one is the serious attempt by Jung and his followers to catalogue all of the ethnomathematical systems, undertaking a serious study and survey of various cultures and their relationship with number, trying to find common threads, and through psychoanalytical work and dream studies, trying to find extract essential patterns to build up a body of material from which we could possibly deduce something about how number interfaces with the psyche at a fundamental level. The other approach is to seriously study number theory, because as far as I'm concerned, that *is* numerology, really – you're looking at the properties of integers, and if you study it to a certain depth it takes you into the realms of what you could only call the mystical or the uncanny, where cracks seem to open up in your normal understanding of reality.

C: Is that perhaps what characterises number theory as opposed to mathematics, what makes it a very different discipline?

MW: Well, number theory is universally acknowledged as a branch of mathematics. It can't really be separated from it like that. But it arguably has a unique status at the very heart of mathematics. You're working at the very root of it all, dealing with the simplest objects, the positive integers. And yet you come across these counterintuitively complicated structures and results. You can separate mathematics into branches and disciplines but they all ultimately overlap and interrelate. Gauss (who himself was called the 'prince of mathematicians') called mathematics 'the queen of the sciences', and number theory 'the queen of mathematics'. The idea is that number theory is generally seen as the pinnacle, in that it contains the most difficult problems; also it's concerned with the integers, and all of the rest of mathematics ultimately relies on integers. Hence it's not surprising that problems of number theory do seep into other areas of mathematics, and even physics. What *is* surprising is that physics is beginning to shed light on number theoretical structures like the zeta function, as if it were just one of a class of objects, whereas it's meant to be this fundamental object underlying everything.

What I'm trying to describe with my clusters of bubbles isn't intended as any sort of serious mathematical proposition, it's just a picturesque visualisation – trying to look at the number system from another angle, if you like. But there's a hidden assumption within the Peano axioms, I think, which needs to be addressed – although I don't think I'm the one to address it. It concerns the axiom which allows you to always add one. Even in the proof of the infinitude of primes, I sense some sort of subtle circularity there – the idea is that, if the number of primes were finite, you could multiply them all together and then add one. And that rapidly leads to a contradiction concerning primeness and divisibility…hence there must be infinitely many primes. So that takes you back to the Peano axioms, the idea that you can always add one. But in my visualisation, multiplying them all together would correspond to building one mighty cluster using one of each type of bubble. And in that visualisation 'adding 1' is a far less obvious operation. This ties in with problems of time, the idea of time, repetition, even basic physical questions: you know, this 'adding 1' business presupposes that you've got a physical space, something like the space we're familiar with, in which you can make a sequence of marks, or a time continuum in which you can make a sequence of utterances or beats. And I feel there may be subtle assumptions concerning the homogeneity of time and space involved in this, too.

C: These questions of time and space must fall out from the primes' intimate connection to the relationship between multiplication and addition.

MW: Brian Conrey, who's President of the American Institute of Mathematics, and Alain Connes have both been quoted as saying that RH is ultimately concerned with the basic intertwining of addition and multiplication. And if we haven't really got a clue how to prove RH – which we don't – we're going to have to own up, we don't even understand how addition and multiplication interrelate. A more succinct, precise way of describing these two possible constructions of the primes that I have outlined – the conventional 'just add 1' approach, and my 'lexicographical' approach with its equivalent clusters-of-bubbles visualisation – is given by Grald Tenenbaum, who certainly knows what he's talking about:

> Addition and multiplication equip the set of positive natural numbers with the double structure of an Abelian semigroup. The first [addition] is associated

> with a total order relation as it is generated by the single number one.

So if you've got addition and you've got this single number 1, you can generate the postive integers just by adding 1 plus 1, 1 plus 1 plus 1, etc. If you take 1 as your 'additive generator', the universe generated is the set of positive integers.

> The second [multiplication], reflecting the partial order of divisibility,

This probably isn't the time to get into the subtle issues of 'order' in mathematics – you've got 'total order' and 'partial order': addition relates to total order, where something definitively comes before or after something else; and divisibility relates to partial order, a less distinctive type of order, although I won't get into the details of that…

> [Multiplication], reflecting the partial order of divisibility, has an infinite number of generators, the prime numbers.

So, now, rather than starting with just the number 1 and combining it with itself in every possible way using addition, we start with this infinite set of primes and then take all possible *multiplicative* combinations.

> Defined since antiquity, this key concept has yet to deliver up all of its secrets, and there are plenty of them.[8]

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[8] Tenenbaum and France, *op. cit.*

It has the quality of a square peg in a round hole, this tension between addition and multiplication. It's almost like, despite the inarguable perfection of the number system, they don't really fit together very well, and they generate what I feel is something like friction, and this produces the sprawling mass of definitions, theorems, lemmas and conjectures that we call analytic number theory. There's a novel by Apostolos Doxiadis called *Uncle Petros and Goldbach's Conjecture* – it's written as fiction, but he gets some key ideas across through an elderly mathematician character. This is very well put, I feel:

> Multiplication is unnatural in the same sense that addition is natural. It's a contrived second order concept, no more really than a series of additions of equal elements.[9]

So that's the point, that 3x5, you can see that as 0+3+3+3+3+3 – you start with nothing, zero, and add three five times. So in a sense you can build multiplication out of addition, whereas it doesn't work the other way around. So addition is a first order operation, and multiplication is, as he's saying, unnatural, in that it's 'second order'. The thing that struck me about it when I was dwelling on this for a while was that it has to do with *time*, it has to do with repetition. And it also relates to the very deep issues concerning the whole idea of where number comes from and how we define number. As I hinted earlier, I've spent a lot of time thinking about how you could ever have two of anything. You know, there are two people sitting here in this room right now, but that relies on the definition of what a 'person' is. We define the category linguistically, and we think we know what a 'person' is, but you can imagine some sort of genetically-engineered mutant that may or may not be a 'person' depending on how the definition was formulated, and the definition's made of words and each word is imprecise, is subject to interpretation. So any type of category you define is going to have a 'fuzzy' boundary, so...although it works quite well for day-to-day affairs, counting things works fairly well, you've got fifteen sheep in your paddock. But you can always contrive some convoluted situation where, maybe it's fourteen sheep or maybe it's fifteen – is that odd looking creature really a 'sheep' or is it something else?

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[9] Doxiadis, A. *Uncle Petros and Goldbach's Conjecture*. NY: Bloomsbury, 2000.

So, it comes down to issues of language and definition. We consider chunks of spacetime, we recognise patterns and say, yes, that chunk of spacetime falls into such-and-such a category. As I said, I started to wonder how you can really have two of anything. Every entity ultimately distinguishes itself from every other, these categories are not mathematically precise, there's an arbitrary element involved in deciding whether things get included – "where do you draw the line?" as they say. And yet these categories are the essence of counting, and if there's a problem with applying the concept '2' to our experience then there's going to be a problem with all of the other positive integers.

Exceptionally, when you get down to the subatomic level you can have two of something, because each individual electron is absolutely indistinguishable from the others. So that's interesting, that this concept makes sense at the subatomic level but then 'fuzzes out' at macroscopic scales.

But the thing is, when you say '3x7', you're effectively saying 'three sevens'. So, seven pebbles in a row – you count out seven by adding one plus one plus one, etc. That feels quite 'natural'. But then, to make the leap to 'three lots of seven'…you can have three giraffes or three potatos, the fuzzy boundaries mean that's a difficult enough issue as it is, but 'three sevens' presupposes that a 'seven' is *something that there can be more than one of* in some sense...

C: One would have to say that the multiplier and the multiplicand are somehow of a different order, two different types of numbers are involved in the operation.

MW: Yes, one is operating on the other. If you add, it doesn't matter...I mean, it's true to say that 3x7 is the same as 7x3, you've got this basic 'commutative' property applying to the positive integers. But when you consider the 'act' of 3x7, the three is how many times you're doing something, whether it's laying out a row of seven beans or playing seven drumbeats, and the seven is some kind of an extension in space or time. Whereas in adding

3+7 or 7+3, both numbers play the same rôle. So there's something there, not easy to pin down, which we don't understand, and I have a very deep sense that we won't really understand it until we really understand *time*. It has something to do with time. Our inability to understand the primes, our inability to prove RH is a symptom of our inability to understand the relationship between addition and multiplication, and that is related to our relationship with time.

C: On your site you quote J.J. Sylvester:

> I have sometimes thought that the profound mystery which envelops our conceptions relative to prime numbers depends upon the limitations of our faculties in regard to time, which like space may be in essence poly-dimensional and that this and other such sort sort of truths would become self-evident to a being whose mode of perception is according to superficially as opposed to our own limitation to linearly extended time.[10]

MW: I think he must have been thinking about the relationship of multiplication and addition in terms of time. This was 1888, so RH had been posed, but mathematicians long before RH understood that the enigma of the prime numbers was rooted in the uneasy relationship of addition and multiplication. So possibly he had a sense that the relationship had something to do with time. But he says 'the profound mystery which envelopes our conceptions relative to prime numbers' – in other words, the puzzling interface of addition and multiplication – 'depends upon the limitations of our faculties in regard to time'. So if there were a higher dimensional, a two-dimensional 'time surface' or something like it – the word 'superficially' is being used by Sylvester in the original sense meaning 'relating to surfaces' – our minds, normally constrained to a 'timeline', could perhaps 'spread out across it' in some sense. It's perhaps a bit like being able to come up off the surface of the earth and look down from a third dimension to get a sense of how things are laid out, whereas when you're stuck on the ground, certain things are not at all apparent...but these are all very vague and intuitive ideas.

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[10] Sylvester, J.J. 'On certain inequalities relating to prime numbers', *Nature* 38 (1888) pp259-262, reproduced in *Collected Mathematical Papers*, Volume 4. NY: Chelsea,1973 p.600

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C: In one of the papers you link to in the archive[11], Volovich suggests a most extreme and startling explanation for the concurrence of physics and mathematics.

MW: Yes, and you may have noticed that he quotes Pythagoras at the beginning, a slightly amusing Greek-to-Russian-to-English compound translation of "all is number" – "the whole thing is a number". I got very excited when I first found that paper, because he's suggesting that number theory is the ultimate physical theory. That came out in 1987 as a preprint at CERN – he's an accomplished physicist – but it was never published in a journal. The fact that it never got published and the fact that he hasn't responded to my questions about it could suggest that he's backed away from it somewhat. I can't speak for him, but I wonder if he's slightly embarrassed by its more grandiose claims, in the way I was suggesting earlier that physicists and mathematicians can be.

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[11] I.V. Volovich, "Number theory as the ultimate physical theory", Preprint CERN-TH **87** 4781-4786 (1987)

But the thing is, he has done this vast body of work on *p*-adic physics, which I referred to earlier. And the rise of *p*-adic physics is a very interesting thing in itself because, you see, even though the universe at the scale of this room is Archimedean – I can lay my ruler end to end and will eventually reach the end of the room – the universe is *not* Archimedean at all scales. Below the Planck scale, it's no longer Archimedean. Below this 10^{-35}m or so – which to some people sounds too small to worry about, but you just take a metre, then a tenth, then a tenth, not that many times, really…It's not that our instruments aren't precise enough to measure below that scale, it's that the whole idea of measurement as we've formulated it ceases to make consistent sense. And effectively, space becomes non-Archimedean below that scale. There's a similar scale with time and other fundamental quantities, below which they become non-Archimedean. You can theoretically join some unit of measurement end-to-end and never achieve a given, finite extension.

This has led people to think that maybe *p*-adic physics, where you're dealing with a non-Archimedean number system, would be more appropriate for application at the sub-Planck scale. And Volovich seems to be suggesting that different non-Archimedean number systems could apply to different regions of space and time at different scales. Again, I'm not entirely sure: large parts of the paper are beyond the scope of my present understanding. I'm intrigued by his referenced to 'fluctuating number systems', but I don't know whether he means fluctuating with time, or in some other more generalised sense.

People are now starting to think about applying *p*-adic mathematics to the physical world. Each *p*-adic number system provides a different sense of 'distance' between two rational numbers, and that notion of distance then allows you to define all the other numbers which aren't rational via precise mathematical concepts involving 'limits'. I mentioned this earlier. This distance or 'metric' is defined in terms of divisibility of primes. It has to do with highest powers: for instance, in a 7-adic metric, finding the distance between two rationals involves basically looking for the highest power of 7 that divides into the numerator of their difference – that difference of course is also a rational number – when it is expressed as a fraction in lowest terms. As a result of that, number theory comes flooding into your *p*-adic physics: if you start looking at *p*-adic or adelic space and time, issues associated with the prime numbers become directly relevant. Of all of this number theory/physics material I'm archiving this is the area I'm least familiar with.

C: Saying that the means of measurement, that the possibility of measurement has changed is one thing, but saying that numbers are actually the 'atoms' themselves, so to speak, is something else: that means that there is no longer some *thing* you're measuring. The measurement itself takes on a sort of substantiality.

MW: Yes, these are very difficult notions to grasp, in so far as I understand what's being proposed. I think, perhaps like myself, Volovich caught a glimpse of something, got quite excited about it and wrote it down; he's quoted Pythagoras – it's as if there's some mystical quality to his insight.

C: There might be thousands of these papers hidden everywhere that people haven't published.

MW: I'm not sure it would be in the thousands, but who knows…There's a general hesitance to stick one's neck out. If I'm helping to encourage that sort of thing, then I suppose that's a useful contribution.

C: Exeter University has granted you an honorary fellowship and hosts the web- archive, but there is no funding available for your work. Apart from your own fascination with the subject, what drives you to continue this labour of archiving and making your own speculative connections public?

MW: Over the years after I'd dropped out of formal academia, I spent a lot of time thinking through and honing these ideas about mathematics being some sort of inner priesthood of our scientistic culture that's in the process of destroying the ecosystem, and wondering what could be done about it, how do we change this, you know? I felt that campaigning to stop the destruction of this or that rainforest isn't going to be enough, you've got to go right to the core, to the root of the problem, the fulcrum. And, reading von Franz, with her ideas about ethnomathematics, and quantity and quality, and reading René Guenon, who – although I don't embrace his traditionalist fundamentalism – wrote a fascinating book called *The Reign of Quantity and the Signs of the Times*, I started having this idea that only when Western Culture re-evaluates its relationship with number can there be any real change in the way we relate to the world, because we've got stuck in a 'quantocentric' view of the world. And so I have felt at times that what I was trying to bring forth – whether it was in my strange 1998 'evolutionary' notion or just in my networking of various people's work via my web-archive – was an acceleration towards an imminent transformation in our relationship with the number system. I was quite driven for a while, but I've become considerably more cautious and sober in my approach to this since. I saw what I perceived to be clues...felt that it *had* to be coming, and only through that sort of transformation will the Western project ever be able to steer itself in a less destructive direction. At times I've felt that I had an important rôle to play – not that I was 'chosen' to do it or anything, but that my work was cut out for me, and it was an important mission. Other times, I've been much less certain, and wondered, you know, why am I sitting in front of this computer editing HTML, when I could be spending the same time and effort campaigning for, say, the rights of an indigenous tribe having its land ravaged by a multinational corporation. I had to justify this to myself when people I knew were involved in things like that, by telling myself, well actually they're just dealing with the symptoms, whereas I'm trying to deal with the root of the problem. So it verged on an idealism, almost an activism.

C: The point being that rather than lamenting the destructive rôle of number and of science, one tries to recognise that there's something else within number, and as you said, to re-evaluate our relationship to it, which is not to say to reject it, but to become *more* numerate...

MW: Yeah, which is what I saw around me, people being very suspicious towards mathematics, hating it, seeing it as controlling and evil, and I thought, no, we need to get inside it, try to understand where it comes from and how it works.

But then I started to question whether I was just creating a whole set of complex and noble motivations for myself when in fact it was just my ego or desire to be acknowledged for what I'd achieved, or, you know, just wanting some sort of recognition or status. I was continually wondering what it was that was motivating me, and trying to rein myself in and consider the worst possible motivations as well as the best.

I had a kind of motivational collapse in early 2005, when I was struck by a very deep sense of there being insufficient time; you know, I had this grandiose hope of helping to effect some sort of long term change in culture and the way in which we deal with the number system. I started to think, maybe what I'm contributing to *would* have that effect if there were a few more centuries left of relatively leisurely culture and well-funded academia to take these ideas on and develop them, but, you know, we're facing multiple global crises, and this sort of thing is never really going to have time to take root.

I've since drifted in and out of this activity periodically, found what I think is a healthy level of interest in these matters. But I don't strongly believe that I'm part of some current of cultural change anymore, I'm just...I suppose you just can't know what effect you're having, particularly with the Web, when you're pushing ideas out. You don't know who's reading them and what they're going to do with them – a bright teenager who reads my website might be inspired to study mathematics and, influenced by some of the hints, clues, suggestions, *etc.* I've assembled, go on to make amazing discoveries...who knows?

There's also the whole relationship between psyche and matter which seems to have been at the centre of all my interests over the years. I got involved in parapsychology for a while, online psychokinesis research in 1996, wondering whether there really was something in that, and what it would imply concerning the psyche-matter interface. There's also a very exciting interdisciplinary field of 'consciousness studies' emerging, and which I've been following, people trying to understand the physics of consciousness, looking at microtubules in brain cells and how quantum mechanical phenomena at that scale might help to explain the origins of consciousness – physicists, neurologists, philosophers, psychologists, anthropologists, psychopharmacologists, *etc.* are all contributing to this field. Then there's all the Jungian theory concerning myth, archetype, synchronicity and the 'psychoid' level of reality – a kind of psycho-physical interface. The simple fact that mathematics is able to describe the world at all, that's a mystery involving mental constructs being mapped mapping onto material reality. There's the 'mind-brain problem' which philosophers debate. And then dreaming, shamanism, schizophrenia, quantum-mechanical paradoxes, these are all things I've spent a lot of time thinking about, reading about – generally wondering how it all fits together. And it had occurred to me that these topic cluster around the central mystery of how matter and psyche interface. But I'd been thinking about prime numbers, etc. for a few years before it occurred to me that this is very much part of the same picture. I'd been exploring the interface of physics – which concerns matter, obviously – and number theory, which, as that Tenenbaum quote suggested, is really an exploration of 'the mind itself'. And the research I've been interested in archiving displays a two-way traffic: Number theorists have been providing concepts and structures which physicists have used to better understand the world of matter. Physicists have been able to, using their understanding of matter, shed light on the internal workings of the number system. Even number theory *without* the physics is implicated: although number is widely considered as a mental construct, at the same time it manifests directly in the world of matter: when you consider a quartz crystal or a five-petalled wildflower, it's hard to deny there's an essential 'sixness' or 'fiveness' there. So, number itself is a bridge of sorts between psyche and matter.

This last idea, that number is a bridge between psyche and matter, comes quite close to something Jung was exploring in his later career. He left a lot of incomplete work when he died, and I believe he left von Franz to look at number archetypes. He'd looked at individual integers, the first few integers and their various associations. But later, more importantly, he'd come up with the idea that, not individual numbers with their associations, but the *set of positive integers as a single entity* is in itself an archetype, the archetype of order.

Now what has distinguished Western culture from the rest of humanity, what characterises the Sumerian-to-Babylonian-to-Greek-to-Roman-to-Western-European cultural current that dominates the planet with its measurement and science and so on, is the way we've dealt with this archetype which normally inhabits the collective unconscious. I picture it as a sort of mysterious sea creature – we've hooked it and we've hauled it out from the dark depths into the daylight of consciousness. We've taken something that was primarily unconscious, and which would naturally manifest primarily via the number archetypes and number associations in other cultures. We've dragged this thing out of the sea and onto the land, cut it up and studied it, studied its anatomy in great detail in order to obtain a new kind of magic, if you like, and that, I came to believe, was the root of all the world's problems.

But then we have this emergence into consciousness of the set of the prime numbers buried within the set of positive integers, a hidden archetype within an archetype, a kind of chaos within order, the black dot in the yin half of the yin-yang symbol; the emergence of *that* archetype – the prime numbers, the zeta function and everything they entail – into mass consciousness, is just starting now, really. The first four 'popular' books on RH have all come out in the last couple of years...it's strange that this should all be happening so suddenly. Thinking along the quasi-Jungian lines I've sketched out, the integration of these ideas into consciousness, the idea of the Riemann zeros having their origins in some 'older' or 'deeper' numerical reality, something more ‘primordial’, *etc.* may turn out to be of profound historical significance. According to the insanely optimistic wishful thinking which I’ve since distanced myself from, this could be the event that would start to alleviate the effects of rampant ‘quantocentrism’ and put things back into balance.

C: I wonder whether the growth of ‘popular science’ could play a rôle here – thinking in particular of the many books which have been published on RH.

MW: The fact that you’ve got four books on RH out suddenly – why is this, why hadn’t this happened before? I’m sure a few years ago most people involved would have said that it’s impossible to explain RH to lay-people. But four authors have done their best, with varying degrees of success. The books have all been well-received, have sold fairly well. So why is this happening? The mystically inclined might invoke an unseen force that’s trying to bring these ideas into consciousness. Jungians might talk about ‘compensation’ and the collective unconscious. But more simplistically, more materialistically, it’s market forces, it’s capitalism, and it’s because people are looking for meaning. Many are turning to New Age cultism, some are turning to born-again Christianity, Scientology, fundamentalist Islam, whatever. But there are a lot of people who are aware that the real ‘guardians of truth’ these days are not priests and monks, but scientists and mathematicians, and yet, they find themselves in a position where they don't know anything about the essential subject matter. So they want someone to explain, say, the mysteries of quantum physics to them. I get this all the time, people really wanting me to explain quantum physics, fractals, relativity, the golden mean, chaos theory, p; there's a handful of things that people get really excited and obsessed about, you know. And of course the market system rises to meet a demand, a growing demand for meaning. The problem is that capitalism doesn't care whether a book is accurate or well-written, it just cares about sales figures. So as a result you get gross oversimplifications hitting the market and sometimes selling quite well. Because the market has expanded, there is more competition, and ideally, if you believe in the effectiveness of capitalism, then the 'best' stuff will float to the top – but 'best' in this sense doesn't necessarily correlate with truthfulness or accuracy, rather with how successfully the book quenches readers' thirst for meaning. There does seem to have been a certain amount of progress, though. I don't really watch much TV, but it does now appear that with the computer graphics available, it's possible to make some things a lot more visually accessible, so viewers can at least get a flavour of the problem, or of what's at stake.

But the really deep stuff, the major philosophical problems underlying maths and physics…it's hard to imagine that there really is a shortcut to years and years of disciplined study. I mean, you might be able to get the basics of something across to a few, a small section of the population who are already interested and whose minds are structured in a certain way – it's not to do with levels of intelligence, just a certain kind of intelligence. You've got committees for the popular understanding of science and things of that nature, but they're very marginal. Unless there were a major cultural shift, unless you had major government funding, and the top layer of mathematicians and scientists committing themselves full-time to bringing this stuff through into popular culture...but there's no motivation for that to happen – governments aren't interested in educating their populations except in ways which will further economic growth. They want a certain proportion of young people to be trained up to be economists, accountants, engineers, *etc.* 'Truth' doesn't really come into it. So I doubt it…but, again, you never know, some major cultural shift could occur where the demand for this sort of knowledge reaches the point where the best people would feel obliged to provide it. Or, possibly, there could be some sci-fi type breakthrough involving direct brain-to-brain knowledge transfers, you know, you can't rule these things out, but I'm not holding my breath!

You've probably noticed, part of my website is very formal-academic, the web-archive aspect; and part of it is just about getting fundamental ideas across to people who are open to them and just want to understand their reality a bit better. I have felt in the past, with my 'activist' hat on, that it's important to bring some of these issues to widespread public attention – the basic issues of the number system. At this stage I don't know if it *is* 'important' or not, but I'd be very interested to know what the overall effect of that kind of exposure would be. Again, I suppose I am still gripped by the idea that, if we transform humanity's relation with number, that could have a positive transformative effect. I suspect I'm still partially motivated by that belief at an almost subconscious level.

The only thing I can really say with any confidence at all is that I think we're on the verge – and again, the timescale is very indefinite here – but Western Civilisation is on the verge of collectively realising that the number system is something very different from what it had previously thought it to be. I haven't got a particular theory about what it is, I just know it isn't what we think it is.

Introduction to ABJAD

'Incognitum'

ABJAD (ابجد) is an acronym derived from the first four consonants of the Hebrew/Arabic/Persian alphabets; *Alif, Ba, Jeem, Dal.* It is a simply-constructed but functionally-complex alphanumeric system condensing different belief-dynamics from Near- and Middle-Eastern cultures, which became particularly prominent after the rise of the *Shi'a* religion in Iran. Arabic ABJAD originates from the Semitic family of scripts.

In working with Arabic ABJAD usually three numeric values (the ABJAD value of the letter, the order of the letter in the ABJAD table and the alphabetic order of the letter in the Arabic alphabet) are used as numerating values; the most interesting and complex products of ABJAD are those operating with more than one numeric

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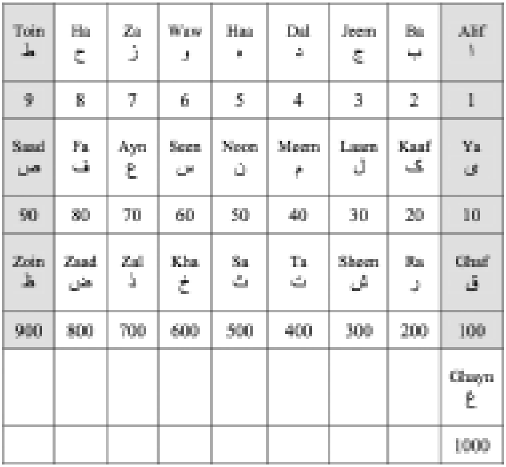
value (i.e. ABJAD value, ABJAD order and Alphabetic order simultaneously) but later works by ABJAD scholars from Iran, India, Afghanistan and Arabic countries show an inclination towards a unified ABJAD value called ABJAD-e Kabir (Major ABJAD).



Toin ط	Ha ح	Za ز	Waw و	Haa ه	Dal د	Jeem ج	Ba ب	Alif ا
9	8	7	6	5	4	3	2	1
Saad ص	Fa ف	Ayn ع	Seen س	Noon ن	Meem م	Laam ل	Kaaf ک	Ya ی
90	80	70	60	50	40	30	20	10
Zoin ظ	Zaad ض	Zal ذ	Kha خ	Sa ث	Ta ت	Sheen ش	Ra ر	Ghaf ق
900	800	700	600	500	400	300	200	100
								Ghayn غ
								1000

Fig. 1. ABJAD Table (*ABJAD-e kabir*: major abjad)

The arabic ABJAD table (ABJAD-e Kabir) is arranged in powers of 9:

Level 1. *Alif* (= 1) to *Toin* (= 9)
Level 2. *Ya* (=10) to *Saad* (= 90)
Level 3. *Ghaf* (= 100) to *Zoin* (= 900)
Level 4. *Ghain* (= 1000)

The ABJAD values of all levels are based on the connections between the ABJAD order and the ABJAD value of each letter at the first level (1-9), where the

ABJAD value of each letter is equal to its ABJAD order.

LEVEL 1: from 1 to 9. Take the letter *Haa* as an example: its ABJAD value is based purely on its ABJAD order *i.e.* 5=5.

LEVEL 2: from 10 to 18 (ABJAD order). Since the level changes, there is a phase transition from one- to two-numeral values (using one '0' as a place holder). The ABJAD order of the letter *Noon* (under the letter *Haa*) is 14, which can then be numerically simplified as 1+4 = 5. The single numeral x is converted to xx to indicate the letter *Noon*'s location on the second level. Consequently we have 50 instead of 5: 50 is the ABJAD alpha-numeric value for the letter *Noon*.

LEVEL 3: from 19 to 27 (ABJAD order); on the third level xx changes to xxx; the letter *Sa* is under the letter *Noon*; its ABJAD order is 23: 2+3=5=500 (xxx)

LEVEL 4: at this level ABJAD diverges from the power of nine. This might be considered the apogee of the ABJAD alpha-numeric progression.

The numerical arrangement of ABJAD into four alpha-numeric layers, three of which are built upon the power of 9 (9-based) is strongly in accordance with the unique politics of Islamic apocalypticism, whose allegiance is not to sectarian ideologies but to the explicit text of the Quran, immutable according to Islamic scholars. We have three levels (1-9, 10-90, 100-900) whose structures are numerically never concluded (they never reduce to One, remaining imperfectible and inconclusive). Only the letter *Ghayn* numerically stands on its own plane as 1000 (Kabalistically reducible to 1); however, the One here is external to the 9-based arrangement of ABJAD: In Islam, the divine constantly remains on the outside; it is characterized by its radical externality to its multiplicative creation, and conceived not as conclusion or *telos* but as externality. This only serves to highlight the overall imperfectability and inconclusiveness of ABJAD/Creation. The Divine loiters on the exterior (beyond the threshold of ontological possibility) even on the Day of Apocalypse (as in Islamic Apocalypse, *Qiyamah*). God never reveals itself (*Apocalyptio*), shifting the radicality of its exteriority and the inconclusiveness of its creation to another plane.

> While God was the exclusive source of the revelation to Muhammad, God himself is not the content of the revelation. Revelation in Islamic theology does not mean God disclosing himself. It is revelation from God, not revelation of God. God is remote. He is inscrutable and utterly inaccessible to human knowledge [...] Even though we are his creatures whose every breath is dependent upon him, it is not in interpersonal relationship with him that we receive guidance from him.[1]

The ambiguous monotheistic structure of ABJAD (enshrouding obscure religio-political inclinations), and its empathy for imperfectability, multiplicity and

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1. Edmund Perry, *The Gospel in Dispute: The Relation of the Christian Faith to other Missionary Religions* (New York: Doubleday, 1958), p155.

inconclusiveness, unillumined by a rabid exteriority ungraspable for Man, has made ABJAD the alphanumeric system most favorably-disposed to heresies and obscure apostasies. It is no exaggeration to say that the history of Islam has been perpetually accompanied by ABJAD exploration and alphanumeric distortion of all forms of official and established religious institutions and texts (the latter being untransgressable, and consequently prone to the generation of profound heresies). "Everywhere that ABJAD can be found, a heresy has already emerged," remarks Abidulah ibn-Maymun, the founder of the *Ba'teni* – later to become *Ismailie* – cult.

Given the fact that the syncretic configuration of ABJAD scriptures as well as ABJAD diagrams has always been complemented by the sheer syncretism of its redactors and exegetes, their usage in mass culture and belief systems of Muslim populations has sprawled over a vast array of everyday affairs, surpassing mere occult instrumentality and elitism. In the timeframe between the rise of *Horoufi* sect (from which the most prominent ABJAD theorists rose – 9th Century) to the *Qajar* dynasty (1781-1925) ABJAD diagrams were composed for purposes including education in elementary schools to depict the interactions between alphabet, numbers and religious matters in an efficient way (commonly being used for memorizing religious stories, names or even basic mathematical or linguistic lessons), interpreting the Quran and other Islamic or sectarian scriptures, healing diseases, invoking love or hostility, conjuring deities, operating as catalyzer-spells in alchemical experiments, *etc.*

The multi-functioning (heretical) nature of ABJAD also allowed it to be extensively employed as a language of communication between minorities (or within minorities)[2], and as an instrument for supporting the political belief-systems of Islam's non-Apocalypse through mathematics, astronomy and geometry and through the cross-fertilization of these fields with linguistics, cipherology and occultism, producing a vast field of crypto-sciences or heretical knowledges. ABJAD has become an example of a numerical system which, far from being a nomadic numerical machine, intrinsically operates within the State in order to initiate anomalous reciprocations (in the case of ABJAD, the state and numbers go hand in hand).

ABJAD Diagrams are perhaps among the more well-known productions of the heretical knowledge and absolute syncretism one finds in ABJAD systems, yet they remain unexplored. They critically condense and compile wide varieties of monotheistic and non-monotheistic elements, although they constitute elements specifying their connection with the minority belief-dynamics of either *Sunni* or *Shi'a.* At the top they usually include the number 786 which alphanumerically equates to *Besmellah-e Rahman-e Rahim* (*In the name of Allah, the passionate, the merciful*), the opening verse of each chapter (Sura) in the

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[2] In fact, all sectarian ciphers in Islam and Islam-inspired religions are constructed and can be only deciphered by ABJAD.

Quran. The diagrams are mostly constituted of humanoid figures with bodies in positions evidently inspired by the Zurvanite, Sumero-Babelian and Zoroastrian cartographies of blasphemy, or demographic configurations. Archaeological explorations of Near and Middle Eastern cults (especially from the time of the Mesopotamian civilizations to the end of antiquity) reveal that forms of demonism ('demons' being understood as avatars of the outside) are mainly characterized by their anomalous cartographies – diagrams which present the bodies and positions of the demons, and the arrangement of their appendages (faciality is the least significant aspect of Eastern demonolatry. Islam also forbids the 'facialization' of religious figures and martyrs):

- The right hand upward and the left hand downward is a cartography of demonism of the greatest archaeological provenance, originally emerging in the Assyrian period, where demons of pestilence and contagious epidemics are presented as seen in the bronze *Tablet of Disease* (in the collection of M. De Clercq). A significant number of ABJAD humanoid diagrams maintain this cartography in the most explicit way (see page 202) while presenting the ABJAD numbers connected to the legion of the damned and blasphemous people mixed with holy names and numbers on their bodies.

- From stretched hands, one pointing to east and one pointing to west, we can identify solar demons (the Romans ironically borrowed this same diagrammatic position from the Babylonians in their crucifixions, the most prominent of which are the iconographic portraits of the crucified Jesus). (See page 200).

In ABJAD diagrams, when it comes to the divination of a religious figure, facialization is achieved through composing the face, head and body with the exclusively use of numbers and letters, with no depiction or explicit portrayal (see page 201). In consequence, ABJAD pushes Islam's holy ban on facialization into a blasphemous demonic complexity which with the same reprobate enthusiasm tears itself away from the expressionist hegemony of facialization.

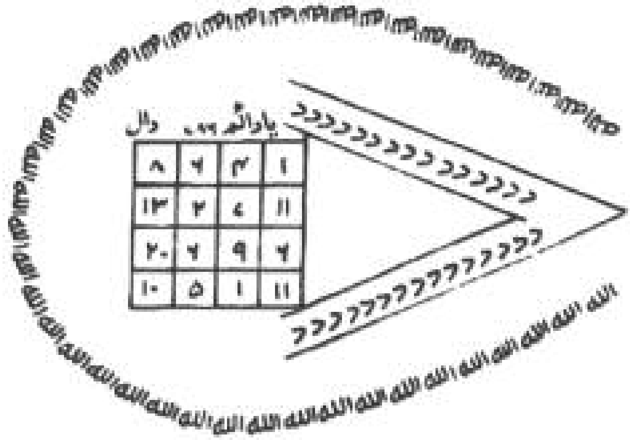
In these diagrams each part of the body (including the head) has its own agenda of ciphers and exclusive numbers. Usually most of the body is enveloped and takes the form of a repetition of the letter *Haa* (ABJAD value = 5) representing the five individuals of Shia: Mohammad, Ali, Fatemeh, Hassan, Hussein (see page 201).

In western occultism, diagrams and magic squares are usually surrounded by magic circles and other geometric shapes which are always closed and symmetric. Their task is to converge the power of the spell upon a certain objective. In ABJAD diagrams these circles are replaced by open geometric shapes such as triangles and curves conducting open-ended and divergent experiments in syncretism. In ABJAD diagrams these curves and shapes are commonly known as ABJAD shields. Most ABJAD books, although published by *Shi'a* authors and containing the names of *Shi'a* Imams, correspond to the cipherology of the traditional Arabic ABJAD in which diagrams or figures are guarded by ABJAD shields, covered by either the letter *Meem* or the letter *Dal* (the first and the last letters of the name Mohammad); the design of these traditional ABJAD shields is of two intersecting lines forming an acute or obtuse angle representing the letter *Dal* (ABJAD value=4). Unlike in *Sunni* ABJAD (see page 199), in *Shi'a* ABJAD these shields are not pointed and, rather than the letter *Dal* are in the form of the letter *Ha* – expressing the *Shi'a* politics of *Taqiyya versus* the *Sunni* politics of conflict in *Jihad* – but with curved lines diagramming the calligraphic elements of the letter *Haa*. These curved lines usually become overrun by the repetition of the letter *Haa* (ABJAD value = 5) on their outer surface, standing for 'Panj Tan-e Aal-e Abba' *i.e.* Mohammad, Ali, Fatemeh, Hassan, Hussein who are the pillars of Shia (See page 210).

Page 199: A spiteful spell for calling upon a disease or replacing a fatal disease with a less dangerous illness. The word *Allah* constitutes the outer open circle, the targeting-arrow of the letter *Dal* (empowered by the outer circle and representing the power of the prophet Mohammad) can operate from the opening and directing the power of the ABJAD square (composed by the numerated name of a disease) in the guise of a sting towards a person.

Page 201: The Arabic and Abjad equivalents of the words 'No' or 'Closure' compose the face of this ABJAD figure, making her mute, blind and deaf or, symbolically, easy to be controlled. At the center of this ABJAD diagram is an ABJAD square which has replaced the heart. The symmetry of numbers and certain words (the word speed and the name *Ali*) make this spell oscillate between negative and positive intentions. This spell should be engraved on four pieces of alloy (fusion of the senses), buried in soil, put in fire, exposed to wind and thrown in water to make a person possessed by an involuntary love.

Pages 204-205: An Abjad diagram for memorizing the names (unique characteristics) of Allah in an interacting form.



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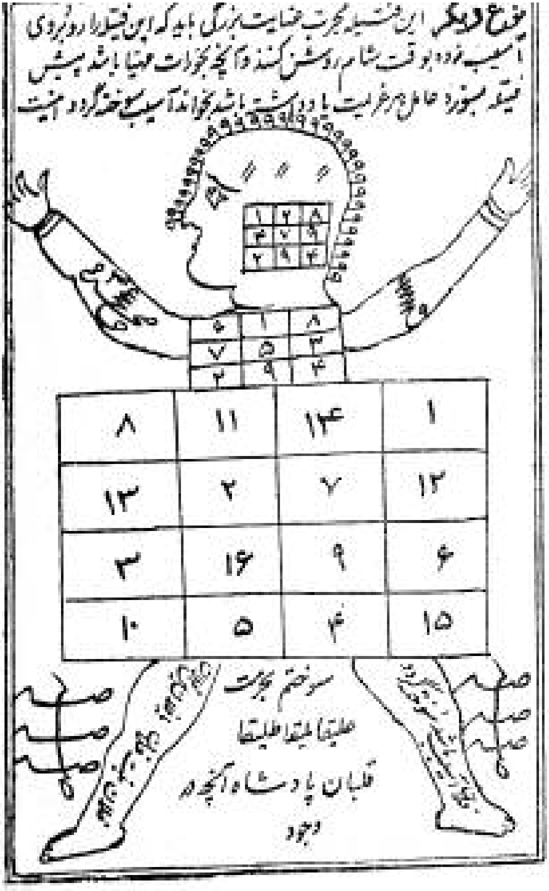
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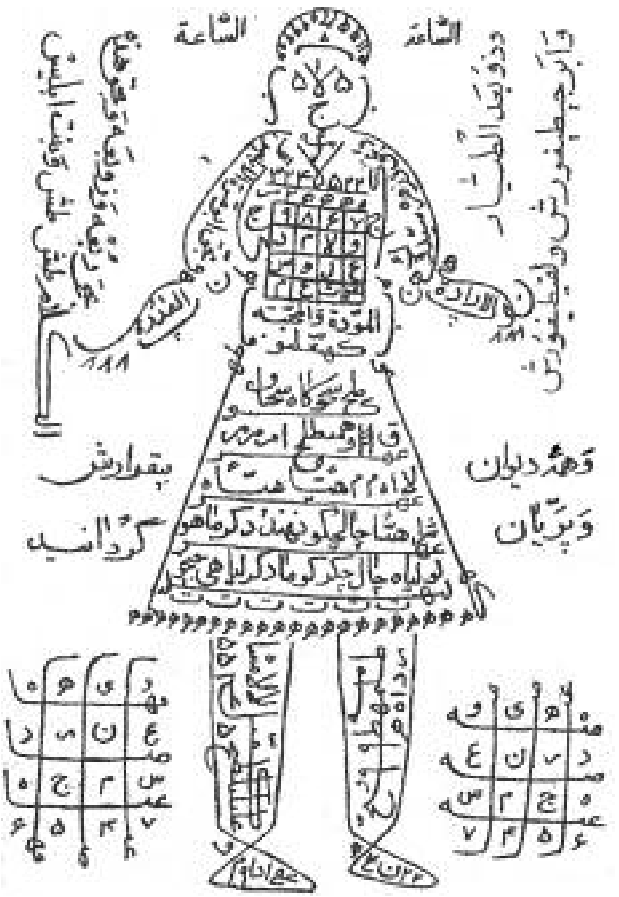

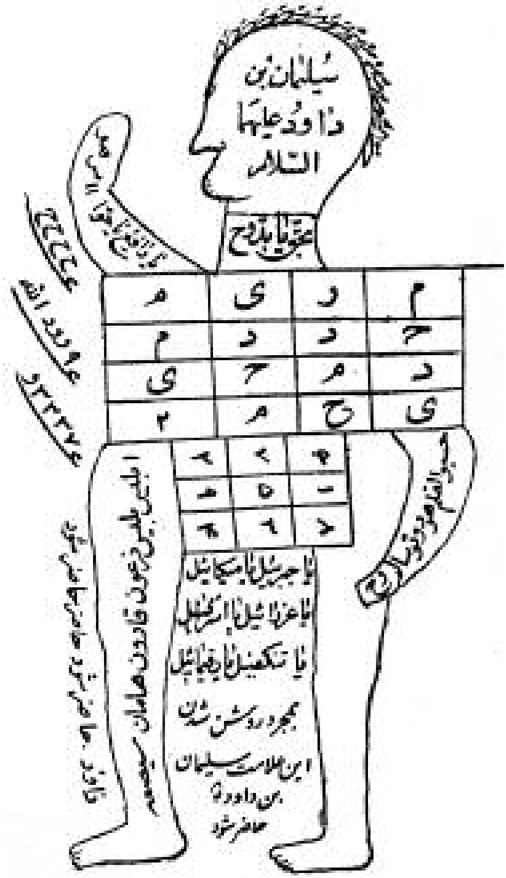
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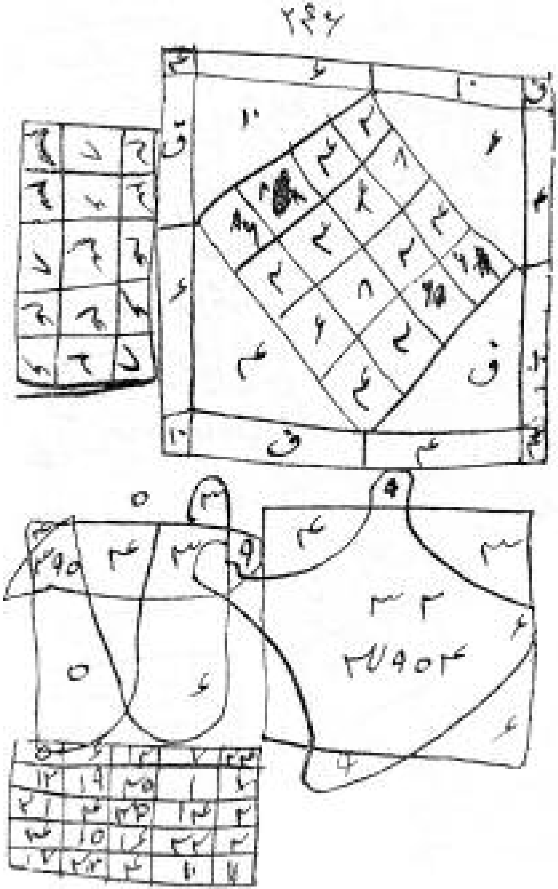

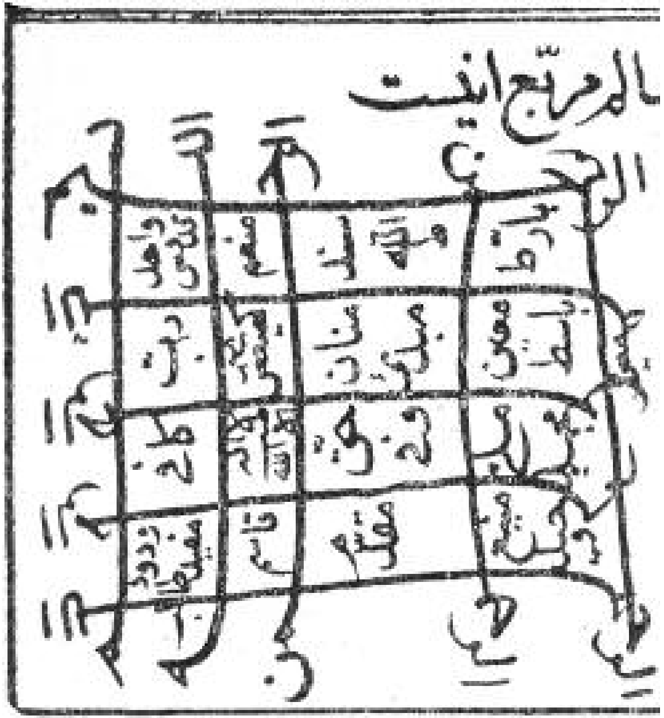

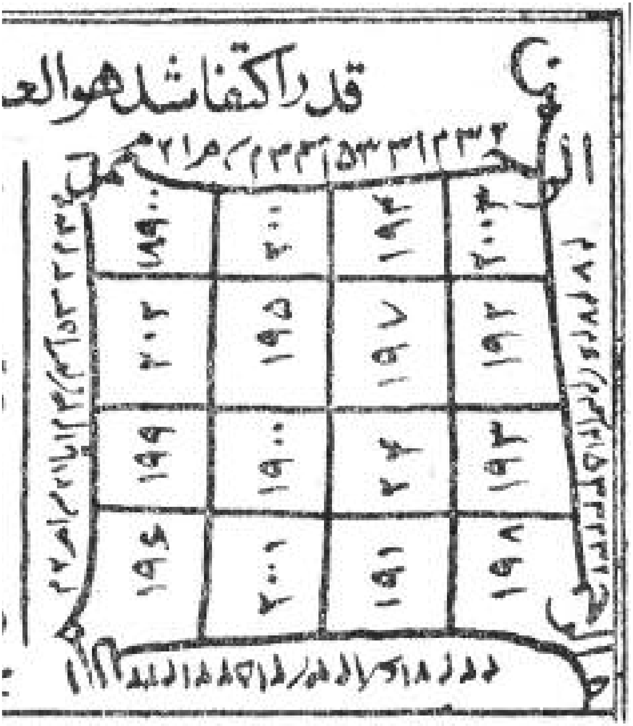

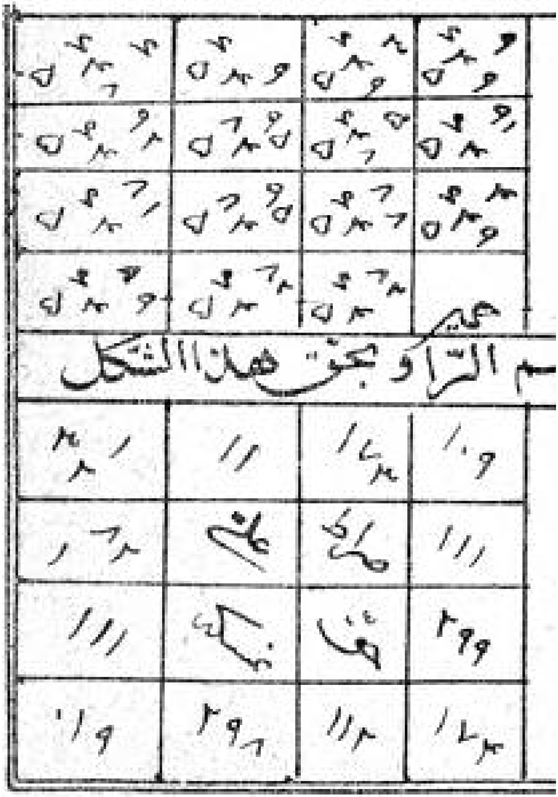
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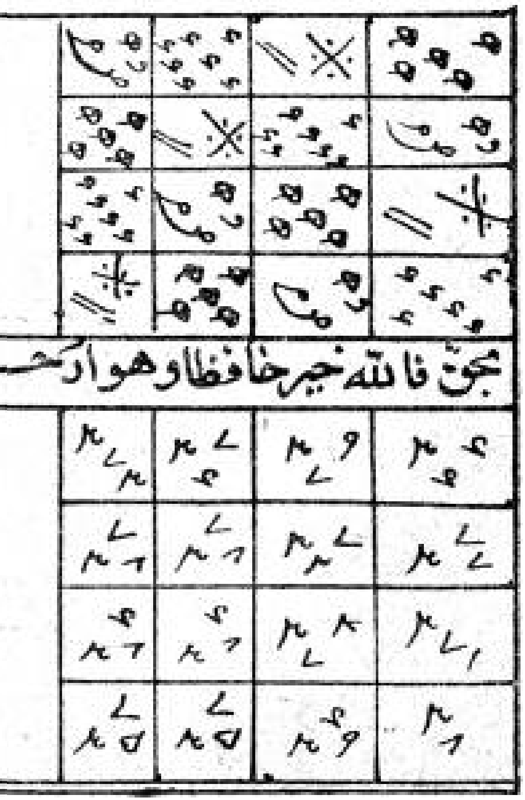

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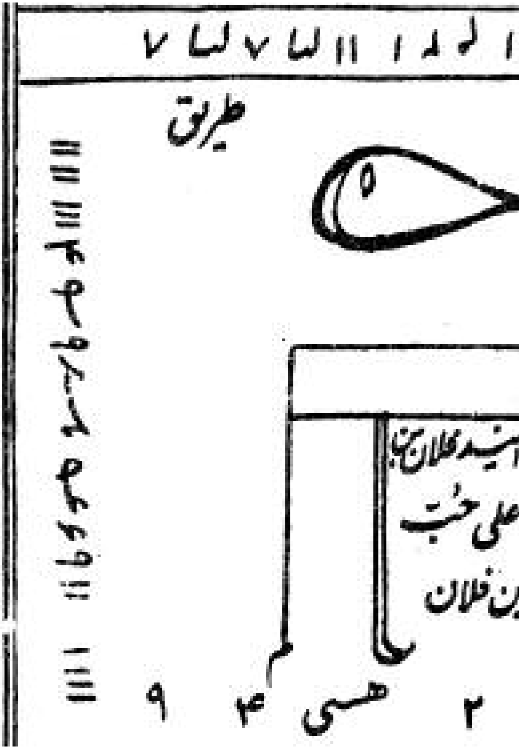
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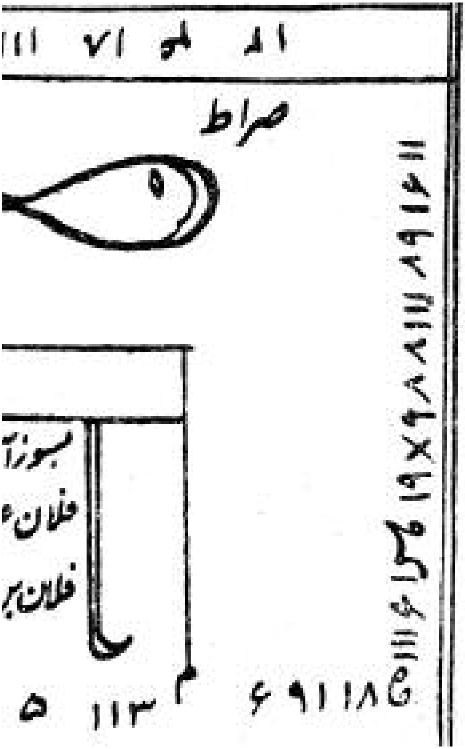
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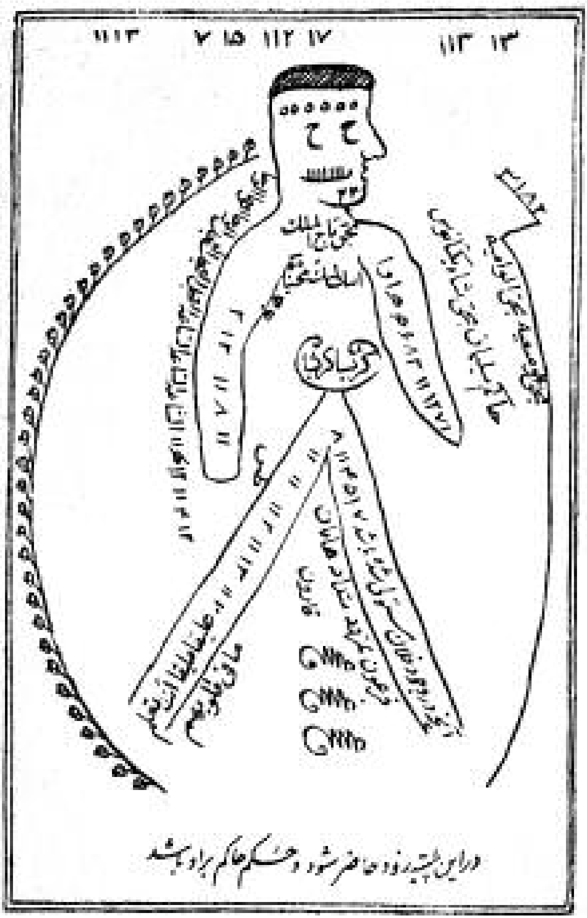
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Existential Risk

Interview with Nick Bostrom

The Future of Humanity Institute forms part of the ambitious research program of the 21st Century School *established by benefactor James Martin at Oxford University in the UK. If it is surprising that the UK's most traditionalist university by reputation should host an interdisciplinary research institute dedicated to evaluating the long-term prospects of the human race, it is perhaps even more remarkable that the director of the Institute Nick Bostrom began his academic life in analytic philosophy. He talks to* COLLAPSE *about the wide-ranging research program of the FHI which seeks to address 'existential risks' for mankind ranging from natural catastrophes to biotechnical modification and the emergence of nonhuman intelligences.*

COLLAPSE: The establishment of the Future of Humanity Institute seems to mark one of those 'crossover' moments where strands of research that once

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http://www.urbanomic.com

seemed purely academic, or were at best categorised as interesting 'thought experiments', are becoming pragmatically pertinent: amongst the issues you deal with are bioscience, cryogenics, catastrophes of an ecological and cosmological nature. Is the function of the Institute to liaise between the academic research environment and various public policy, governmental, or security bodies who are looking for ways to gain traction on these issues?

Nick Bostrom: Yes, but its primary mission is a research mission – to try to improve our understanding of three broad areas. One is human enhancement, ethical issues especially related to that, but also practical issues, policy issues. The second is global catastrophic risk; and the third area is methodological problems and issues that crop up when we're thinking about the big picture for humanity, both in relation to the first two areas and more generally when we're thinking about anticipated future technologies, and so on. So the primary focus is to improve understanding through research in those areas, but it has a component – or will do, in the future – of liaising with policy-makers and trying to create some public awareness and stuff like that.

So the interdisciplinarity is not an end in itself. It's just that when you try to address some of these problems and issues, it just so happens that more than one discipline is needed.

C: Given the magnitude of the problems you're proposing to treat, is it surprising that there hasn't been such a unified initiative to tackle them until now?

NB: I don't know, it's difficult to do within a traditional disciplinary setting, that's one reason. Because none of these problems fit neatly into a discipline. So it might not be so surprising that it hasn't been done, because it requires probably some framework that goes outside traditional disciplinary boundaries. In one sense it is surprising because the issues are important enough that one would have thought that humanity would have a few people somewhere thinking about them: extinction risks, for example. So, from that, from the observer from Mars perspective, I think they would be surprised.

I should also say that although these three areas are quite a broad range, in reality what it means is that one would have to pick specific, tractable questions within those areas, and look for opportunities where analytic methods and our current knowledge actually enable us to say something.

C: You were trained as a philosopher, and we were struck by the fact that the Institute is attached to the philosophy faculty. How did the Institute originally come about?

NB: I was in the philosophy faculty, I was a postdoctoral fellow. And I've always been interested in, been pursuing, these kind of questions. And together with Julian Savulescu, who is professor of practical ethics here, we had a couple of ideas for research projects, or programmes that we wanted to pursue or get funding for. One of them was human enhancement ethics, another global catastrophic risk, and there was a third one. So we went to the development office, these are the people responsible for fundraising in the university, to see if they had any ideas. And they said that they knew someone they thought would be interested in this, and had actually mentioned me to him before. It turns out this is James Martin, who is the benefactor for the James Martin 21st Century school, of which the Institute is now a part. And James Martin had interviewed me earlier, about a year before, for some television documentary he was doing, and appeared to be quite enthused about what I was trying to do. So by sort of coincidence – because I didn't know that he was a donor, or a funder, a rich man, at that point, he was just somebody doing an interview – this development guy managed to put one and one together, and establish some contact, and then there were lots of drafts back and forth, and lots of different proposals, and discussion, and this is what resulted in the end.

C: So, with the involvement of Martin, is it actually a genuinely philanthropic exercise?

NB: Yes – we have some co-funders as well, but that's where the bulk came from. And Julian Savulescu, he's the director of the Uehiro Centre for Practical Ethics, downstairs in this same building, but he also has a programme on Ethics and New Biosciences, which is also part of the James Martin 21st Century School.

The whole James Martin school is really James Martin's attempt to do a couple of things: to encourage interdisciplinary work and to bring Oxford into the 21st century, but more specifically to try to get Oxford to focus on some major problems for humanity in this century and see what practical solutions can be found. The whole school to some extent is shaped by that vision.

C: How closely would the Institute's research have to track or monitor things like ongoing developments in, for example, AI research, and even A-Life research? Different research programs underlie both of those, with internal technical debates that would have ramifications for broader questions about the nature of other intelligences and the characteristics they would possess.

NB: There will be one level of monitoring which is just keeping some general idea of what's going on. But then depending on which specific projects or which specific paper you're working on at the moment, you would obviously then have to dig down very deeply in that area. So if you were writing a paper on artificial intelligence let's say, then you would have to get up to date on the latest details of that. But generally you can't be up to date on the details of everything that is possibly relevant, it's just not humanly possible. So you have to have some general idea of roughly what's happening, and then you get to focus, like I say, when you're producing something specific.

C: Are there practical limits? If the Institute expanded its staff would you be able to have these subcategories…?

NB: Yeah, you still wouldn't be able to keep track of everything, but you could have people specialising more, or covering a greater range of topics. We're still in the bootstrapping phase now.

C: What seems remarkable is that you're trained in analytic philosophy, and you're applying the methods of analytic philosophy to problems which up until now have only been thematised in so-called continental philosophy, i.e. the problem of death, the problem of what it is to be human, etc. And yet within your programme you seem to be pursuing these problems in a way which continental philosophy has been unable to do. For example despite its obsession with the concept of death continental philosophy doesn't seem to have tackled the basic fact that when the sun expires we will all die – and what the consequences of that are for thought.

NB: I think there is a traditional view that the continental philosophers have all the interesting questions whereas the analytic philosophers have had the right answers but the boring questions…I see philosophy as on a continuum with science really, I don't make a sharp distinction. It's the more general end of the spectrum, things that haven't yet been crystallised out, specialised into different particular sciences. And so whatever seems relevant material to thinking about the particular problem questions, I think that's what one should use. And also in some cases even though the questions might seem the same they might actually be different. So although continental philosophers might have thought a lot about death, there are lots of different questions you can ask about death: about its meaning for the artist, or for the human being on one hand, or you could ask more concrete questions such as whether current research priorities make sense, is the allocation of research money to biogerontology versus cancer research in the right proportion, for example.

C: How do other philosophers – not only at Oxford but also elsewhere – regard your work?

NB: Some of the work I've done has a sort of dual-use function, which is the way I have had to work up more or less until now, since I haven't been able to have a post full-time for doing this. So some of the papers like *Infinite*

Ethics or *Are we Living in a Computer Simulation*?[1] can be read by people who are really interested in the FHI from a purely philosophical point of view, and there is enough in it for them that even if you're not interested in the practical dimensions of it you'll find some worthwhile philosophy there. But from my point of view the reason why I've written about them is that I think it relates to this broader vision, to the practical concerns that I have. So one could find some of these stepping stones where one could get both philosophy and the relation to humanity's future down on the same paper, but it requires a little bit of picking and choosing and figuring out clever ways of combining the two. It's obviously much more desirable if one can do work solely on the basis of the criteria that it should be relevant to the big picture for humanity.

C: You propose to tackle analytically problems which are of such cosmic scale that they induce what you call in your own work 'infinitarian paralysis': that is to say, given the magnitude of these questions, how is it possible to do select one path or another, to choose between options? One of the methods you seem to be using is the quantification of risk, a risk-management or risk-assessment approach. This quantitative treatment of risk is something which is of great importance in public policy, in corporate policy, in finance, but how is it applicable to these massive existential dilemmas?

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[1] Both at http://www.nickbostrom.com

NB: Well that's a relevant question, whether it is or not. Specifically, in the case where you have literally infinite stakes – which is the case this paper, *Infinite Ethics*, discusses – there is a set of ethical theories that run into trouble when you take seriously the possibility that either the universe might be infinite and have infinitely many people in it, or even that our actions might have infinite consequences. Even if you think the possibility of that is small, you're still going to have what I call this 'infinitarian paralysis' problem. It seems as if it's impossible that we could make a difference, in terms of changing the expected value of the world. Now, that might be more a problem for certain ethical theories rather than for humanity, because if certain ethical theories have that implication then we might just take the lesson that we should have other ethical theories instead that avoid it. So I think it's a significant but technical point. There is a broader sense in which it's possible to think about some of these things. It's easy to get a sense of vertigo sometimes, because there are such extremes in terms of the best outcomes and the worst outcomes, just the sheer magnitude of them: the problems and the stakes are so much larger than things that people spend so much more time thinking about. But my view is that one should try not to look away, one should just try to keep a steady gaze, and use the same methods, as much as one can, use the same analytical rigour, sober analysis, and step-by-step investigation to make progress on these.

C: Is the long term proposition of the methodological approach that you will actually be able to answer ethical questions relating to these 'existential' issues on the basis of quantitative consequentialist ethics? Myron Scholes, for example, created a formula for quantifying risk in financial transactions: do you propose that such a thing is possible in ethics, or do such methods only give guidance for further thinking about the problem?

NB: Yes, I think it's one ingredient, I think there is more to ethics than risk analysis. In terms of a meta-ethical view or a foundational view, I'm not firmly committed, I'm still trying to figure out which meta-ethical framework is correct, I don't know. Certainly I think taking consequences into account must be at least one thing that any reasonable theory would do, but there might be other things in addition, and how you should take them into account. So the answer would be no, I don't assume that would be the be-all or end-all. I think it would be one useful piece of information to have, if you could have that: information about the risks and the expected utility of different actions, I certainly think that would be useful. Really, the value proposition would be to try to illuminate some aspect of the big picture for humanity, pretty much those aspects where it's possible to illuminate them. Some might be very interesting, but would need some new insights that nobody else had, to figure out how we could say anything intelligent about them – maybe it's just not possible given current knowledge. But then there are some aspects where, with hard work or ingenuity, or using techniques of various kinds, we can say something that is not obvious and yet is relevant. So it's shooting for those targets of opportunity...

C: That's what you mean by 'opportunistic research'? Choosing the problems you think you can gain some traction on.

NB: Exactly.

C: Prior to the methodological question, it seems, are certain fundamental underlying assumptions which are driving the research, amongst which are the ideas that longevity is a good thing, that survival of the human race is a good thing: and the optimism of the 'transhumanist values'[2] that you personally espouse go beyond this.

NB: In terms of the first one, longevity, my view is that increased longevity and great health, or people having the option, would be a good thing. So that's my view, it's not necessarily a premise of all the work that the Institute will be doing. But that's the sort of question the ethics of which would be a subject of enquiry. It might turn out also not to be a yes-or-no thing, it might under certain circumstances be a good thing, under other circumstances it would be problematic. If other researchers looked at it maybe it would not be…and so whereas I am personally quite enthusiastic about the prospect of healthspan extension that's not a premise for the Institute. Now as for the survival of humanity, could that be seen as a premise? Well it's not an unquestionable premise, you could have a philosophical seminar where you would discuss that, and indeed we have had such a seminar, papers have been written discussing whether that would be a bad thing or not. So it's certainly discussable. Now if the work moved more into liaising with policymakers then I guess it would be hard not to make some assumptions like that. I mean, it's just as when you have someone researching cancer they just assume that it's good if we can find a way to detect breast cancer early, you don't have to have a huge philosophical conversation about that.

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[2] See 'Transhumanist Values' at http://www.nickbostrom.com

C: But precisely from a philosophical point of view this becomes a problem: It's not that one needs to denounce the fact that philosophy liases with the world, tries to engage with practical problems. But isn't it problematic that the 'transhumanist values' seem to have a basis in a particular political (and implicitly, philosophical) position already – *e.g.* when you talk about the 'entrepreneurial spirit' being part of the set of values?

NB: But you've got to keep distinct transhumanism and the FHI. There are other organisations – the World Transhumanist Association and so forth. That one in particular is not so much a specific philosophy but a conglomeration of different people and thoughts and values, some of which I disagree with; but obviously I am a transhumanist in a certain sense. But the FHI is not an institute for transhumanism or anything like that. What it does though is to focus on problems that would be of interest to transhumanists and many other people as well, I mean obviously global catastrophic risk would be of interest to a transhumanist, but so would it be to many other people. And similarly with the implications and ethics of new technologies. So there again, you can have different perspectives and viewpoints and arguments, which might or might not agree with certain transhumanist positions.

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C: In several of your papers you talk about the possibility of transcending 'observer selection effects'.

NB: Yes, observer selection effect is a kind of distortion of our thinking that occurs when the evidence we get is filtered in a certain way. The easiest way to explain it is a selection effect that we find in many contexts: there is the fish example where you catch a hundred fish from a given pond, and they're all larger than six inches. So you draw the inference that probably the smallest fish in the pond is not less than six inches. Then you look at the thing you caught them with, this net, that can't actually catch smaller fish. So you realise that although you have one hundred data points, they're all filtered through the selection effect that the net introduces. So, once you realise that you have to correct for it, if you want to estimate the population of fish in the pond you have to take that into account. So there are different methods for doing that in standard statistics. Now, an observation selection effect is similar, except it's not introduced by limitations in our measurement apparatus – the fish net – but by the fact that all observations require there to be a suitably-positioned observer to make the observation or to build the measurement instruments in the first place. In many cases these are not really relevant, but there are certain specific questions and problems where observation selection effects become crucial: in cosmology for example, they are of critical relevance when one is trying to figure out what observational predictions one can derive from current inflationary cosmological models. Also, if you ask certain questions about the evolution of intelligent life, they become relevant again. The probability of us discovering extra-terrestrials: they turn out to be relevant to answering that question. And then they are relevant to others, like the probability of catastrophe. And to a number of philosophical thought experiments as well, like the 'Sleeping Beauty' Problem.

C: So our analysis of the possibility of certain events depends on a prior 'transcendental analysis' of the human cognitive condition?

NB: I wouldn't go so far as that, no. But let me give you a particular example. There has been some concern amongst people who are doing these high energy particle accelerator experiments that – it seems unlikely – but theoretically maybe they could cause a breakdown of the metastable vacuum state, which would mean that there would be a rip in space-time that would expand at the speed of light in all directions, and bring utter disaster not just to earth but eventually to the whole observable universe. And so the question is, what reason can we have for thinking that these things won't happen?

The director of the Brookhaven particle accelerator commissioned this report a few years ago, the Brookhaven Report, to study this potential risk. And the authors of the Brookhaven Report made a good point, that the energies that would be attained in the reactor when particles collide, are attained all the time in the atmosphere: there are cosmic rays, particles from space that hit molecules in the atmosphere. And they occur much more frequently there. So, assuming that the reactor events are equivalent to the naturally-occuring ones, we can then calculate an upper bound on how probable these reactor disasters could be, and it's very reassuring if you do that.

Now one problem here is, how do we know that the natural disasters are not very common? Suppose it were the case that on average, taking an average cosmic region, that it was usually sterilised after one day, so you would have this furious destruction of cosmic regions, and then nothing else would happen. Now how do we know that that's not the case? Even if that was the case then we would still obviously expect to be alive – you don't observe these destructions, the destruction hits you at the speed of light, so no-one can see these things. So the only thing that would be seen would be parts of the universe that survived. And if the universe is big enough there would always be such parts. And so they had overlooked that. But it turns out that you can get around that, and this is a recent paper in *Nature*[3] I wrote with Max Tegmark, who is a physicist, where we point out that you can use data from planet formation rates to place an upper bound on this. The basic idea is that if these sterilisation events had been very common, then we should have expected to have been on a planet that had been formed much earlier. So there you can, using these data, and awareness of these observer selection effects, find a way round it. In this case it supports the original conclusion.

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C: As is the nature of the research undertaken under the aegis of the Institute, issues about the possibility of some posthuman intelligence, non-carbon-based life – there's a high degree of philosophical speculation, or abstract speculation, involved in these. On what basis would you discriminate between relevant and irrelevant degrees of speculation? For instance, after the 'singularity', this unimaginable amplification of cognitive capacity, there's an issue about whether there would be any continuity between intelligence as we know it, as familiar to human beings who are organic entities with a set of organic interests, and some sort of massively distributed non-organically-individuated intelligence. Would it have the same kinds of interest, would it want the same things that carbon-based lifeforms want? These are massive issues, obviously. But what's the cut-off point where you foreclose speculation?

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[3] 'How Unlikely is a Doomsday Catastrophe,' at http://arxiv.org/abs/astro-ph/0512204

NB: Well I guess there are a couple of ways in which it could satisfy the relevance criteria. One is that the question might have independent philosophical significance, philosophers often use thought experiments to test different philosophical positions – the 'brain in a vat' experiment, it's irrelevant how likely it is that scientists can actually make a brain in a vat if you want to think about internalism or externalism about mental states, for example. So obviously anything that is relevant apart from its empirical possibility would fall into that category. But then there are issues that are important because they might have practical relevance to what we should do now, or to one of the main questions that the Institute will study, but where it's just not possible to get anything better than a speculative answer. So then again, my view is that we'll have to make, and use, whatever tenuous guesses we can make, but then simultaneously recognise them as being tenuous guesses.

Because there's not going to be a vacuum here, and if one doesn't try to do something carefully, with qualification and with as much precision as one can, then people are going to do something there anyway, which is going to be less good. So that's one way in which it can be relevant.

And then there are some theories that would be very speculative, and where you might not be able to say that's what's going to happen, but you might be able to say if this thing happened or that thing happened then you can construct a quite good argument for why a third thing would happen, so there might be these conditional results as well. So given certain assumptions and premises you can make a strong case that there would be these other consequences. So that's the third way. To some extent one knows it when one sees it, if it seems to – even if it doesn't prove the point, if it sort of seems like an intelligent, carefully thought out, worthwhile consideration, then that's a kind of useful study.

C: Might some of the questions concerning superintelligence or a transhuman intelligence not be beyond our analytic capabilities? Why would a higher form of intelligence be something that would be recognisable to us any more than human intelligence is recognisable as such to an insect?

NB: If I could answer this in a personal capacity, what I currently think about it is that a superintelligence may be best thought of as a very powerful optimisation process, which means that whatever its goals are, the defining characteristics of a superintelligence would be that it is very good at achieving those goals. So that means that what it would actually do, how it would manifest itself, would depend critically on what its goals were. So the effects might be anything from being totally invisible to tiling the world with paperclip factories or smiley faces or whatever. You might imagine some unwise AI programmer in the future, when they are just about to create this first superintelligence, who thinks it would be very good to give it a motivation system based on reward learning. So they train it to get a reward whenever it sees a happy face, a smiling human face, then if the humans seem happy it gets rewarded for that, so it gets a motive to perform those actions. And then once it becomes more intelligent then it realises that it can produce this outcome that it has been taught to find desirable much more efficiently just by creating lots of smiley faces. And if that's the only goal it has then it might work out a very clever way of achieving a maximum of smiley faces. So I think with something that would be radically superintelligent – not a human that is slightly smarter than us, or AIs in the near future, but a really radical superintelligence – I think it could be very alien, and one shouldn't think of it as a sort of human genius.

C: This indicates another fundamental issue, the question of whether intelligence is necessarily connected with goals or aims. One could say that human intelligence precisely has this excessive problem-solving capacity without having a particular aim, or at least the former exceeds the latter to a comical (or tragic) extent. Is intelligence necessarily goal-directed? And if a superintelligence emerges, will it emerge from somebody explicitly setting out to build it? Might it not emerge instead as something which has not been planned at all? If you think of the Internet, or something like Google, an intelligent system that has in a sense developed a model of meaning, of how words are connected together, couldn't something intelligent emerge from that without it being planned?

NB: To some extent on the first question, one might think that if a superintelligence turns out not to have any particular goal, then it might not do or amount to very much, and then its just a matter of waiting until sooner or later some superintelligence arises that has these goals and then you would get one of these scenarios where the outcome might be very good or bad, it would all depend on what the goals were. Another kind of answer to that question is that it just depends on how you define goals. So if you just have some thinker just sitting there and looking at the world and pondering it you might think that they have some sort of internal goal, of having their thoughts more highly organised, or thinking true thoughts or something like that.

And as for the second question, it's difficult to say.

There are three cases, there is one where somebody deliberately sets out to build a superintelligence, and then there is the other case where it just would arise spontaneously from the Net or something. And then there could be intermediate cases where people set out to build something but then it goes farther than they imagined it would. If some sort of self-improving system is created, they might not really have clearly envisaged what the outcome would be, but nevertheless you could get a superintelligence out of that. Now which of those is most likely is difficult to tell. Some people think that deliberately setting out to do it is likely to get there much sooner. You might do a comparison with other things, like you don't accidentally build a car or an aeroplane.

C: Are there particular technologies which you think the emergence of other forms of intelligence is tethered to?

NB: Better brain-scanning technology. Well, we can create thin slices of the brain, but then scanning those slices more effectively than we can today, in an automated fashion, in a scalable way. I think that's a real enabling technology. Of course computing power, generally, that's another.

C: But isn't that again to assume that any intelligence will be modeled on human intelligence? Or is that the only assumption that can be made?

NB: No, but it's one way we can imagine getting there: we know one intelligent system, the human brain, it's a physical system, with neurons and stuff like that. So in principle if we could figure enough out about this system then we could see how it does it and do the same thing on a computer. Now it might not be the thing that would get us there most quickly, it might be better and easier and more effective to do it based on other approaches that don't really follow the human mind closely. And for those other approaches I think computing power would be one thing that helps. But since right now the theoretical problem of how to program any sort of system like that is very difficult, and I think progress in neuroscience and/or uploading is a potential technology that could help.

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C: The Institute seems to belong to this notable category in the post-industrial world where research programs that seem to be completely unconnected to any pragmatic problems suddenly become crucial. Prime number research, which related to a pure mathematical problem, suddenly became the locus of massive financial investment when cryptography became an crucial commercial factor. The last few years have obviously been boom years for certain Islamologists, who suddenly find themselves in great demand by media and intelligence agencies alike, and so on.

Given that philosophy has such a huge wealth of material that is apparently 'useless', one would have thought that its time was overdue…Are there corporate or other interests outside the university who are interested in your research, who see that this extremely long-view research, with a necessarily philosophical component, has important consequences for them?

NB: My own background is that I'm a philosopher but I also do other things apart from philosophy, so it's sometimes hard to see which of these is in play, especially in the catastrophic risk area: I've done some consulting for some intelligence agencies, some stuff like that. Corporate, I haven't really tried to reach out to that yet, it might happen in the future. But the things that are directly relevant to corporations tend to happen anyway, because they tend to have money and they make them happen. The things that don't get done are things that might be of great concern for humanity as a whole, that our species would do well to invest some effort in thinking about. But any particular corporation, it's not their responsibility or their benefit. Like human extinction risks, which corporations are unlikely to fund! But nevertheless it seems like a good thing. So I'm trying to do those things which should be done but aren't being done.

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C: The mass media plays a huge role in transforming the perception of risk; is there any space in what you're doing to think about the role that that mediated reflection of the risk plays in transforming culture, and the consequence that fear of risk can be just as significant – if not more so – than risk itself? Obviously if you think about the supposed War on Terror and everything that's involved there, these factors are as important as the risk itself.

NB: I agree with that. There is one additional way in which thinking about perceptions of risk might be involved, in addition to the way the perceptions themselves make things change in the world: there is a genuine objective risk, and then there is people's perception of that risk. And if you can study the process between these, the sort of distortions that occur, the fact that there are certain types of risks that people might overestimate because of they are vivid, and are played out in the media; and others they might tend to underestimate because they happen bit by bit on an everyday scale and are more abstract in some way. Now, if you could figure out exactly what those distortions are, for the cases when you can both know the objective risk and people's perception of it, then you might look at another case where the objective risk is unknown but you can still study people's intuitions about it, and maybe you can extrapolate back to get a better estimate of what the real risk is, by a sort of counterbalancing for these known biases. Especially with regard to certain existential risks, I think that's a useful thing to study. And there is quite a lot known about people's risk perceptions, and the biases and heuristics we use to assess probabilities of things. It's also known that our intuitions about those things are wide of the mark, that there are systematic distortions.

C: Aren't humans constitutively non-rational agents? It's impossible for us to right our perception of risk completely, isn't it?.

NB: It's a question of more or less closely approaching. Take weather forecasters, they're pretty good, they're well-calibrated. Calibration is when you say, if you think there is a ninety percent probability of something happening, then ninety percent of the time when you say that, that thing's happened, that's what calibration means. So it doesn't mean that you're right all the time when you guess, but your confidence matches your real knowledge. So weather forecasters are trained on this, you go through lots and lots of examples when you're trained, so they're quite well-calibrated. Pretty much everyone else is ill-calibrated, maybe there are other specific groups that are calibrated, insurance brokers or stock market speculators. So it's possible, given enough feedback and enough incentive, to become a better calibrated risk-assesssor. But that doesn't seem to happen spontaneously or naturally.

C: Bayesian analysis could be applied here, since it includes a measure of confidence in probability calculations.

NB: Certainly. With a lot of the biggest risks, you have to rely a lot on subjective opinion. There's just no way around it, you can't quantify a lot of these disasters that have never happened in the world. The probability that humanity will create a big war with nanotechnology some time later this century: you can't run a frequentist approach and count the number of times this has happened in the past. You don't have a solid scientific model like in quantum mechanics, where you can calculate and get probabilities out, so what do you do? Well, you have to think about it, what would the capabilities be that advanced nanotechnology would make available; how would that play out in a strategic context in the world with competing powers. You think about these things, you discuss with other people, you critique arguments back and forth, but in the end you're probably going to have a situation where different people who are intelligent, who have now read all of this, will assign different probabilities. And I think that's unavoidable.

C: So you do have to work with a synthesis of the facts that you can represent statistically and the knowledge of people's reaction to these statistics.

NB: Yeah, so when we have solid statistical data then obviously we use that. But most of the questions that are of most interest to humanity you can't solve by exclusively relying on that. And that's not just when you think about the big picture of humanity, but when you think about policy, political decision, or indeed your own life decisions: if you decide you're going to marry this person you've been together with, there is no formula or deductive proof that this is the right thing to do, you just have to follow your gut feeling, after having taken into account the obvious objective knowables, then you just have to make an assessment. But that doesn't mean there aren't better and worse ways of doing it. You can certainly be foolish or wise, and different people might do these things differently well. So just because there is a subjective component doesn't mean that there are no constraints.

C: Is it possible for a human being to calibrate themselves in respect of risks on a cosmological scale? If we were truly able to take into account the futility of being a human being on earth, we wouldn't ever do anything – wouldn't that be the truly rational response to these sort of questions?

NB: Futility…well, I suppose it depends on what your measurement scale is. So if you do assign equal value to all life, or all humanlike beings, and you think that a non-futile action is some action that changes the total value, then you run into problems if the universe is infinite. Although there are technical issues there, which my paper *Infinite Ethics* covers.

C: The use of non-standard analysis.

NB: Yes, and it gets very difficult. But suppose you have a different criterion of what's futile or not. So you might think something is worthwhile if it makes you happier, and some people you care about, and people on earth are not harmed, and perhaps helped a little bit, and a few hundred children in Africa are surviving. I mean, these are quite big outcomes from one perspective.

C: But the question still remains of the independence of philosophical thought, and whether in this endeavour there are certain assumptions that have already been made, illegitimately. For instance, if you were to produce a paper which said simply, the rational thing to do is to despair, there's no point in doing anything, that would obviously be bad for the Institute – aren't you automatically disposed to a sort of philosophical optimism?

NB: No, I don't think so. Certainly if someone came up with a good argument that it doesn't matter what we do, or that we're all going to go down the drain, then that would certainly be a paper that would seem very relevant. I mean, I've written some papers which, although they're not quite saying that, could…the *Infinite Ethics* paper doesn't quite say that, but it's going in that direction. *Existential Risks*[4] doesn't say that we're going to be extinct, but it certainly takes that possibility very seriously and argues that the probability is significant. The big picture is difficult. We haven't really thought about it, and one shouldn't be surprised if there are some rather unexpected things once one has started to think about it, that would come out of that.

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[4] At http://www.nickbostrom.com

C: Is it possible that the more interesting, the more demanding ethical questions will arise precisely from the position of despair rather than from the assumption that the human race is a good thing, that it's a good thing to live longer? You're asking a tougher question if you say that the sun will expire, and with it all human life – now, how should one act…it's a more profound ethical question.

NB: Well, I think the sun will expire, and we want to know how we should act now, so I suppose that's the question I'm asking in a sense. Although you want to make it more specific to be able to get something out of it. But I think in general whenever you do some kind of reseach project you have some kind of starting point. Maybe one starting point and then you see where you end up. Now for an Institute you can have more than one starting point, for each paper you write you might have a different starting point, and each person might have a different set of background assumptions.

C: The pessimistic view would be that for evolutionary reasons, there's a fundamental mismatch between human beings' requirements, their psychological requirements, what they would need to have to make them happy, and reality: Freud basically says he's a pessimist because, as a result of our evolutionary, our biological legacy we are doomed to be perpetually dissatisfied. Would that have ramifications for you, given that you say that a superintelligence would be a superoptimiser, would such a superintelligence be able to overcome this mismatch between needs, requirements and the capacity of reality to meet them?

NB: With a superintelligence that could be one scenario, you could have a 'Santa Claus' superintelligence scenario, where you have some wish-granting thing. You might have a similar thing without superintelligence. In a certain sense that's what technology is – it increases the ability of humans to realise their desires. Things sometimes backfire, people sometimes have conflicting desires, and you get war and you get pollution. But there is also something more specific, which is that even if, and to the extent that, that's how humans currently are – we're not designed to be happy, but to maximise inclusive fitness on the African savannah, which is very different – it doesn't imply that that's the way we will, or should, remain forever. Which is the transhumanist perspective, that human nature itself is something that humans can change. And certainly this points towards an area of interesting questions.

C: If humanity is going to actively shape its own future, its own destiny, it would have to presumably make some choices, make some selections about the kinds of desirable characteristics it should have in order to change itself so that it can be happy. This goes back the question of the 'transhumanist values': those values have obviously been selected on a partisan basis, they relate very strongly to a certain political position.

NB: I wouldn't say so much a certain political position, in the sense that there are people with all different politics in transhumanism, from social democrats to libertarians. But it's certainly true that the transhumanist perspective is one distinctive take, a specially-valued take on some of these things, and not everybody does or should agree with that. But in terms of humanity choosing, that's one scenario where you would have humanity as a big entity making co-ordinated decisions. One might question the desirability of that, but even more perhaps the probability of that, in the sense that right now there are lots of groups of humanity that are making their own decisions.

C: The conception of humanity acting as *an* agent.

NB: Yes, it's very problematic, I agree with that. If you think like that, you will miss out certain, maybe quite likely, possibilities: there are these effects that arise when you have competition between groups; we might do something that we all know collectively might lead to disaster, just because it's difficult to co-ordinate. Arms races are a good example of this, they're good for nobody but they're hard to avoid. So you might get a different set of possibilities if you had a world government or some kind of very powerful UN in the future that could make co-ordinated choices than if you have a situation where you have multiple nodes of power that act independently.

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C: Some of the scenarios you're talking about are the stuff of science fiction movies. To what extent are you yourself engaged in a sort of science fiction? Is it a matter of our having to tell ourselves these stories which extrapolate from the state of technology in our society, the things we know we can do, in order to come to terms with the massive risks that are the necessary corollary of every new technology?

NB: I don't know, I'm not a great science fiction reader, or watcher, I'm afraid. Clearly a lot of people find inspiration in science fiction. I think it's both good and bad. It's good in that it might make people aware of possibilities or of future worlds that they hadn't thought about, and it can serve to stimulate people's imagination. On the other hand I think it might distort people's intuitions, because there is a constraint that all science fiction you read or watch has to satisfy – it has to tell an interesting story, so you often have heroes rescuing the world, you have dynamic struggles with human-like characters playing a key part, and determining the outcome. But that's not necessarily the most likely way for things to happen. If you're going to constantly read these, it probably shapes your expectations. If it's all filtered through what I call the 'good story bias', then that can actually warp your thinking.

C: Writers like Greg Egan have dealt with biotechnology, AI, and so on, in a way which certainly doesn't conform to that stereotype.

NB: Yes, I think he's certainly one of the exceptions, I should read more of his work.

C: Science fiction does indeed stimulate people to think about the world and about situations they hadn't thought about; are you not providing a similar service to people who possibly don't read science fiction, providing the same necessary service of widening the scope of people's everyday thinking?

NB: Maybe, I don't see that as the main thing that I'm aiming for, but maybe that's a good effect. Widening people's thinking, to me, has the feeling of a cliché.

I don't know if there is a systematic bias towards narrowness in people's thinking. There might be in specific cases. But maybe some people's thinking ought to be more focused rather than widened.

On the Mathematics of Intensity: A Logic of Self-Belonging

Thomas Duzer

"One must be a rigorous logician or grammarian, but at the same time full of fantasy and music" (Hesse)

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"I am speaking, obviously, of philosophy and philosophers, of those who force themselves to see, to know, to prove as many things as possible in the course of their existence" (Chestov)

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"Intense codings are connected and sometimes severe mathematics are required since, in effect, the price of victory over the shadow cast by a slumbering but perpetual captain–against the depredations of this hippocampus, then–reveals itself to be eternity and the absence of chains. Nevertheless, for the benefit, and for good reason, of those unhappy souls who remain trepidatious before it, let us recall that where self-belonging–which is substantial freedom– is concerned, where the universe is concerned, no-one is bound." (Anaximandrake)

'To be in being,' is to *be* being according to the mode corresponding to one's proper singular essence. The term 'being' is used out of convenience, for its neutrality, thus indicating no prejudice as to possible different names of being. We will see that the baptism of being is the

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supreme activity of ontology, which for that reason cannot be ‘first philosophy’, despite the position of Aristotle and of the scholasticism that followed him. This position however differs from that of Levinas.

Necessity is the only modality of being; thus freedom is the effectuation of its own necessity. As Spinoza says, ‘freedom is not opposed to necessity but to constraint.’ This effectuation corresponds to what is commonly known as grace, or the state of grace. Each instant is the good since it can only be justified by itself. This process is in fact creation of being – that is to say, becoming. It is a question of the expression of the Mystical, of that mental zone (*qua* primary determination) that is not linguistic, but purely intensive. This expression or logic of the Mystical is called the *mathematics of intensity*. The unconscious is in fact a true physical topography (specific to each singularity) each of whose dimensions corresponds to a zone of intensity. It has *a thousand plateaus*.

The integral production of the mathematics of intensities has a preliminary requirement: the conquest of the unconscious by any means available. In fact the unconscious is first of all in chains, in a state of servitude. It is under the empire and the influence of diverse instances of the *Socius* as the power which, through the mediation of the law, separates the individual from what he can do, that is to say from his power, hence from his singular essence. These instances are grouped under the unifying aegis of the Superego which systematizes them in the form of the Ego. It is a question of the imposition of a coding filter on the singular profile of the unconscious, a filter which only allows certain passages between certain points of its territory. The rest remains in the shadows, and so we are etymologically correct to name it the unconscious. The unconscious is spoken, the unconscious speaks. *Ça parle* (*It/id speaks*). Every attack against a bastion of the coding filter manifests itself through a specific emotional phenomena: anguish. It is, moreover, by way of this sign that we can recognize that it is indeed active. Each bastion that is conquered is a step towards the annihilation of the filter. Obsession is an intermediary phenomenon; the bastion is not annihilated but besieged.

Such a parasitized, colonized unconscious (one which thus regards itself as a theatre) presents two centres of gravity. One is virtual; it is the centre of gravity corresponding to the essence of the singularity. It is virtualized by the second centre of gravity imposed in a continuous fashion by that structural effect of transcendence which is the *Socius*. This centre is called Superego if it is not identified through consciousness. In this case, the unconscious is master, the master is unconscious. Otherwise, it is known as the internal tyrant or monster (composite being) as soon as it is detected. This detection correlatively compels the localization of the singularity's own centre of gravity and the quasi-complete distinction between the Self and the non-Self. The Lacanian concept of the Other is thus dethroned in favour of a concept of negation which is internal to mathematical logic (and not to a Hegelian dialectics). This is a corollary of the destitution of the Ego in favour of the Self. At this stage, the former remains no less virtual. Its actualisation passes by way of the precise localisation of the internal tyrant or monster and the destruction of its citadel (which is not the strongest but the most strategically well-situated) permitting the metamorphosis of the Ego into the individual. The centre of gravity of the individual is the *e*go which is the informational point of compression of preceding configurations of the unconscious; it is therefore in perpetual becoming and in incessant movement in the unconscious. The ego, the unconscious and their diverse configurations form the Self.

It is a question of carefully distinguishing the *e*go, the Ego and the Self. Let us note that the speed of thought is all the faster in so far as there is no Ego, that is to say no Other, but the operator ego which generates the instantaneous synthesis of apperception and produces reflexivity as a result. Meanwhile, it is necessary that it produce a sufficient unconscious to have a memory available, that is to say in a form that is compressed and not deployed, as of a 'picture'. The ego as the engine brake. Yes, *good* narcissism, *qua* success of the mirror stage, that is to say, non-psychoanalytically, refusal of identification and thus comprehension of the reality of the illusionism of the image, is the constitution of an evolutionary story whose global coherence is suspended at the instant, open to the hard purity of the real event. The ego therefore, as necessary and variable fiction: matter and chronology and egoic form, which are separable instances, each capable of subsisting for itself. But the Self cannot be reduced to it. *Bad* narcissism proves therefore to be a belief of a transitive type: the cult of the fiction, of the *fixing*, of the Ego. Thus, the narcissistic phases must surpass the Ego, that is to say in passing by way of the intellect which is thought in act, that is to say, thought without images. In fact, the Self is not constituted on the basis of a Lacanian Other, that is, by an avatar of the dead God, but by the symbolic exchange with another rational being. It is only by way of the symbolic that experiences can be connected and integrated with each other, even whilst they remain perfectly heterogeneous in reality. Yes, first and foremost, the Self is real coherence thanks to the symbolic – contrary to the Ego which is an attempt at the imaginary conjuration of the circulating "empty case" which drives the signifiers.

Primary narcissism – that of the Ego – is mysticism of the All, that which it is not abusive to designate as the desire for fusion with the mother. The Other here is but the imaginary disguise of the Same, that is to say, the obsessive negation of every other real in an auto-parturition with no issue. The Ego is thus only a local illusion, a reflection of the absolute in a lateral pool. The Thing: stasis and abolition. It is, moreover, this rejection of the symbolic which posits the psychotic as such. *Lapsus mentis* : psychosis conflates objective genitive and subjective genitive. On the contrary, and far from the totalitarian affirmation of the Ego, the auto-referentiality conquered thanks to the symbolic instance proves to be a remedy against infinite regression. Because the only movement in which one understands *all* is that of death. The movement of nous, that which produces the opening, which constitutes the Open, when it ceases, gives way to a bounded, deployed, unfolded totality. It is indeed the mystery of All which must be clarified – in other words, that which makes a totality a totality. And it is in psychogenesis that it is appropriate to seek the solution: first alterity encountered, neoteny of the human animal. This is moreover why the language of the human being *qua* social, since language-using, logically produces the Ego. Let us note in this regard that the substantial Ego is nothing but the perturbation of the Self's relation to Self (that is to say of reflexivity), and this evidently for the purposes of subjugation. It is therefore not so much that the All is an unattainable mirage, an illusion specific to the suspension of senses. The problem is rather that the All is in fact homogeneous with a repose modeled on death, a death which is the truth of all transcendence. However, madness will never be mad enough to render the ontic and the ontological indistinct. Transcendence *versus* chaos? No. Let us be clear: the wisdom adequate to chaos, that is to say to a truly inhuman madness, is discernment.

We should in fact realize that the point of being proves to be junction of the real, the imaginary and the symbolic. No precedence of any one of these dimensions over any other. Otherwise, transcendence *qua* asymmetric cut arrives as a hallucination provoking real effects. This caesura, heterogeneous to the symbolic, is the arrival of the void as such, that is to say, of non-being as phantasm. Because it is indeed castration which is the origin of the imaginary's real takeover of power. In effect, the sovereign image is the negation of the *puncta coacta* which constitute it, and thus the affirmation, by denial, of the All. Denial of castration? In fact, it is the delirium of the All itself which testifies to castration. The real of castration is delirium, not as process but as legitimation of the takeover of power of one of the dimensions of being. Yes, the symbolic caesura differs from castration because it is the condition of connection and disconnection, that is, of the formation of alls. In fact, there is no all which is not fragmentary, and thus relative. An all is not all unless there exist possible components which it does not totalise. Yes, the pure multiple is untotalisable. Were this not so, the absolute, formalised, would annul itself infinitely. This is in fact the mistake of all religion: faith as strict inverse of doubt, correlate of the exclusion of their subsumption.

In short: the All is the index of transcendence, that is of coalescence between the real and the imaginary, thus of the refusal of the symbolic, that is to say of the other, and thus, as we will see, of the Self. Differences, feared, are aligned under the category of opposition. It is remarkable that it is the rejection of the other that gives birth to the Other, that is to say to the very possibility of alienation. One sees then that it is a sophistic tropism that makes possible voluntary servitude, then denied, hence perfectly interiorised. But no, all is not in language, and the "All" is only in language. Yes, since it reflects nothing, being appears as chaotic, void, or eternal multiplicity disseminating itself sempiternally. Thus, presence *qua* eternal is the assumption of time as event of pure difference, this paradoxical substance. But to attain the All – the end of time – in excluding the other, that is to say the Self, amounts to joining with the Other – that is to say, with nothing.

But, let us be specific. We have said, necessity is that of the singular essence, that is to say real essence. There is no global necessity unless there is a One-All, therefore an outside of the universe, that is to say if 1=2. This initial paradox tries to conjure up freedom, the unpredictability of the living, and notably as to the issue of the struggle until death. For a judgment, second illusion, which is triplopia, it would have to be that 1=3. In this case, the delirium goes even further. Desire in an impasse, construction of sin *ad hoc,* the big Other. *Ne uter*. In achieving the paternity of the One, one would lose in it the immanent distinction in the indiscernible, this mixture escaping the dialectic of the void and the plenum. This is to say that one would lose the act of the intellect, the movement of *nous*. One would thereby lose singular individuation in favour of a regular cloning. And we can be sure that this would indeed be a shame, so long, of course, as one allows this anti-wager, which is an authentic risk, hence one which no law probabilises in advance.

Thus one and one only entity or instance, the Self, is "conscious" of "its" contents via the intermediary of *reflection* between individuals. The obstacle, which is considerable, is that one finds some who take themselves for Egos. But the Ego is a false unity, a false coherence which, in order to subsist qua illusion, must mortgage the future in the form of a quasi-cancerous growth, by destroying – that is, consuming – possibles. It is in fact its internal contradiction which forces it to submit in order to be able to project its contradiction, and make of the other the imaginary suffering appendix of its fictive Ego. But to make an Ego, you need at least two bodies. Even the dialectic of master and slave, that servile caricature, requires two human beings, for it deals with desires and consciousnesses. Not that of the Ego. In fact, it is a question there only of a relation between an object and its possessor. This is patently obvious, for example, in fetishism. Recall Federer's thesis, reprised by Bergler (the typical neurotic): the slave dedicates himself to the master in order to escape the panic to which his freedom exposes him. But by the same token, this master is only his instrument. *Ellipse.*

Consequently – and this is no solipsism – there is a Self, diversely modified into spirits and bodies which are images, that is to say, figures of the agency of the imaginary. The Self *qua* intensive is nevertheless traversed by the symbolic dimension of language, that is to say, perceived as an Other which affects the Ego. Nevertheless the Self is one and "unreflectable". One cannot "see" it, since it is not an Ego, an image, but, on the contrary, that place from which one sees. Here we are far from the form of the Ego. The Self is that "planomenon" (Deleuze), that paradoxical substance where the polyphony of intensities circulates in pure immanence; intensive grammar itself in perpetual differance since it is connection, syntax of differences. "To be in being": here one is indeed involved in a logic of self-belonging.

But to believe in the Ego or in the Unique (Stirner) is much more than not to believe in anything, it is to believe in nothing. And as Weininger says: "cowardice is a way of taking nothingness to be something". For their part, in fact, the nihilists preach, whether silently or not, and along with others, the following: do not expect anything. But this is to expect nothing. In fact, the nihilist always expects something but it is nothing that he desires. Even alerted by Blanchot that the apocalypse disappoints, he waits, and that is *all*. He does not want himself living, for that would be to risk, enjoyment certainly, but above all suffering: he wants himself dead. Now, this nothing would not be lack unless there was the possibility of something in its place. Certainly, certain halfwits, subtle rhetoricians that they are, will not hesitate to object that lack is precisely something. Which is true, indubitably so. Isn't it in this way that we can understand the demon of the malicious Descartes' *Cogito*? But let us reassert that "nothingness has no properties"; and refuse every "effect", every mystification, as base. For you will only find the plenum there where it is not lacking, which is to say, there where it is. It could only be lacking where it is not if it were there. Which is to say that it is logically contradictory for it to be lacking. In effect, it is not lacking in its place because the place does not belong to it. Certainly, there is void where one looks for the plenum. But the question is: in whose interest is it to put your desire, which lacks nothing, in an impasse? Who could want to set up contradiction at the very fundament of ontology? Those who satisfy their desire through your impotence, those who rule by and on the basis of anguish. Because, and this is the only axiom of their "science", they know full well that anguish is the link to lack. Here, the secret of tyrannies reveals itself, all the more blinding for it. Being is no longer the knot of the real, symbolic, and imaginary, but that which is put in quotation marks becomes *lèse-majesté*, and being is nothing more than that which passes via the mouth. Because, just as the Stoics knew – and this is only a paradox for the excarnated of all descriptions – it is the incorporeal which renders possible the real mixture of bodies. It is the very condition of possibility for the event. Yes, despite the egoic myriads, the symbolic is transcendental.

It is therefore clear that to recognise the instance of the Other is, paradoxically, to misrecognise that of the symbolic. To posit the Other is to render castration unsurpassable, transcendent. But the instance of the Other is only a projection of the imaginary upon the symbolic. This is indeed what leads us to claim that the Ego only arises from the SuperEgo (*qua* effect of a certain type of *Socius*). Certainly, "something", in the symbolic, must structure the Id; but the SuperEgo petrifies it, *i.e.*, produces the Ego. Another organisation of the Socius is therefore necessary to resolve this problem. In fact, castration, linked to the imaginary belief in the Other (the uncastratable), induces the separation between the zones of highest intensity.

Nihilism is therefore, as Nietzsche emphasised, the touchstone. Its partisan is on the near side of the intuition of the distinction between joy and sadness, between augmentation and diminution of desiring-power. "What sense? What sense?" chants this ridiculous parishioner, a sort of plebeian relativist Heraclitus, for whom ascent and descent are equivalent. So, that place "where we feel the whole nervous system burning like an incandescent lamp" (Artaud) is for the nihilist a place unknown, or perhaps forgotten – but, at least, lost. It is true, as Gabriel Marcel says, that this type of philosophy, which, fundamentally, opposes to being an end not to receive, is coherent, rational, "philosophical" in sum. Likewise, Sartre concedes that the spirit can deny itself and even possesses an infinite power of doing so. And already, the cavalier Descartes, that Pascal from before the Fall, finds the reason for that strange mania in the disproportion between finite understanding and infinite will. Point noted.

Thus, whether it is a case of the All, of God or of the Ego, every philosophy of the transcendent One is indeed in this sense a nihilistic and ancillary philosophy. Yes, in order to be able to reciprocate (whether explicitly or not) being to the One, it cannot but differentiate them, but as derived. But let us posit a precondition: Spinoza, according to the *vulgate*, is a philosopher of the One-All. We will nevertheless retort that his system leans towards Epicurism and Atomism. Because it is indeed rather Neo-Platonism which is the philosophy of the One-All; it is the doctrine of emanation which properly characterises the latter. Good and Evil are its autophagous principles: the absolute devours itself in it. Psychosis and transcendence. In complete contrast, Spinozism is pure immanence. The good and the bad are only ever said relatively here, but are nevertheless absolutely distinct. Here is the difference: joy has no need of sadness. Joy as augmentation of power is sufficient unto itself, whilst sadness is servile, bound to lack, that is to say, to anguish. Thus, it is with absolute sovereignty that Spinoza withdraws God from the grip of the theologians and their creed, and makes of it the pure multiple which is only multiple of itself. His work, and in particular the polemical *scolia* of the *Ethics*, demonstrates this clearly.

Not cannibalistic bipolarity, but one axis only: aristocratic joy as augmentation of force. Chronos emasculated. What is power [*pouvoir*], then? It is merely the lowest degree of force [*puissance*]; it is force's separation from itself, self-separation and projection of this separation. Thus: the One is pure alienation. Hence it is the instance which allows the others to link themselves into a whole. Thus there are ones. Which can also be said: there is only one and the other if One occupies the function of the Other, that is to say the One *qua* alienated. Now, this function of the Other, if it is a question of joy, becomes that of negation. No dialectic. Negation of negation does not yield identity. It is identity which denies itself in denying. Being is not becoming, it is becoming which creates being. What of their conflation? It is the Ego. The non-Self is the site of transcendence alienated in perpetual negation but, therefore, and consequently, of itself, that is to say of its Self which is illusion and its sole substance. For the One is indeed a pure generic difference, but the latter is without relation, and consequently, without Self. Self-sufficient image. But the image, irremediably, is punctured. It is thus the epiphany of the perverse process in the pure state: the image identified with being, the terrible synecdoche. Non-separation, devourment, death fantasmatically denied, swallowed. Immortality is promised to the perverse only in exchange for their absolute alienation. But who makes it necessary? For in fact joy is entirely other, eternity, *hic et nunc*, that is to say the pure Self which arises from the relation of pure differences. Yes, the Self is the indiscernability of the one and the multiple.

Thus the mathematics of intensities is firstly a geography, a cartographical relief map of the unconscious. But secondly, it proves to be a pure pragmatics. In fact, thanks to nous, to the intellect, an automatic computation is effectuated which mobilises, in the Self, the full gamut of intensities, and extracts those which are adequate to the solicitations of the non-Self, whether it is a matter of connections or disconnections, that is to say of compositions or of decompositions of relations, of links. Thus the domain of "us" can arise. From now on, the unconscious is productive, that is, capable of continuous creation. At this stage, it is possible, by way of a *linguisterie*, to replace the term 'unconscious' by the term 'in-conscious'. In fact, the liberated unconscious is not conscious in the sense of being re-presented reflexively in consciousness but in the sense of being intensively presented in *it*. Then, and only then, is it a question, for the philosophies of the multiple and of the concept, of effectuating logical conjunctions (connections and disconnections), that is to say, within the immanence thereby conquered, of creating significant liaisons in systems of relations which are external to their terms. This is how the mathematics of intensities, which is the logic of self-belonging, and hence etho-onto-logic, can become a real pragmatics, that is to say, a constructivist philosophy between free individuals.

Various tactical and strategic mappings, scattered and principally offensive, disseminated in universal literature, await an Esperanto. The science of these lacings and interlacings has yet to be elaborated. This mathematics of intensities is the real ethics of the event, the practical science of manners of being, that is to say, an empiricism at once superior (Schelling) and radical (William James), and therefore transcendental (Deleuze). It is the knowledge of desire since "desire is the very essence of man" (Spinoza). If we connect this theorem with another Spinozist theorem, namely "essence is force", we immediately deduce that the force of man is desire. Being being produced by becoming, ontology, the science of being *qua* being, is logically secondary. In this way, etho-onto-logic becomes capable of supplanting the ancient onto-theo-logy, since the coherence (of Logos in act, the actualisation of Logos), which differs from the non-contradiction of classical logic, is no longer that of the Ego or of God but that of the force of desire. Heraclitus, the Stoics, Montaigne, Spinoza, Hume, Nietzsche, William James and Deleuze (and perhaps even Wittgenstein) were already closer to etho-onto-logy. But they conceptualised an onto-etho-logy without naming it as such. To name it thus proves that each of them actually taught the inverted double of that which they did, that is to say, an etho-onto-logic in act. They were individuals but designated individuality without conceptualising it. This is why Spinoza's *Ethics* is written invertedly (incessant shuttling, halls of mirrors, figures of light): substance turns around the modes and not the other way around. So it is that the name of being is that which, *logically*, gives it becoming in immanence. *Igitur.*

Translated by Robin Mackay and Ray Brassier.

Crowds

Keith Tilford

p262-3.
Untitled, 2005.Ink on Paper, 121.92cm x 177.8 cm

p264,265.
Details from the above

p266-7.
Untitled, 2005. Ink on Paper, 120.65cm x 163.83cm

p268,269.
Details from the above

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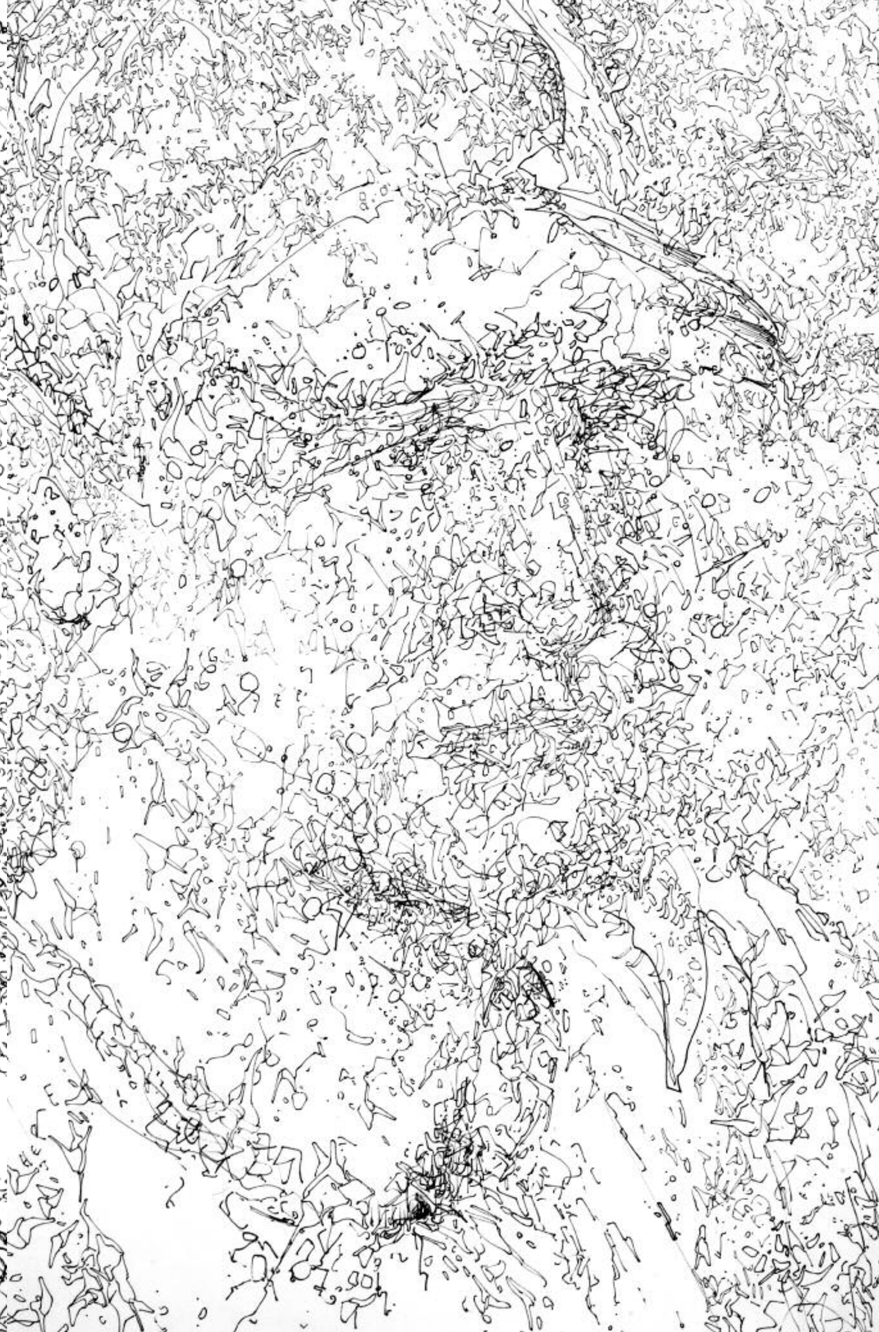

Qabbala 101

Nick Land

INTRODUCTION

Is qabbalism problematical or mysterious? It seems to participate amphibiously in both domains, proceeding according to rigorously constructible procedures – as attested by the affinity with technicization – yet intrinsically related to an Outsideness through which alone it could derive programmatic sense.

If there is no source of at least partially coherent signal that is radically alien to the entire economy of conventional human interchange, then qabbalism is nothing but a frivolous entertainment or a fundamentally futile practical error. Yet unlike any kind of metaphysical assault on 'the noumenal', qabbalism cannot be definitively critiqued on a purely rational or formal basis, as if its mode

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of 'error' was that of logical fallacy. Since qabbalism is a practical programme, rather than a doctrine of any kind, its formal errors – mistakes – are mere calculative irregularities, and correcting these is actually a procedural requirement of (rather than an objection to) its continued development.

It is the rational dismissal of 'the' qabbalistic enterprise that is forced to take a metaphysical stance: ruling out on grounds of supposed principle what is in fact no more than a guiding 'empirical' hypothesis (that signal from 'outside the system' is detectable by numerical analysis of codes circulating within the system).

Epistemologically speaking, qabbalistic programmes have a status strictly equivalent to that of experimental particle physics, or other natural-scientific research programmes, even if their guiding hypotheses might seem decidedly less plausible than those dominant within mainstream scientific institutions.

Lovecraft understood the epistemological affinity between natural science and programmatic (as opposed to doctrinal) occultism, since both venture into regions once declared mysterious, following procedures of a rigorously calculative-problematical type. It is the alliance between purely speculative metaphysics and common sense that betrays such affairs of pure reason to futility, since they lack the calculative traction to revise their own conventional notions on the basis of their encounters. Practices – however implausible their guiding motivations – can know nothing of absolute mystery or metaphysical transcendence because their realm of certainty is procedural-problematic and uncontroversial, whereas their reserve of knowledge is empirical, refutable, repeatable, revisable, nonmystical and accumulable.

There may be no 'empirical', procedurally approachable mysteries – or mysterious problems – of the kind qabbalism guides itself towards. If so, it will approach this fact in its own way – empirically, probabilistically, impressionistically, without any logical, transcendental or philosophical meta-discourse ever having been positioned to put it in its place.

I. POPULAR NUMERICS

Traditional gematria (whether Hebrew, Greek, Farsi or Arabic[1]) have distinctive typical features: (1) They substitute letters for numerical values, overcoding numerals where they exist. (2) They code for discontinuous numerical values, typically 1-10, then 20, 30 ... chunked in decimally significant magnitudes.

The ocean in which qabbalism swims is not mathematics, but popular numerical culture. From a mathematical perspective it remains undeveloped, even ineducable, since it cannot advance beyond the Natural number line even to the level of the Rationals, let alone to the 'higher' numbers or set-theoretical post-numerical spaces. Where counting ceases, qabbalism becomes impracticable.

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[1] See Incognitum, 'Introduction to ABJAD', in the present volume.

Socially, qabbala makes an implicit decision against specialization, in order to remain virtually coincidental with the entire economy of digitizable signs. It is essentially 'democratic' (in the most inclusive sense of this word), even when apparently lost in its own trappings of hermeticism. It is bound to the 'blind' undirected contingencies of pre-reflective mass-social phenomena, with all the inarticulate provocation this entails in respect to professional intellectuals. Wherever exact semiotic exchange occurs, a latent qabbalism lurks (even within the enclaves of intellectual professionalism themselves). Deleuze & Guattari's 'Nomad War Machine', within which number is socially subjectivized, captures crucial aspects of this qabbalistic fatality.

Historically, qabbala arises through epic accident, as a side-product of the transition between distinct modes of decimal notation. Its historical presupposition is the shift from alphabetical numerals (of the Hebrew or Greek type) to modular notation, with its resulting unlocalizable (and theoretically indeterminable) confusion. This transition provided the opportunity for a systematic calculative 'error' – the mistaken application of elementary techniques appropriate to alphabetical numerals – simple addition of notated values – to the new modular signs. This mistake automatically resulted in digital reduction, by accident, and thus as a (theoretically scandalous) gift of fate. Arising historically during the European Renaissance - when zero, place value and technocapitalism finally breached the ramparts of Western monotheism – qabbalism (born in a semiotic glitch and thus lacking the authority of tradition or even purpose) was compelled to hyperstitionally generate an extreme antiquity for itself, in a process that is still ongoing.

Technically, qabbala is inextricable from digital processing. Emerging from calculative practicality within the context of blind mass-cultural metamorphosis, it antedates it own theoretical legitimation, making sense of itself only derivatively, sporadically and contentiously. Its situation is analogous – and perhaps more than analogous – to that of a spontaneous artificial intelligence, achieving partial lucidity only as a consequence of tidal pragmatic trends that ensure an integral default of self-mastery. Practical systematization of technique precedes any conceivable theoretical motivation. Dialectical interrogation of qabbalism at the level of explicit motivation thus proves superficial and inconsequential, essentially misrecognizing the nature of the beast. (It is equally misleading to ask: What is a computer really for?)

Politically, qabbalism repels ideology. As a self-regenerating mass-cultural glitch, it mimics the senseless exuberance of virus, profoundly indifferent to all partisan considerations. Indifferent even to the corroded solemnity of nihilism, it sustains no deliberated agendas. It stubbornly adheres to a single absurd criterion, its intrinsic 'condition of existence' – continual unconscious promotion of numerical decimalism. Qabbala destines each and every ‘strategic appropriation’ to self-parody and derision, beginning with the agenda of theocratic restoration that attended its (ludicrously robed) baptismal rites. Even God was unable to make sense of it. It has no party, only popularity.

II. PRIMITIVE NUMERIZATION

Among the primary test-beds for qabbalistic analysis are the numerolexic systems inherited from cultures overcoded by the modern Oecumenic alphabet. These include the Hebrew and Greek alphabets (with their Neoroman letter names and mathematico-notational functions) and the Roman numbers (inherited as Neoroman letters and still numerically active in various domains). In this respect, the absence of names for Neoroman letters are an index of their pseudo-transcendence – as ‘unnameable’ – within the present Oecumenic order.

A discontinuity is marked in the alphanumeric series (0–Z) by the fact that the numerals composing the first ten figures in this series do have names, grouping them with the letters of previous alphabetical numbering systems from a certain qabbalistic perspective. This might be taken as the residual indication of an ‘alien quality’ still characterizing the numerals in relation to the Oecumenic cultural order they now indisputably occupy, a legacy of the cultural trauma attending their introduction.

The qabbalistic provocation posed by the English number names is conceptually comparable to that of any other numerolexic system, while surpassing any other in the intimacy of its challenge. If the numerals have names, shouldn't the qabbalistic processing of them as words yield – at the least – compelling suggestions of nonrandom signal? If the standard numeral names emit nothing but noise when qabbalistically transcoded, the attempt to establish relatively persuasive criteria for the evaluation of qabbalistic results suffers an obvious and immense reverse.

What, then, would count as a minimally controversial first step in such an examination?

Surely the most basic of all qabbalistic (or subqabbalistic?) procedures is simple letter counting – Primitive Numerization (PN). As a reversion to sheer 'tallying' PN has a resonance with the most archaic traces of numerical practice, such as simple strokes carved into mammoth bones and suchlike palaeo-ethnographic materials. If anyone was to bother systematizing PN procedure for the purpose of mechanization or simply for conceptual larity, it would be most efficiently done by transcoding ('ciphering') each letter or notational element as '1' and then processing the result numerically.

PN's extremely tenuous relation to issues of modulus-notation ensures that it can only ever be a highly dubious tool when intricate qabbalistic calculation is required. Yet this utter crudity also makes it invaluable as a test case, since it minimizes axiomatic arbitrariness and precludes any plausible possibility of symbolic conjuration ('sleight of hand') while fully sharing the qabbalistic 'deficiency' of sufficient anthroposocial or communicative motivation. Common reason – sanity – insists upon noise as the only PN output consistent with the general intelligibility of signs (a pre-judgement applying rigorously to all qabbalistic procedures).

No message should inhere in the length of a word, excepting only the broad pragmatic trend to the shortening of commonly used terms. It is immediately obvious why this exception has no pertinence to the case in question here, unless stretched to a point (for instance, expecting the smaller numerals to exhibit the greatest lexical attrition) where it is straightforwardly contradicted by the actuality of the phenomenon.

So, proceeding to the 'analysis' – PN of the English numeral names: ZERO=4, ONE=3, TWO=3, THREE=5, FOUR=4, FIVE=4, SIX=3, SEVEN=5, EIGHT=5, NINE=4. Is there a pattern here? Several levels of apparent noise, noise, and pseudo-pattern can be expected to entangle themselves in this result, depending on the subsequent analytical procedures employed.

To restrict this discussion to the most evident secondary result, not only is there a demonstrable pattern, but this pattern complies with the single defining feature of the Numogram[2] – the five Syzygies emerging from 9-sum twinning of the decimal numerals[3]: 5:4, 6:3, 7:2, 8:1, 9:0.

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[2] . On the Numogram, see *Abstract Culture 5:Hyperstition* (1999).

In the shape most likely to impress common reason (entirely independent of numogrammatic commitments) this demonstration takes the form: ZERO + NINE = ONE + EIGHT = TWO + SEVEN = THREE + SIX = FOUR + FIVE – revealing perfect numerolexic-arithmetical, PN-'qabbalistic' consistency.

The approximate probability of this pattern emerging 'by chance' is 1/243, if it is assumed that each decimal digit (0-9) is equiprobably allotted an English name of three, four, or five letter length, with 8-sum zygosys as the principle of synthesis. 7-sum or 9-sum zygosys are inconsistent with any five or three letter number-names respectively, and thus complicate probabilistic analysis beyond the scope of this demonstration (although if everything is conceded to the most elaborate conceivable objections of common reason, the probability of this phenomenon representing an accident of noise remains comfortably below 1/100).

Partisans of common reason can take some comfort from the octozygonic disturbance of the (novazygonic) Numogrammatic reference. How did nine become eight (or vice versa)? Lemurophiliac numogrammaticists are likely to counter such queries with elementary qabbala (since digital cumulation and reduction bridges the

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[3] . PN confirmation of the Numogrammatic Novazygons (9-Twins).
ONE + EIGHT = NINE + ZERO. (PN 3 + 5 = (4 + 4 =) 8)
TWO + SEVEN = NINE + ZERO. (PN 3 + 5 = (4 + 4 =) 8)
THREE + SIX = NINE + ZERO. (PN 5 + 3 = (4 + 4 =) 8)
FOUR + FIVE = NINE + ZERO. (PN 4 + 4 = (4 + 4 =) 8)

'lesser abyss' in two steps, 8 = 36 = 9, as diagrammed by the 8th Gate connecting Zn-8 to Zn-9).

III. AGAINST NUMEROLOGY

Consider first an extraordinarily direct numerological manifesto:

> When the qualitative aspects are included in our conception of numbers, they become more than simple quantities 1, 2, 3, 4; they acquire an archetypal character as Unity, Opposition, Conjunction, Completion. They are then analogous to more familiar [Jungian] archetypes...

It is hard to imagine a more 'archetypal' expression of numerological ambition than this. Yet rather than meeting this claim with docile compliance, the qabbalist is compelled to raise a number of awkward questions:

(1) How can a numerological coding that proceeds in this fashion avoid entrapping itself among the very smallest of Naturals at the toe-damping edge of the number line? If '4' symbolizes the archetype 'Completion,' what to make of 127, 709, 1023, or similar small Naturals? Do they also have analogues among the intelligible archetypes? How would one 'qualitize' ($2^{127)}$-1, or a larger number (of which there are a very considerable number)?

(2) Is an 'archetype' more basic than a number in its unsymbolized state? Does 'qualitizing' a number reveal a more elementary truth, a germ the number itself

conceals, or does it merely re-package the number for convenient anthropomorphic consumption, gift-wrapping the intolerable inhumanity of alogical numerical difference and connectivity?

(3) Why should a number be considered 'quantitative' in its Natural state? Is it not that the imposition of a quantity/quality categorization upon the number requires a logical or philosophical overcoding, a projection of intelligibility alien to the number itself? Quantity is the decadence of number (while quality is its perversion), so – since arithmetic provides no basis for a reduction of the numerical to the quantitative – what is the supposed source of this (numeric-quantitative) identification (other than a disabling preliminary innumeracy)?

(4) If '1' numerologically evokes 'Unity,' why should UNITY not qabbalistically 'evoke' 134 (=8, its Numogrammatic twin[4]) with equal pertinence? Can any expressible 'archetype' avoid re-dissolution into the unfamiliarity of raw number pattern? Numerology might assimilate '2' to opposition, but OPPOSITION = 238 = 13 = 4 (twice 2, and the Numogrammatic twin of ('4' = COMPLETION = 212 =) 5), while even if numerological '3' as CONJUNCTION = 237 = 12 = 3 finds itself qabbalisitically confirmed (at the extremity of its decimaliza-

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[4] . Employing August Barrow's 'Anglossic Qabbala', the basic tool of which is the Alphanumeric Gematria. This numerization of the Neo-Roman alphabet , continuing the procedure now familiar from Hexadecimal, is a continuous nonredundant system, supplementing the numerals 0-9 with numerized letters from A (=10) to Z (=35), treating the 0-Z alphanumeric sequence as a numeral succession, corresponding to the numerals of a modulus 36 notation.
Thus UNITY = 30+23+18+29+34 = 134. 1+3+4 = 8.

tion), this is not, perhaps, in an altogether comfortable mode.

Numerology may be fascinated by numbers, but its basic orientation is profoundly antinumerical. It seeks essentially to redeem number, through symbolic absolution into a 'higher' significance. As if the concept of 'opposition' represented an elevation above the ('mere') number two, rather than a restriction, subjectivization, logicization and generalized perversion, directed to anthropomorphic use-value and psychological satisfaction. Archetypes are sad limitations of the species, while numbers are an eternal hypercosmic delight.

Nevertheless, qabbalism is right up against numerology, insofar as it arises 'here,' within a specific biological and logocratic environment. The errors of numerology are only the common failures of logic and philosophy, human vanities, crudified in the interest of mass dissemination, but essentially uncorrupted. The numeric-critique (or transcendental arithmetic) of a Gödel (or Turing, or Chaitin (or Badiou?(??(???)))) can be rigorously transferred to this controversy, demonstrating – within each particular milieu – that overcodings of numerical relation by intelligible forms – 'archetypes' or 'logics' – are unsustainable reductions, reefed on the unsurpassable semiotic potency of number. Gödel has shown that there is always a number, in fact an infinitude of (natural) numbers, that simulate, parody, logically dialectize, paradoxically dismantle, archetypally hypervert, and in whatever way necessary subvert each and every overcoding of arithmetic. Number cannot be superseded. There is no possibility of an authoritative 'philosophy of arithmetic' or numerological gnosis.

Qabbala assumes that semiotics is 'always already' cryptography, that the cryptographic sphere is undelimitable. It proceeds on the assumption that there cannot be an original (unproblematic) coding, providing the basis for any solid definition or archetypal symbol, since the terms required for such a coding are incapable of attaining the pure 'arbitrariness' that would ensure the absence of prior cryptographic investment. There is not – and can never be – any 'plain text,' except as a naïve political assumption about (the relative (non)insidiousness of) coding agencies and the presupposition that communicative signs accessibly exist that are not already 'in code.' Since everything is coded, or (at least) potentially coded, nothing is (definitively) symbolic. Qabbalistic cryptocultures – even those yet to come – ensure that number cannot be discussed or situated without subliminal or (more typically) wholly unconscious participation in numerical practices. Logos, including that of numerology, is also always something other than itself, and in fact very many things.

Qabbalism thus operates as an inverse or complementary Gödelian double-coding. Where Gödel demonstrated that the number line is infested by virtual discursive systems of undelimitable topicality and complexity, pre-emptively dismantling the prospects of any conceivable supranumerical metadiscourse, qabbala demonstrates that discourses are themselves intrinsically redoubled (and further multiplied) by coincidental numerical systems which enter into patterns of connectivity entirely independent of logical regimentation.

The supposed numerical de-activation of the alphabet, marking semiotic modernity (the era of specialized numerical signs), has an extremely fragile foundation, relying as it does upon the discontinuation of specific cultural procedures (precisely those that withdraw into 'occultism') rather than essential characteristics of signs themselves. The persistent numerical functionalization of the modern alphabet – with sorting procedures based on alphabetical ordering as the most prominent example – provides incontestible evidence (if any was required) that the semiotic substructure of all Oecumenic communications remains stubbornly amphibious between logos and nomos, perpetually agitated by numerical temptations and uncircumscribed polyprocesses.

At the discursive level, any 'rigorization of qabbala' can only be a floating city, with each and every definition, argument and manifesto continually calving off into unmasterable numerical currents and alogical resonances. How could qabbala be counterposed to a code, to meaning and reason, when CODE (= 63) finds duplicitous harmonics in MEANING = REASON = 126? If qabbala positions itself discursively AGAINST NUMEROLOGY (= 369), the echoes of its novanomic signature perpetuate themselves even through such unlikely terms as

SIGNIFICANCE (= 207) and SIGNIFICATION (= 252). Pronouncements that begin as projected logical discriminations revert to variations on triplicity and the number nine, performing a base qabbalistic subversion of philosophical legislation and its authority to define (or delimit connectivity).

No polemic against numerology – whether conducted in the name of qabbala or of Oecumenic common reason – will transcend the magmic qabbalistic flux that multiplies and mutates its sense. Perhaps dreams of numerological archetypes even sharpen the lust for semiotic invention, opening new avenues for qabbalistic incursion. But this at least is certain: Numbers do not require – and will never find – any kind of logical redemption. They are an eternal hypercosmic delight.

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Editorial Introduction

Robin Mackay

This volume comprises a selection of texts, some of which would not have existed, others of which may not have been published, and none of which would have ended up in such odd company, were it not for the underlying vision of **COLLAPSE**, which seeks to generate and to bring together philosophical writing from varying perspectives with work drawn from other fields, in order to challenge institutional and disciplinary orthodoxies and to set in motion new syntheses. This second volume has emerged, as did its predecessor, from the combination of this overall vision, a collaborative process with the authors, and a set of happy coincidences. The result is, we hope you will agree, a rich and rewarding set of conceptual conjunctions.

The first part of the volume coalesced into a 'dossier' centring on the work of QUENTIN MEILLASSOUX, whose

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recent book *After Finitude*[1] is a work designed to fundamentally disrupt that dubious consensus within continental philosophy which emphasises the primacy of the relation of consciousness to the world – however that may be construed – over any supposed objectivity of 'things themselves'. It may seem that, in the wake of Kant's Copernican Revolution, this 'correlationist' credo – the injunction that, unable to know things 'in themselves', philosophy must limit itself to the adumbration of 'conditions of experience' – is unassailable, something that only the most unsophisticated, 'pre-critical' thinker would seek to challenge. And yet, once this consensus is broken, the consequences are startling.

In 'The Enigma of Realism' RAY BRASSIER gives a lucid exposition of this transvaluation of the stakes of contemporary philosophical thought. However, questioning whether Meillassoux is right to single out the 'arche-fossil' as the privileged site of this contestation, Brassier ultimately suggests that the curse of correlationism runs deeper still, and intimates that an even more thoroughgoing 'decontamination' of the tools used to critique the current *doxa* might yet be necessary. Brassier's text already takes us beyond the scope of Meillassoux's book, identifying a number of serious problems which he identifies as issuing from a 'fundamental dilemma' relating to Meillassoux's proposal to reinstate some form of intellectual or mathematical intuition. Brassier's text almost tends toward a dialogic form, as Meillassoux responds to subsequent objections with further refinements of his own position.

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[1] *Après la Finitude: Essai sur la necessité de la contingence* (Paris: Seuil, 2006). English translation *After Finitude* (trans. R. Brassier) (London: Continuum, forthcoming 2008).

Meillassoux's audacious countermanding of philosophy's historical abjuration of speculative rationalism proceeds via the positing of the 'necessity of contingency' indexed to an absolute time. In 'Potentiality and Virtuality' he sketches a route to this principle via a discussion of Hume's problem of causality. With admirable panache, Meillassoux rescues this perennially abandoned problem from its alleged epistemological dissolution and restores it to its most potent ontological form. This is a question of resisting the pragmatist referral of ontological problematics to heuristic solutions rooted in empirical consensus: the apparent necessity of a recourse to an empirical *genesis* of the law rather than a metaphysical *grounding* for it, Meillassoux suggests, results from supplementing the terms of the problem with a 'common-sense' judgement that is in turn rooted in an inappropriate application of probabilistic thinking. Conversely, a philosophical enterprise with the courage of its conviction in rationality would refuse to concede this 'defeat of reason', daring to affirm on the contrary that there is in fact no reason to postulate the constancy of natural laws.

Thus Meillassoux sketches the contours of a bold reclamation of rationalism issuing from the refusal of particular forms of (probabilistic) reasoning embedded in 'common-sense'. Rather than seeking a 'meta-law' to subtend the laws of reality, Meillassoux instead loosely binds reality within the singular rational principle of an 'absolute contingency'.

It is perhaps owing in part to his relative independence from the philosophical issues at stake here that our interview with theoretical cosmologist ROBERTO TROTTA serves in many ways as the centrepiece of this discussion. Following as it does upon the more abstractly philosophical discussions of the previous two papers, and yet circling around essentially the same issues, this interview serves to lend instructive insight into the transformation which ostensibly purely *a priori* philosophical problems undergo when transposed into the concrete contexts of scientific research programmes. It would be impossible here to provide more than the barest sense of the content of this lengthy conversation, which we feel sure will repay repeated reading. Fully confirming our faith in the potential of the interview as a (sadly under-exploited) form of contemporary intellectual engagement, this conversation provides an invaluable perspective upon the problems surrounding the determination of 'ancestral phenomena' (Meillassoux's 'arche-fossil') from the privileged 'insider' vantage-point of someone immersed in their empirical study and scientific interpretation on a daily basis. Touching as it does upon everything from the evidence for and ontological status of 'dark matter' through string theory, anthropic reasoning, inflationary cosmology and the meaning of concepts of time and space in cosmological contexts, this interview not only lends a much-needed sense of concreteness and specificity to the problems introduced by Brassier and Meillassoux, but also provides a helpful and readable introduction to the most up-to-date problems and findings of contemporary cosmology.

If Meillassoux's neo-rationalism draws upon the resources of transfinite mathematics and set-theory in order to precisely locate the fundamental parameters of rational thought itself, GRAHAM HARMAN's contribution aims at a different kind of precision, one which perhaps has more affinity with Bergson's critique of dialectical concepts as being 'too large', 'not tailored to the measurements of the reality in which we live'[2] – 'baggy clothes'[3] which, covering everything, reveal little and stifle movement. If Harman, no less than Meillassoux, seeks to escape the prevailing *doxa* which would see in the relation between consciousness and world the primary hinge of any philosophy worthy of the name, and if both thinkers are equally intent on resuscitating a 'speculative realism' long-since left for dead by the philosophical mainstream, it would yet be difficult to find two more starkly contrasting styles of philosophizing.

Harman's inquiry bears no less than Meillassoux's upon the problem of 'correlationism', however. Against Meillassoux's positive desertion of a philosophical demonstration of causality, in 'On Vicarious Causation' Harman seeks to revive the problem of causation itself in all its specificity, beyond the question of whether it can be known or justified, and claims that the revival of this problem entails the rejection of Kant's Copernican turn 'and its single lonely rift between people and everything else'. Whereas for Meillassoux the problem is the apparent facticity of the 'correlationist gap', Harman sets out to generalise this gap, shattering the cosmos into absolutely disjunct objects. Through his generalisation of Heidegger's famous tool-analysis in *Being and Time*, Harman attempts to maintain a recognisably phenomenological commitment to the ontological anteriority of the ‘manifest’ over the ‘scientific’ image of the world whilst simultaneously acknowledging the chronic futility of anti-scientific philosophies of presence. If here philosophy engages ‘the same world as the various sciences’ but ‘in a different manner’, it is not through a meditation on the presencing and absencing of Being, but rather through a tracking of the ‘grain’ of the immediate phenomenon in which a new ‘first philosophy’ is announced in the guise of an aesthetics.

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[2] H. Bergson *Oeuvres* (*La Pensée et le Mouvant*) (Paris: PUF, 1963), 1/1254.

[3] G. Deleuze *Bergsonism*, trans. H. Tomlinson & B. Habberjam (New York: Zone Books, 1991), 44.

In blazing this trail Harman introduces a refreshingly novel philosophical language which is still a work in progress. It is already, however, a work that finally goes beyond those interminable mantras preparatory to phenomenology in which the Heideggerian corps has by now been drilled for decades. Harman sets out, with a hard-won philosophical innocence, to *do* phenomenology in an entirely new way, a way which conjoins the immediacy of the phenomenon with the affirmation of the reality of the object. The future of this enterprise deserves to be followed closely.

Neurophilosopher PAUL CHURCHLAND has no qualms about cleaving to the scientific image, and in our informal and wide-ranging interview makes it entirely clear that, at least in his own area of research, the sense of unfamiliarity that gives rise to its traditional description as ‘cold and machinelike’ (Harman’s ‘grey matrix’) should not be yielded to. Part of what is most intriguing in Churchland's take on the theme of common-sense and science is that, rather than seeing the two in a relation of dramatic rupture, he proposes that as the work of science continues, the corpus of folk-theory will gradually absorb its *prima facie* paradoxical statements.

Much of our discussion with Churchland relates to the problem of so-called ‘qualia’ – the supposedly irreducible subjective components of experience which have been for many years a touchstone for the relation between philosophy and science – and it is instructive to observe that these putatively *sui generis* elements also raise their head in Meillassoux's contribution in this volume. Having criticised advocates of so-called ‘anthropic reasoning’ for championing a neo-finalism on the grounds of ‘astonishment’, and having castigated Goodman for justifying induction on the grounds of the ‘absurdness’ of the alternative, Meillassoux himself ratifies his radical retraction of the Lucretian principle that ‘nothing can come from nothing’ with an appeal to ‘new situations, whose qualitative content is such that it seems impossible to detect, *without absurdity* [emphasis added], its anticipated presence in anterior situations’, giving as an example the fact that ‘a life endowed with sensibility’ could not, ‘short of sheer fantasy’, emerge from matter as conceived by mathematical physics.

How not to see in this dedication to radical novelty the ‘good sense’ – however exalted – of a grand style in French philosophy which has ever striven to reconcile a rigourous engagement with modern science with the moral exigency of an absolute sovereignty and freedom of thought? As Brassier points out, correlationism runs deep, and it may be difficult to break its circle without also subverting this neo-Cartesianism. And the requisite lifting of the proscription on the ‘objectivation of thought’ would require that philosophy take seriously the research programmes of neuroscience and cognitive science, and hold in abeyance any decision as to thought's putative 'irreducibility'.[4]

Certainly, Churchland holds any such rash decision in suspense, arguing that a study of the history of science gives us every reason to bracket our local conditions and to say with him: 'I agree … it is *hard to imagine* … [b]ut I am unimpressed by this'. One cannot help but feel that Churchland thus modestly inherits the boldest speculative enterprise of philosophy in the twentieth century: to reconcile scientific realism with evolutionary epistemology; to capture the vagaries of 'our' access to things as a *datum* rather than exalting it as an insuperable 'condition'; to reverse the humanity-function so as to accede to an unconditioned knowledge of nature 'itself'.

The apparently pleonastic 'speculative realism' only makes sense when we realise that here the ouroborian figure philosophy has grappled with since the birth of Galileanism is negotiated not by asserting the 'primacy' of one part of the unbroken circle over another, nor by anticipating an eventual accomplishment and unification, but rather by focusing on the process of autophagy itself in action. The two moments of such a programme are, firstly, the account *as datum* of the real conditions of our experience (a technical task descended from Kant's 'transcendental philosophy' as 'the idea of a science')[5] and secondly their effective neutralisation within our self-image (a cultural process). In two different ways – in the resistance of nature to our scientific theorising, and in our own intuitive resistance to the absorption of those theories – it is the recalcitrance of our cognitive constitution that poses a natural obstacle. But as Churchland insists, there is no reason to think this obstacle insuperable in principle.

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[4] On these points, see also our interview with Alain Badiou in *Collapse* Vol. I.

[5] *Critique of Pure Reason*, tr. N. K. Smith (London: MacMillan 1929), A13/B27.

Just as the philosophical contributors to this volume draw afresh upon the philosophical tradition, so CLÉMENTINE DUZER and LAURA GOZLAN in their film *Nevertheless Empire* have returned to the traditions of expressionism and *noir*, as well as to later enigmatic figures such as Tarkovski, in order to create a science fiction which – as an exemplary instance of the genre – is a speculative portrait of the present, an extrapolation of the twenty-first century amalgam of social dysfunction, generalised fear, and techno-medical monstrosity. As well as maintaining that cinema was itself a very particular way of thinking, Deleuze wrote that 'a book of philosophy should be in part […] a kind of science-fiction.'[6] To present a film, in a volume of philosophy, as a series of stills, represents a further convolution of this complex relationship between thought and image. But this 'stuttering' finds its own consistency on the page, the momentary glimpses reforming in new depths.

In his contribution 'Islamic Exotericism', as in Volume I's 'Militarization of Peace', REZA NEGARESTANI petitions for the adoption of the term 'affordance' into the philosophical vocabulary. Negarestani traces the asymmetry of the 'War on Terror''s landscape of fear, and the shifting apocalyptic narratives engendered by the situation, to the refusal of affordance implicit in Islamic theology.

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[6] G. Deleuze, *Difference and Repetition*, trans.Paul Patton (London: Athlone,1994),xx.

KRISTEN ALVANSON's photo/diagrammatic essay emphasises a concrete locus for this difference in the theological image of thought: the graveyard as a 'staging of ontology' betrays once again the patterns of affordance, the exigency of survival inherent to Western thinking even in death. Alvanson's inquiry thus forms a concrete counterpart to Negarestani's theological disquisition.

According to Negarestani, through its spatial and temporal approaches to God and Apocalypse, Islamic theology formulates a methodology for the construction of a politically profound tool capable of turning theology itself into heresy. Where Meillassoux uses a rationality unbounded by real necessity to absolutize its own limits, 'touching' itself in a movement of intellectual intuition, Negarestani shows how theology can be reinvented as an epistemological tool for confronting a pure externality, without reducing it to ontological possibilities or to an object of 'affordance'. One might then say that the insubordinable externality Negarestani describes is cognate with the absolute time proposed by Meillassoux – a beyond of chronology, from which irrupt events in principle unpredictable by statistical or economical reason. This is perhaps the most surprising of the many subterranean connections linking the various contributions to this volume of **COLLAPSE**: Do a desacralized thinking of the infinite subtracted from the expectation of mystical union and a proper place for man, and a hyper-rationalism which refuses to bend to real necessity, deliver us to this Now of eternal externality, from which nothing may be expected? Does the conversion of god into a heresy invoke the divine inexistence?

Obviously, it has only been possible in this brief introduction to give a very selective and superficial survey of a volume which suggests so many rich vectors of philosophical thought and so many fascinating possibilities. But we hope to have lightly sketched a portrait here of the underlying conviction, expressed forcefully in so many different voices – and in an age where institutions and publications seem to take pride in cleaving to narrow specialisms – that philosophy, in gloriously unqualified form, is still possible.

In concluding, we would like offer our thanks to our contributors for their generous collaboration on this volume, and to our readers for their enthusiastic response to Volume I. This reception encourages us in our belief that our experiment constitutes a necessary eccentricity in relation to the mainstream – and that in some way it helps set free some of the latent force of philosophical thought – once more 'to resume the offensive'.[7]

Robin Mackay,
Oxford, February 2007.

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[7] G. Harman, present volume, 174.

The Enigma of Realism: On Quentin Meillassoux's *After Finitude*[1]

Ray Brassier

1. THE ARCHE-FOSSIL

Quentin Meillassoux has recently proposed a compelling diagnosis of what is most problematic in post-Kantian philosophy's relationship to the natural sciences.[2] The former founders on the enigma of the 'arche-fossil'. A fossil is a material bearing the traces of pre-historic life, but an 'arche-fossil' is a material indicating traces of 'ancestral' phenomena anterior even to the emergence of life. It provides the material basis for experiments yielding estimates of ancestral phenomena – such as, for instance, the radioactive isotope whose rate of decay provides an index of the age of rock samples, or the starlight whose luminescence provides an index of the age of distant stars. Natural science produces ancestral statements, such as, for example, that the universe is roughly 13.7 billion years old, that the earth formed roughly 4.5 billion years ago, that life

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[1] This is a heavily edited version of a chapter from the author's *Nihil Unbound: Enlightenment and Extinction* (Basingstoke: Palgrave Macmillan, forthcoming 2007).

[2] *Après la Finitude: Essai sur la necessité de la contingence* (Paris: Seuil, 2006). English translation *After Finitude* (trans. R. Brassier) (London: Continuum, forthcoming 2008).

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developed on earth approximately 3.5 billion years ago, and that the earliest ancestors of the genus *Homo* emerged about 2 million years ago.[3] Yet it is also generating an ever increasing number of 'descendent' statements, such as that the Milky Way will collide with the Andromeda galaxy in 3 billion years, or that the earth will be incinerated by the sun 4 billions years hence, or that all the stars in the universe will stop shining in 100 trillion years, or that eventually, one trillion, trillion, trillion years from now, all matter in the cosmos will disintegrate into unbound elementary particles. Philosophers should be more astonished by such statements than they seem to be, for they present a serious problem for post-Kantian philosophy. Yet strangely, the latter seems to remain entirely oblivious to it. The claim that these statements are philosophically enigmatic has nothing to do with qualms about the methods of measurement involved, or with issues of empirical accuracy, or any other misgivings about scientific methodology. They are enigmatic because of the startling philosophical implications harboured by their literal meaning. For the latter seems to point to something which violates the basic conditions of conceptual intelligibility stipulated by post-Kantian philosophy. In order to understand why this is so, we need to try to sketch the latter.

For all their various differences, post-Kantian philosophers can be said to share one fundamental conviction: that the idea of a world-in-itself, subsisting independently of our relation to it, is an absurdity. Objective reality must be transcendentally guaranteed, whether by pure consciousness, intersubjective consensus, or a community of rational agents; without such guarantors, it is a metaphysical chimera. Or for those who scorn what they mockingly dismiss as the 'antiquated' Cartesian vocabulary of 'representationalism', 'subject/object dualism', and epistemology more generally, it is our pre-theoretical relation to the world, whether characterized as *Dasein* or 'Life', which provides the ontological precondition for the intelligibility of the scientific claims listed above. No wonder, then, that post-Kantian philosophers routinely patronize these and other scientific assertions about the world as impoverished abstractions whose meaning supervenes on this more fundamental sub-representational or pre-theoretical relation to phenomena. For these philosophers, it is this relation to the world – *Dasein*, Existence, Life – which provides the originary condition of manifestation for all phenomena, including those ancestral phenomena featured in the statements above. Thus if the idea of a world-in-itself, of a realm of phenomena subsisting independently of our relation to it, is intelligible at all, it can only be intelligible as something in-itself or independent 'for-us'. This is the reigning *doxa* of post-metaphysical philosophy: what is fundamental is neither a hypostasized substance, nor the reified subject, but rather the relation between un-objectifiable thinking and un-representable being, the primordial reciprocity or 'co-propriation' of *logos* and *physis* which at once unites and distinguishes the terms which it relates. This premium on relationality in post-metaphysical philosophy – whose telling symptom is the preoccupation with 'difference' – has become an orthodoxy which is all the more insidious for being constantly touted as a profound innovation.[4]

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[3] 'Billion' and 'trillion' will be used throughout following their now internationally accepted US usage, as meaning a thousand million and a million million respectively.

Meillassoux has given it a name: 'correlationism'. Correlationism affirms the indissoluble primacy of the relation between thought and its correlate over the metaphysical hypostatization or representationalist reification of either term of the relation. Correlationism is subtle: it never denies that our thoughts or utterances *aim at* or *intend* mind-independent or language-independent realities; it merely stipulates that this apparently independent dimension remains internally related to thought and language. Thus contemporary correlationism dismisses the problematic of scepticism, and of epistemology more generally, as an antiquated Cartesian hang-up: there is supposedly no problem about how we are able to adequately represent reality, since we are 'always already' outside ourselves and immersed in or engaging with the world (and indeed, this particular platitude is constantly touted as the great Heideggerian–Wittgensteinian insight).

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[4] Graham Harman has elaborated a profound critique of this tendency in contemporary philosophy, seeing in it an avatar of a generalized anti-realism. Whether the relation in question is the epistemological relation between mind and world, the phenomenological relation between noesis and noema, the ekstatic relation between *Sein* and *Dasein*, the prehensive relation between event-objects, or the processual relation between matter and memory, Harman argues that this premium on relationality occludes the discontinuous reality of objects in favour of their reciprocal idealizations. Harman's startlingly original interpretation of Heidegger provides the point of departure for his complete re-orientation of phenomenology away from the primacy of the human relation to things and toward things themselves considered independently of their relation to humans or each other. Accordingly, the fundamental task for this 'object-oriented philosophy' consists in explaining how autonomous objects can ever interact with each other, and to that end Harman has developed a particularly ingenious theory of 'vicarious causation' – See Harman's contribution to the present volume, 171-205.

Note that correlationism need not privilege 'thinking' or 'consciousness' as the key relation – it can just as easily replace it with 'being-in-the-world', 'perception', 'sensibility', 'intuition', 'affect', or even 'flesh'. Indeed, all of these terms have featured in the specifically phenomenological varieties of correlationism.[5]

But the arche-fossil presents a quandary for the correlationist. For how is the correlationist to make sense of science's ancestral claims? Correlationism insists that there can be no cognizable reality independently of our relation to reality; no phenomena without some transcendental operator – such as life or consciousness or *Dasein* – generating the conditions of manifestation through which phenomena manifest themselves. In the absence of this originary relation and these transcendental conditions of manifestation, nothing can be manifest, apprehended, thought or known. Thus, the correlationist will continue, not even the phenomena described by the sciences are possible independently of the relation through which phenomena become manifest. Moreover, the correlationist will add, it is precisely the transcendental nature of the correlation as *sine qua non* for cognition that obviates the possibility of empirical idealism. Thus, *contra* Berkeley, Kant maintains that known things are not dependent upon being perceived precisely because known things are representations and representations are generated via transcendental syntheses of categorial form and sensible material. Synthesis is rooted in pure apperception, which yields the transcendental form of the object as its necessary correlate and guarantor of objectivity. The transcendental object is not cognizable, since it provides the form of objectivity which subsumes all cognizable objects; all of which must be linked to one another within the chains of causation encompassed by the unity of possible experience and circumscribed by the reciprocal poles of transcendental subject and transcendental object. Yet the arche-fossil indexes a reality which does not fall between these poles and which refuses to be integrated into the web of possible experience linking all cognizable objects to one another, because it occurred in a time *anterior to the possibility of experience*. Thus the arche-fossil points to a cognizable reality which is not given in the transcendental object of possible experience. This is a possibility which Kant explicitly denies:

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[5] The writings of Husserl and Heidegger are littered with paradigmatic expressions of the correlationist credo. Here are just two examples:

> The existence of Nature *cannot* be the condition for the existence of consciousness, since Nature itself turns out to be a correlate of consciousness: Nature *is* only as being constituted in regular concatenations of consciousness. (Edmund Husserl, *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy. Book One*. Tr. F. Kersten, Dordrecht, The Netherlands: Kluwer, 1982: 116).

> [S]trictly speaking we cannot say: there was a time when there were no human beings. At every *time*, there were and are and will be human beings, because time temporalizes itself only as long as there are human beings. There is no time in which there were no human beings, not because there are human beings from all eternity, but because time is not eternity, and time always temporalizes itself only at one time, as human, historical Dasein. (Martin Heidegger, *Introduction to Metaphysics*, tr. G. Fried and R. Polt, New Haven and London: Yale University Press, 2000: 88-9).

> Thus we can say that the real things of past time are given in the transcendental object of experience; but they are objects for me and real in past time only in so far as I represent to myself (either by the light of history or by the guiding clues of a series of causes and effects) that a

> regressive series of possible perceptions in accordance with empirical laws, in a word, that the course of the world, conducts us to a past time-series as the condition of the present time – a series which, however, can be represented as actual not in itself but only in the connection of a possible experience. *Accordingly, all events which have taken place in the immense periods that have preceded my own existence really mean nothing but the possibility of extending the chain of experience from the present perception back to the conditions which determine this perception in respect of time*.[6]

For Kant, then, the ancestral time of the arche-fossil cannot be represented as existing in itself but only as connected to a possible experience. But we cannot represent to ourselves any regressive series of possible perceptions in accordance with empirical laws capable of conducting us from our present perceptions to the ancestral time indexed by the arche-fossil. It is strictly impossible to prolong the chain of experience from our contemporary perception of the radioactive isotope to the time of the accretion of the earth indexed by its radiation, because the totality of the temporal series coextensive with possible experience itself emerged out of that geological time wherein there simply was no perception. We cannot extend the chain of possible perceptions back prior to the emergence of nervous systems, which provide the material conditions for the possibility of perceptual experience.

Thus it is precisely the necessity of an originary correlation, whether between knower and known, or *Sein* and *Dasein*, that science's ancestral statements flatly contradict. For in flagrant disregard of those transcendental conditions which are supposed to be necessary for every manifestation, they describe occurrences anterior to the emergence of life, and objects existing independently of any relation to thought. Similarly, science's descendent statements refer to events occurring after the extinction of life and the annihilation of thought. But how can such statements be true if correlationism is sound? For not only do they designate events occurring quite independently of the existence of life and thought; they inscribe the transcendental conditions of manifestation themselves within a merely empirical timeline. How can the relation to reality embodied in life or thought be characterized as transcendentally necessary (*sine qua non*) for the possibility of spatiotemporal manifestation when science unequivocally states that life and thought, and hence this fundamental relation, have a determinate beginning and end in space-time? Don't science's ancestral and descendent statements strongly imply that those ontologically generative conditions of spatiotemporal manifestation privileged by correlationists – *Dasein*, life, consciousness, and so on – are themselves merely spatiotemporal occurrences like any other?

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[6] *Critique of Pure Reason*, tr. N. K. Smith (London: MacMillan 1929), A495; emphasis added.

2. THE CORRELATIONIST RESPONSE

Confronted by Meillassoux's argument from the arche-fossil, partisans of correlationism have not been slow in mounting a counter-offensive. In a supplement to the forthcoming English translation of *Après la finitude*, Meillassoux recapitulates the two most frequently voiced objections and responds to both. The correlationist defence is two-tiered. In the first stage, Meillassoux is accused of inflating an un-observed phenomenon into a negation of correlation, when in fact it is merely a lacuna in correlation. In the second stage, Meillassoux is deemed guilty of naively conflating the empirical and the transcendental. We will consider each of these objections, as well as Meillassoux's responses to them, in turn.

In the first stage, the correlationist contends that, far from being novel and challenging, the argument from the arche-fossil is merely a restatement of a hackneyed and rather feeble objection to transcendental idealism. Thus, the correlationist continues, the arche-fossil is simply an example of a phenomenon which went un-perceived. But un-perceived phenomena occur all the time and it is excessively naive to think they suffice to undermine the transcendental status of the correlation. In this regard, the temporal distance which separates us from the ancestral phenomenon is no different in kind from the spatial distance which separates us from contemporaneous but unobserved events occurring elsewhere in the universe. Thus the fact that there was no-one around 4.5 billion years ago to perceive the accretion of the earth is no more significant than the fact that there is currently no-one 25 million, million miles away perceiving events on the surface of Alpha Centauri. Moreover, the notion of 'distance' is an inherently ambiguous and unreliable indicator of the limits of perception: technology allows us to perceive objects extraordinarily far away in space and time, while myriad occurrences close at hand routinely go unperceived. In this regard, instances of spatiotemporal extremity are no different in kind from other banal instances of un-witnessed or un-perceived phenomena, such as the fact that we are never aware of everything going on inside our own bodies. Thus the arche-fossil is just another example of an un-perceived phenomenon and, as with all other examples of un-perceived phenomena, it merely exemplifies the inherently *lacunary* nature of manifestation – the fact that no phenomenon is ever exhaustively or absolutely apprehended by perception or consciousness. Far from denying this, both Kant and Husserl emphasized the intrinsically limited and finite nature of human cognition. Thus for Kant sensible intuition is incapable of exhaustively apprehending the infinite complexity of a datum of sensation. Similarly for Husserl, intentionality proceeds by adumbrations which never exhaust all the dimensions of the phenomenon. But the fact that every phenomenon harbours an un-apprehended remainder in no way undermines the constitutive status of transcendental consciousness. All that it shows is that manifestation is inherently lacunary and that the non-manifest inheres in every manifestation. A counterfactual suffices to establish the persistence of transcendental constitution even in cases of lacunary manifestation such as the arche-fossil. Thus the contingent fact that no-one was there to witness the accretion of the earth is ultimately of no importance; for *had there been* a witness, they *would have* perceived the phenomenon of accretion unfolding in conformity with the laws of geology and physics which are transcendentally guaranteed by the correlation. Ultimately, the correlationist concludes, the argument from the arche-fossil fails to challenge correlationism because it has simply confused a contingent lacuna in manifestation with the necessary absence of manifestation.

Against this initial line of defence, Meillassoux insists that the arche-fossil cannot be reduced to an example of the un-perceived because the temporal anteriority involved in the notion of ancestrality remains irreducible to any notion of temporal 'distance' concomitant with correlational manifestation. To reduce the arche-fossil to an un-witnessed or un-perceived occurrence is to beg the question because it is to continue to assume that there is always a correlation in terms of which to measure gaps or lacunae within manifestation. But the arche-fossil is not merely a non-manifest gap or lacuna *in* manifestation; it is the lacuna *of* manifestation *tout court.* For the anteriority indexed by the ancestral phenomenon does not point to an earlier time *within* manifestation; it indexes a time *anterior to the time of manifestation in its entirety*; and it does so according to a sense of 'anteriority' which cannot be reduced to the past of manifestation because it indicates a time wherein manifestation – along with its past, present, and future dimensions – originally emerged. Thus, Meillassoux contends, the 'ancestral' cannot be reduced to the 'ancient'. There are always greater or lesser degrees of 'ancientness' depending on whatever temporal metric one happens to choose. 'Ancientness' remains a function of a relation between past and present which is entirely circumscribed by the conditions of manifestation and in this sense any past, no matter how 'ancient', remains synchronous with the correlational present. In equating temporal remove with spatial distance, the correlationist objection outlined above continues to assume this underlying synchronicity. But ancestrality indexes a radical 'diachronicity' which cannot be correlated with the present because it belongs to the time wherein the conditions of correlation between past, present, and future passed from inexistence into existence. Accordingly, ancestrality harbours a temporal diachronicity which remains incommensurable with any chronological measure that would ensure a reciprocity between the past, present, and future dimensions of the correlation.

Meillassoux detects in this initial correlationist response a subterfuge which consists in substituting a lacuna *in* and *for* manifestation – a lacuna that is contemporaneous with constituting consciousness, as is always the case with the un-perceived – for a lacuna *of* manifestation as such; one which cannot be synchronized with constituting consciousness (or whatever other transcendental operator happens to be invoked). The correlationist's sleight-of-hand here consists in reducing the arche-fossil – which is non-manifest insofar as it occurs prior to the emergence of conditions of manifestation – to the un-perceived, which is merely a measurable gap or absence within the extant conditions of manifestation. However, Meillassoux insists, the arche-fossil is neither a lacunary manifestation nor a temporal reality internal to manifestation (internal to the correlation); for it points to the temporal reality in which manifestation itself first came into existence, and wherein it will ultimately sink back into inexistence. Consequently, Meillassoux concludes, it is a serious misunderstanding to think that a counterfactual suffices to reintegrate the arche-fossil within the correlation, for the diachronicity it indexes cannot be synchronized with any correlational present.

Having failed to rebuff the argument from the arche-fossil with this initial line of defence, the correlationist adopts a second strategy. This consists in contesting the claim that ancestrality indexes a temporal dimension within which correlational temporality itself passes into and out of being. For such an assertion betrays a fundamental confusion between the *transcendental* level at which the conditions of correlation obtain and the *empirical* level at which the organisms and/or material entities which support those conditions exist. The latter are indeed spatiotemporal objects like any other, emerging and perishing within physical space-time; but the former provide the conditions of objectivation without which scientific knowledge of spatiotemporal objects – and hence of the arche-fossil itself – would not be possible. Though these conditions are physically instantiated by specific material objects – *i.e.* human organisms – they cannot be said to exist in the same manner, and hence they cannot be said to pass into or out of existence on pain of paralogism. Thus, the correlationist continues, the claim that the conditions of objectivation emerged in space-time is an absurd paralogism because it treats transcendental conditions as though they were objects alongside other objects. But the transcendental conditions of spatiotemporal objectivation do not exist spatiotemporally. This is not to say that they are eternal, for this would be to hypostatize them once again and to attribute another kind of objective existence to them, albeit in a transcendent or supernatural register. They are neither transcendent nor supernatural – they are the logical preconditions for ascriptions of existence, rather than objectively existing entities. As conditions for the scientific cognition of empirical reality – of which the arche-fossil is a prime example – they cannot themselves be scientifically objectified without engendering absurd paradoxes. The claim that ancestral time encompasses the birth and death of transcendental subjectivity is precisely such a paradox, but one which dissolves once the confusion from which it has arisen has been diagnosed.

Yet for Meillassoux, the initial plausibility of this response masks its underlying inadequacy, for it relies on an unacknowledged equivocation. We are told that transcendental subjectivity cannot be objectified, and hence that it neither emerges nor perishes in space-time; but also that it is neither immortal nor eternal, in the manner of a transcendent metaphysical principle. Indeed this is precisely what distinguishes transcendental subjectivity in its purported finitude from any metaphysical hypostatization of the principle of subjectivity which would render it equivalent to an infinitely enduring substance. But as finite, transcendental subjectivity is indissociable from the determinate set of material conditions which provide its empirical support. Thus Husserl insists on the necessary parallelism which renders the transcendental indissociable from the empirical. Indeed, it is this necessary parallelism which distinguishes transcendental subjectivity from its metaphysical substantialization. Accordingly, though transcendental subjectivity is merely instantiated in the minds of physical organisms, it cannot subsist independently of those minds and the organisms which support them. Although it does not exist in space and time, it has no other kind of existence apart from the spatiotemporal existence of the physical bodies in which it is instantiated. And it is precisely insofar as it is anchored in the finite minds of bounded physical organisms with limited sensory and intellectual capacities that human reason is not infinite. But if transcendental subjectivity is necessarily instantiated in the spatiotemporal existence of physical organisms, then it is not quite accurate to claim that it can be entirely divorced from objectively existing bodies. Indeed, in the wake of Heidegger's critique of the 'worldless' or disembodied subject of classical transcendentalism, post-Heideggerean philosophy can be said to have engaged in an increasing 'corporealization' of the transcendental. Merleau-Ponty is probably the most prominent (though certainly not the only) advocate of the quasi-transcendental status of embodiment. Accordingly, although transcendental subjectivity may not be reducible to objectively existing bodies, neither can it be divorced from them, for the existence of bodies – and *a fortiori* of language, society, history, culture, etc. – provides the conditions of instantiation for the transcendental (i.e. the 'always already'). Thus, Meillassoux concludes, while it is perfectly plausible to insist that the correlation provides the transcendental condition for knowledge of spatiotemporal existence, it is also necessary to point out that the time in which the bodies that provide the conditions of instantiation for the correlation emerge and perish is also the time which determines the conditions of instantiation of the transcendental. But the ancestral time which determines the conditions of instantiation of the transcendental cannot be encompassed within the time that is co-extensive with the correlation, because it is the time within which those corporeal conditions upon which the correlation depends pass into and out of existence. Where such conditions of instantiation are absent, so is the correlation. Thus the ancestral time indexed by the arche-fossil is simply the time of the inexistence of the correlation. This ancestral time is indexed by objective phenomena such as the arche-fossil; but its existence does not depend upon those conditions of objectivation upon which knowledge of the arche-fossil depends, because it determines those conditions of instantiation which determine conditions of objectivation.

3. Ancestrality and Chronology

Meillassoux's responses to his correlationist critics are as trenchant as they are resourceful and they undoubtedly constitute a significant addition to his already weighty case against correlationism. However, they also invite a number of critical observations. First, it is not at all clear how Meillassoux's distinction between ancestrality and spatiotemporal distance can be squared with what twentieth-century physics has taught us concerning the fundamental indissociability of time and space, as enshrined in the Einstein-Minkowski conception of four-dimensional space-time. 'Anteriority' and 'posteriority' are inherently relational terms which can only be rendered intelligible from within a spatiotemporal frame of reference. In this regard, Meillassoux's insistence on the irreconcilable disjunction between a lacuna *in* manifestation and the lacuna *of* manifestation continues to rely on an appeal to the scalar incommensurability between the anthropomorphic time privileged by correlationism and the cosmological time within which the former is nested. This incommensurability is attributed to the fundamental asymmetry between cosmological and anthropomorphic time: whereas the former is presumed to encompass the beginning and end of the latter, the reverse is assumed not to be the case. However, Meillassoux conducts his case against correlationism in a logical rather than empirical register – indeed, we shall see below how this leads him to reiterate the dualism of thought and extension – yet the asymmetry to which he appeals here is precisely a function of empirical fact, and as Meillassoux himself acknowledges,[7] there is no *a priori* reason why the existence of mind, and hence of the correlation, could not happen to be coextensive with the existence of the universe. Indeed, this is precisely the claim of Hegelianism, which construes mind or *Geist* as a self-relating negativity already inherent in material reality. Accordingly, the transcendence which Meillassoux ascribes to ancestral time as that which exists independently of correlation continues to rely upon an appeal to chronology: it is the (empirical) fact that cosmological time *preceded* anthropomorphic time and will presumably *succeed* it which is invoked in the account of the asymmetry between the two. In light of this implicit appeal to chronology in Meillassoux's claim that the arche-fossil indexes the absence of manifestation, rather than any hiatus within it, it is difficult to see how the temporal anteriority which he ascribes to the ancestral realm could ever be understood wholly independently of the spatiotemporal framework in terms of which cosmology coordinates relations between past, present, and future events. A simple change in the framework which determines chronology would suffice to dissolve the alleged incommensurability between ancestral and anthropomorphic time, thereby bridging the conceptual abyss which is supposed to separate anteriority from spatiotemporal distance.

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[7] *Cf. Après la finitude*, 161.

The conclusion to be drawn is the following: as long as the autonomy of the in-itself is construed in terms of a merely chronological discrepancy between cosmological and anthropomorphic time, it will always be possible for the correlationist to convert the supposedly absolute anteriority attributed to the ancestral realm into an anteriority which is merely 'for us', not 'in itself'. By tethering his challenge to correlationism to the spatiotemporal framework favoured by contemporary cosmology, Meillassoux mortgages the autonomy of the in-itself to chronology. The only hope for securing the unequivocal independence of the '*an sich*' must lie in prizing it free from chronology as well as phenomenology. This would entail a conception of objectivity which excludes chronological relationality as much as phenomenological intentionality. Spatiotemporal relations should be construed as a function of objective reality; rather than objective reality construed as a function of spatiotemporal relations. By insisting on driving a wedge between ancestral time and spatiotemporal distance, Meillassoux inadvertently reiterates the privileging of time over space which is so symptomatic of idealism and unwittingly endorses his opponents' claim that all non-ancestral reality can be un-problematically accounted for by the correlation. Thus the trenchancy of Meillassoux's rejoinders above actually masks a significant concession to correlationism. For surely it is not just ancestral phenomena which challenge the latter, but simply the reality described by the modern natural sciences *tout* *court.* According to the latter, we are surrounded by processes going on quite independently of any relationship we may happen to have to them: thus plate tectonics, thermonuclear fusion, and galactic expansion (not to mention undiscovered oil reserves or unknown insect species) are as much autonomous, human-independent realities as the accretion of the earth. The fact that these processes are contemporaneous with the existence of consciousness, while the accretion of the earth preceded it, is quite irrelevant. To maintain the contrary, and insist that it is only the ancestral dimension that transcends correlational constitution, is to imply that the emergence of consciousness marks some sort of fundamental ontological rupture, shattering the autonomy and consistency of reality, such that once consciousness has emerged on the scene, nothing can pursue an independent existence any more. The danger is that in privileging the arche-fossil as sole paradigm of a mind-independent reality, Meillassoux is ceding too much ground to the correlationism he wishes to destroy.[8]

3. THE PRINCIPLE OF FACTUALITY

Meillassoux distinguishes between two varieties of correlationism: weak correlationism, which claims that we can *think* noumena even though we cannot *know* them, and strong correlationism, which claims that we cannot even think them. Weak correlationism, exemplified by Kant, insists on the finitude of reason and the conditional nature of our access to being. The conditions for knowledge (the categories and forms of intuition) apply only to the phenomenal realm, not to things in-themselves. Thus the cognitive structures governing the phenomenal realm are not necessary features of things-in-themselves. We cannot know why space and time are the only two forms of intuition or why there are twelve rather than eleven or thirteen categories. There is no sufficient reason capable of accounting for such a fact. In this sense, and this sense alone, these transcendental structures are contingent. But Hegel will point out that Kant has already overstepped the boundary between the knowable and the unknowable in presuming to know that the structure of things-in-themselves differs from the structure of phenomena. Accordingly, Hegel will proceed to re-inject that which is transcendentally constitutive of the 'for us' back into the 'in-itself'. Thus in Hegel's absolute idealism thinking grounds its own access to being once more and rediscovers its intrinsic infinitude. Where Kant's weak correlationism emphasises the uncircumventable contingency inherent in the correlation between thinking and being, Hegelianism absolutizes the correlation and thereby insists on the necessary isomorphy between the structure of thinking and that of being. In this regard, strong correlationism, which encompasses everything from phenomenology to pragmatism, can be understood as a critical rejoinder to the Hegelian absolutization of correlation. Though strong correlationism also jettisons the thing-in-itself, it retains the Kantian premium on the ineluctable contingency of the correlation, which Heidegger famously radicalizes in the notion of 'facticity'. Thus strong correlationism, as exemplified by figures such as Heidegger and Foucault, insists – contra Hegel – that the contingency of correlation cannot be rationalised or grounded in reason. This is the anti-metaphysical import of Heidegger's epochal 'history of being' or of Foucault's 'archaeologies of knowledge'. Accordingly, if we are to break with correlationism, we must re-legitimate the possibility of thinking the thing-in-itself, yet do so without either absolutizing correlation or resorting to the Principle of Sufficient Reason.

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[8] I am indebted to Graham Harman, Robin Mackay, and Damian Veal for all these critical points.

In a remarkable *tour de force*, Meillassoux shows how what is most powerful in strong correlationism can be used to overcome it from within. And what is most powerful in it is precisely its insistence on the facticity of correlation. For on what basis does strong correlationism reject the Hegelian rehabilitation of the Principle of Sufficient Reason – the claim that contradiction is the ground of being – and the ensuing isomorphy between thinking and being? It does so by insisting on the facticity or non-necessity of correlation against its Hegelian absolutization – thought's access to being is extrinsically conditioned by non-conceptual factors, which cannot be rationalised or reincorporated within the concept, not even in the form of dialectical contradiction. Thus, in order to emphasize the primacy of facticity against the speculative temptation to absolutize correlation, strong correlationism must insist that everything is without reason – even correlation itself. Against Hegel's speculative idealism, which seeks to show how the correlation can demonstrate its own necessity by grounding itself, thereby becoming absolutely necessary or *causa sui*, strong correlationism must maintain that such self-grounding is impossible by demonstrating that the correlation cannot know itself to be necessary. For though we can claim that an empirical phenomenon is necessary or contingent in conformity with the transcendental principles governing the possibility of knowledge, we cannot know whether these principles themselves are either necessary or contingent, for we have nothing to compare them to. This argument proceeds on the basis of a distinction between contingency, which is under the jurisdiction of knowledge, and facticity, which is not. Contingency is empirical and pertains to phenomena: a phenomenon is contingent if it can come into or out of existence without violating the principles of cognition that govern phenomena. Facticity is transcendental and pertains to our cognitive relation to phenomena, and hence to the principles of knowledge themselves, concerning which it makes no sense to say either that they are necessary or that they are contingent, since we have no other principles to compare them to. Against absolute idealism then, strong correlationism insists that to affirm the necessity of the correlation is to contravene the norms of knowledge. Yet in so doing, it violates its own stricture: for in order to claim that the correlation is not necessary, it has no choice but to affirm its contingency.

Accordingly, strong correlationism is obliged to contravene its own distinction between what is knowable and what is unknowable in order to protect it; it must assert the contingency of correlation in order to contradict the idealist's assertion of its necessity. But to affirm the contingency of correlation is also to assert the necessity of facticity and hence to overstep the boundary between what can be known – contingency – and what cannot be known – facticity – in the very movement that is supposed to reassert its inviolability. For in order to maintain the contingency of correlation and stave off absolute idealism, strong correlationism must insist on the necessity of its facticity – but it cannot do so without knowing something which, by its own lights, it is not supposed to know. Thus it finds itself confronted with the following dilemma: it cannot de-absolutize facticity without absolutizing the correlation; yet it cannot de-absolutize the correlation without absolutizing facticity. But to absolutize facticity is to assert the unconditional necessity of its contingency and hence to assert that it is possible to think something that exists independently of thought's relation to it: contingency as such. In absolutizing facticity, correlationism subverts the empirical-transcendental divide separating knowable contingency from unknowable facticity even as it strives to maintain it; but it is thereby forced to acknowledge that what it took to be a negative characteristic of our relation to things – *viz.*, that we cannot know whether the principles of cognition are necessary or contingent – is in fact a positive characteristic of things-in-themselves.

It is worthwhile pausing here to underline the decisive distinction between the idealist and realist variants of the speculative overcoming of correlationism. Speculative idealism claims that the in-itself is not some transcendent object standing 'outside' the correlation, but is rather nothing other than the correlation as such. Thus it converts relationality *per se* into a thing-in-itself or absolute: the dialectician claims that we overcome the metaphysical reification of the in-itself when we realize that what we took to be merely for-us is in fact in-itself. Correlation is absolutized when it becomes in-itself for-itself. But this involves transforming correlation into a metaphysically necessary entity or *causa sui*. By way of contrast, Meillassoux's speculative materialism asserts that the only way to preserve the in-itself from its idealist incorporation into the for-us without reifying it metaphysically is by realizing that what is in-itself is the *contingency* of the for-us, not its necessity. Thus, when facticity is absolutized, it is the contingency or groundlessness of the for-us (the correlation) which becomes in-itself or necessary precisely insofar as its contingency is not something which is merely for-us. Speculative materialism asserts that, in order to maintain our ignorance of the necessity of correlation, we have to know that its contingency is necessary. In other words, if we can never know the necessity of anything, this is not because necessity is unknowable but because we know that only contingency necessarily exists. What is absolute is the fact that everything is necessarily contingent or 'without-reason'.

Consequently, when forced to pursue the ultimate consequences of its own premises, correlationism is obliged to turn our ignorance concerning the necessity or contingency of our knowledge of phenomena into a thinkable property of things-in-themselves. The result, as Meillassoux puts it, is that '[t]he absolute is the absolute impossibility of a necessary being'.[9] This is Meillassoux's 'principle of factuality' and though it might seem exceedingly slight, its implications are far from trivial. For it imposes significant constraints upon thought. If a necessary being is conceptually impossible then the only absolute is the real possibility of the completely arbitrary and radically unpredictable transformation of all things from one moment to the next. It is important not to confuse this with familiar Heraclitean or Nietzschean paeans to absolute becoming, for the latter merely substitutes the metaphysical necessity of perpetual differentiation for the metaphysical necessity of perpetual identity. To affirm the metaphysical primacy of becoming is to claim that it is impossible for things not to change; impossible for things to stay the same; and *ergo* to claim that it is necessary for things to keep changing. The flux of ceaseless becoming is thereby conceived as ineluctable and metaphysically necessary as unchanging stasis. But metaphysical necessity, whether it be that of perpetual flux or of permanent fixity, is precisely what the principle of absolute contingency rules out. The necessity of contingency, Meillassoux maintains, implies an 'absolute time' which can interrupt the flux of becoming with the same arbitrary capriciousness as it can scramble the fixity of being. Absolute time is tantamount to a 'hyper-chaos' for which nothing is impossible, unless it be the production of a necessary being. It is a contingency which usurps every possible order, including the order of disorder or the constancy of inconstancy. It is all-powerful; but an absolute power which is 'without norms, blind, and devoid of all the other divine perfections [...] It is a power possessing neither goodness nor wisdom [...] a time capable of destroying becoming itself by bringing forth, perhaps forever, fixity, stasis, and death'.[10]

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[9] *Après la finitude*, 82.

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[10] *Ibid.*, 88.

4. THE PARADOX OF ABSOLUTE CONTINGENCY

In a move that effectively sidesteps the entire problematic of representation, Meillassoux boldly declares his intention to reinstate intellectual intuition:

> [W]e must project unreason into the thing itself, and discover in our grasp of facticity the veritable intellectual intuition of the absolute. 'Intuition', since it is well and truly in [à même] *what is* that we discover a contingency with no bounds other than itself; 'intellectual', since this contingency is nothing visible, nothing perceptible in the thing: only thought can access it as it accesses the Chaos which underlies the apparent continuities of phenomena.[11]

The deployment of this presumably non-metaphysical variety of intellectual intuition circumvents Kant's critical distinction between knowable phenomena and unknowable things-in-themselves – between reality as we relate to it through representation and reality as it is independently of our representational relation to it – and rehabilitates the distinction between primary and secondary qualities; the former being mathematically intuitable features of things-in-themselves; the latter being phenomenological features of our relation to things.[12] This reinstatement of intellectual intuition is of a piece with Meillassoux's overturning of Kant's critical delimitation of the possibilities of reason. Intellectual intuition now provides us with direct access to a realm of pure possibility coextensive with absolute time. Kant displaced the metaphysical hypostatization of logical possibility by subordinating the latter to a domain of real possibility circumscribed by reason's relation to sensibility. Time *qua* form of transcendental synthesis grounds the structure of possibility.[13] But Meillassoux's absolutization of contingency effectively absolutizes the *a priori* realm of pure logical possibility and untethers the domain of mathematical intelligibility from sensibility. This severing of the possible from the sensible is underwritten by the chaotic structure of absolute time. Where the bounds of real possibility remain circumscribed by the correlational *a priori*, intellectual intuition uncovers a realm of absolute possibility whose only constraint is non-contradiction. Moreover, where real possibility is subsumed by time as form of transcendental subjectivity, absolute possibility indexes a time no longer anchored in the coherence of a subjective relation to reality or in the correlation between thinking and being. Thus the intellectual intuition of absolute possibility underwrites the 'diachronicity' of thinking and being; a diachronicity which for Meillassoux is implicit in the ancestral dimension of being uncovered by modern science. In ratifying the diachronicity of thinking and being, modern science exposes thought's contingency for being: although thought needs being, being does not need thought.

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[11] *Ibid.*, 111.

[12] *Ibid.*, 28.

The question, then, is whether Meillassoux's reinstatement of intellectual intuition may not compromise the very asymmetry which he takes to be science's speculative import. Similarly, it may be that the Galilean hypothesis harbours ramifications concerning the mathematization of thinking which also vitiate Meillassoux's appeal to intellectual intuition. To consider these questions, we must examine the distinction which Meillassoux invokes in order to stave off idealism. This is the distinction between the reality of the ancestral phenomenon and the *ideality* of the ancestral statement. It is on the basis of this distinction that Meillassoux, like Badiou, seeks to distance himself from the Pythagorean thesis according to which being is mathematical:

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[13] This is the upshot of Heidegger's reinterpretation of Kant in *Kant and the Problem of Metaphysics*, tr. R. Taft (Indianapolis: Indiana University Press, 1990).

> [W]e will maintain that, for their part, the statements bearing on the ancestral phenomenon which can be mathematically formulated designate effective properties of the event in question (its date, its duration, its extension), even though no observer was present to experience it directly. Accordingly, we will maintain a Cartesian thesis about matter, but not, let us underline this, a Pythagorean one: we shall not claim that the being of the ancestral phenomenon is intrinsically mathematical, or that the numbers and equations deployed in ancestral statements exist in themselves. For it would then be necessary to maintain that the ancestral phenomenon is a reality every bit as ideal as that of a number or an equation. Generally speaking, statements are ideal insofar as they possess a signifying reality; but their eventual referents are not necessarily ideal (the cat on the mat is real, though the statement 'The cat is on the mat' is ideal.) In this regard, we will say that the referents of ancestral statements bearing on dates, volumes, etc. existed 4.56 billion years ago as described by these statements – but not these statements themselves, which are contemporaneous with us.[14]

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[14] *Après la finitude*, 28-9.

This distinction between the reality of the ancestral phenomenon and the ideality of the ancestral statement is necessary in order to maintain the ontological disjunction between the correlational present and the ancestral past – precisely the diachronicity which correlationism cannot countenance. Nevertheless, if Meillassoux evokes such a distinction, he cannot sequester it on the side of being alone, for it must pertain to thinking as well as to being. Thus this secondary disjunction between real and ideal subdivides both poles of the primary disjunction between thinking and being: thought possesses a real and an ideal aspect, just as being possesses real and ideal features. Clearly, the diachronicity harboured by the arche-fossil can only be indexed by a disjunction between the ideality of the ancestral statement and the reality of the ancestral phenomenon which promises to prove irreducible to the neighbouring distinctions between the real and ideal aspect of thought and the real and ideal features of being, for both of these remain entirely encompassed by the correlation between thinking and being. For the point of Meillassoux's distinction between physical reality and discursive ideality is to discount the idealist claim that the reality of the phenomenon is exhausted by its mathematical idealization in the statement. Although the reality of the ancestral phenomenon can be mathematically encoded, it must transcend this mathematical inscription, otherwise Meillassoux finds himself endorsing Pythagoreanism. And as Meillassoux well knows, the latter provides no bulwark against correlationism, since it effectively renders being isomorphic with mathematical ideality. The point seems to be that the reality of the ancestral phenomenon must be independent of its mathematical intellection – being does not depend upon the existence of mathematics. But Meillassoux's problem consists in identifying a speculative guarantor for this disjunction between reality and ideality which would be entirely independent of the evidence provided by the mathematical idealization of the ancestral phenomenon in the ancestral statement. To rely upon the latter would be to render this speculative disjunction supervenient upon the procedures of post-critical epistemology and thus to find oneself confronted by the injunction to verify or otherwise justify it within the ambit of the correlationist circle.

Thus the question confronting Meillassoux's speculative materialism is: under what conditions would this secondary disjunction between the real and the ideal be intellectually intuitable without reinstating a correlation at the level of the primary disjunction between thinking and being? To render the distinction between the reality of the phenomenon and the ideality of the statement dependent upon intellectual intuition is to leave it entirely encompassed by one pole of the primary disjunction, *i.e.* thought, and hence to recapitulate the correlationist circle. For just as we cannot maintain that this primary disjunction is intellectually intuitable without reinscribing being within the ideal pole of the secondary disjunction, similarly, we cannot maintain that the secondary disjunction is encoded in the ancestral statement without reincorporating the real within the noetic pole of the primary disjunction. How, then, are we to guarantee the disjunction between real and ideal independently of the intelligible ideality of science's ancestral claims? For the ideality of the latter cannot be a guarantor of the reality of the former. Moreover, intellectual intuition subsumes both poles of the secondary disjunction within one pole of the primary disjunction.

Consequently, Meillassoux is forced into the difficult position of attempting to reconcile the claim that being is not inherently mathematical with the claim that being is intrinsically accessible to intellectual intuition. He cannot maintain that being is mathematical without lapsing into Pythagorean idealism; but this relapse into Pythagoreanism is precluded only at the cost of the idealism which renders being the correlate of intellectual intuition. The problem lies in trying to square the Galilean-Cartesian hypothesis that being is mathematizable with an insistence on the speculative disjunction whereby being is held to subsist independently of its mathematical intuitability. Part of the difficulty resides in the fact that although Meillassoux presumably discounts metaphysical and phenomenological conceptions of being, whether as necessary substance or eidetic presence, since both are encompassed within the correlationist circle, he has not provided us with a non-metaphysical and non-phenomenological alternative – such as we find, for example, in Badiou's subtractive conception of the void.[15] Like Badiou, Meillassoux recuses the Kantian formulation of the problematic of access while striving to uphold the authority of scientific rationality. However, unlike Badiou, he does not characterize ontology as a situation within which the presentation of being is subtractively inscribed in such a way as to obviate any straightforwardly metaphysical or phenomenological correlation between thought and being.

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[15] *Cf. Being and Event*, tr. O. Feltham (London: Continuum, 2006).

But as a result he must explain why – given that science teaches us that intellection is in no way an ineliminable feature of reality but merely a contingent by-product of evolutionary history, and given that for Meillassoux himself reality can be neither inherently mathematical nor *necessarily* intelligible – being should be susceptible to intellectual intuition. In this regard, it is worth noting that one of the more significant ramifications of the Galilean-Cartesian hypothesis about the mathematizability of nature consists in the recent endeavour to deploy the resources of mathematical modelization in order to develop a science of cognition. Admittedly, the latter is still in its infancy; nevertheless, its maturation promises to obviate the Cartesian dualism of thought and extension – and perhaps also the residues of the latter which subsist in Meillassoux's own brand of speculative materialism – while conceding nothing to correlationism. The diachronic disjunction between thinking and being is not the only speculative implication harboured by modern science; the development of a science of cognition implies that we, unlike Descartes and Kant, can no longer presume to exempt thought from the reality to which it provides access, or continue to attribute an exceptional status to it.

If thought can no longer be presumed to exempt itself from the reality which it thinks, and if the real can no longer be directly mapped onto being, or the ideal directly mapped onto thought, then thinking itself must be reintegrated into any speculative enquiry into the nature of reality. Thus the central question raised by Meillassoux's speculative materialism becomes: Does the principle of factuality, which states that 'everything that exists is necessarily contingent', *include itself* in its designation of 'everything'? Like Badiou, Meillassoux sees Cantor as having definitively pulverized the concept of 'totality', so that the latter is now devoid of ontological pertinence. But we do not have to assume a spurious totalization of existence to enquire whether the thought that everything is necessarily contingent is itself necessarily contingent. On the contrary, all that we assume is that thinking is just a contingent fact like any other. What we should refuse, however, is the claim that it is necessary to exempt the thought that 'everything is necessarily contingent' from the existential 'fact' that everything is contingent on the grounds that a transcendental abyss separates thinking from being. Once the recourse to this transcendental divide has been ruled out, we are obliged to consider what follows if the principle refers to itself. More precisely, we must consider whether the truth of the principle, and *a fortiori* Meillassoux's speculative overcoming of correlationism, entails its self-reference. Here we have to distinguish between the contingency of the existence of the thought, which does *not* generate paradox, and the contingency of the truth of the thought, which does. Two distinct possibilities can be envisaged depending on whether the thought does or does not refer to itself. First let us consider what follows if it does refer to itself. Then if the thought exists, it must be contingent. But if it is contingent then its negation could equally exist: 'Not everything is necessarily contingent'. But in order for the thought to exclude the possibility of the truth of its negation, then its truth must be necessary, which means that the thought must exist necessarily. But if it exists necessarily then not everything that exists is necessarily contingent; there is at least one thing which is not, *i.e.* the thought itself. Thus if the thought refers to itself it necessitates the existence of its own negation; but in order to deny the possible truth of its negation it has to affirm its own necessary truth, and hence contradict itself once more. What if the thought does not refer to itself? Then there is something which is necessary, but which is not included under the rubric of existence. Reality is 'not-all' because the thought that 'everything is necessarily contingent' is an ideality which exempts itself from the reality which it designates. But then not only does this very exemption become necessary for the intelligible ideality of the thought that 'everything is necessarily contingent', but the intelligibility of reality understood as the necessary existence of contingency becomes dependent upon the coherence of a thought whose exemption from reality is necessary in order for reality to be thought as necessarily contingent. Thus the attempt to exempt the ideal from the real threatens to re-instantiate the correlationist circle once more. Lastly, let us consider the possibility that the necessary contingency of existence does not depend on the truth of the thought 'everything is necessarily contingent'. If everything is necessarily contingent regardless of the truth of the thought 'everything is necessarily contingent', then everything could be necessarily contingent even if we had no way of thinking the truth of that thought coherently. But this is to re-introduce the possibility of a radical discrepancy between the coherence of thinking and the way the world is in-itself – any irrational hypothesis about the latter become possible and strong correlationism looms once again.

Whatever the shortcomings attendant upon their lack of formal stringency, these conjectures seem to point to a fundamental dilemma confronting Meillassoux's project. If he accepts – as we believe he must – that thinking is part of being as the second fundamental speculative implication of scientific rationality after that of diachronicity, then the universal scope of the principle of factuality generates a paradox whereby it seems to contradict itself: the claim that everything is necessarily contingent is only true if this thought exists necessarily. Alternatively, if Meillassoux decides to uphold the exceptional status of thinking vis-à-vis being then he seems to compromise his insistence on diachronicity, for the intelligible reality of contingent being is rendered dependent upon the ideal coherence of the principle of factuality. Indeed, the appeal to intellectual intuition in the formulation of the principle already seems to assume some sort of reciprocity between thinking and being

As one might expect, both these criticisms – *viz.*, that intellectual intuition reestablishes a correlation between thought and being and that the principle of factuality engenders a paradox – have elicited typically acute responses from Meillassoux. In a personal communication, Meillassoux has explained why he believes he can parry both objections. For Meillassoux, the principle of factuality is designed to satisfy two requirements. First, the fundamental *rationalist* requirement that reality be perfectly amenable to conceptual comprehension. This is a rebuttal of the prototypical religious notion that existence harbors some sort of transcendent mystery forever refractory to intellection. Second, the basic *materialist* requirement that being, though perfectly intelligible, remain irreducible to thought. Meillassoux insists that the claim that everything that is is necessarily contingent satisfies both criteria. In his own words:

> Being is thought without-remainder insofar as it is without-reason; and the being that is thought in this way is conceived as exceeding thought on all sides because it shows itself to be capable of producing and destroying thought as well as every other sort of entity. As a factual act produced by an equally factual thinking being, the intellectual intuition of facticity is perfectly susceptible to destruction, but not that which, albeit only for an instant, it will have thought as the eternal truth which legitimates its name, *viz.*, that it is itself perishable just like everything else that exists. […] Thus, it is on account of its capacity for a-rational emergence that being exceeds on all sides whatever thought is able to describe of its factual production; nevertheless, it contains nothing unfathomable for thought because being's excess over thought just indicates that reason is forever absent from being, not some eternally enigmatic power.[16]

These remarks already prefigure Meillassoux's recusal of the second objection, *viz.*, that if applied to itself, the principle of factuality becomes contradictory. Meillassoux maintains that the paradox can be averted by carefully distinguishing the referent of the principle from its (factual) existence. Thus, though the latter is indeed contingent, and hence as liable to be as not to be, the former is strictly necessary, and indeed it is the eternal necessity of the principle's referent that guarantees the perpetual contingency of the principle's existence:

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[16] Personal Communication, 9/8/2006.

> One may then say that the principle as something that is *thought* in reality is factual, and hence contingent. But what is not contingent is the referent of this principle; *viz*., facticity as such insofar as it is necessary. And it is because this facticity is necessary that the principle, insofar as it is – in fact – proffered and insofar as it will be or will have been thought by some singular entity – no matter when or under what circumstances – it is for this reason that the principle will always be true the moment it is posited or thought. What is contingent is that the principle, as a meaningful statement, is actually thought; but what is not contingent is that it is true insofar as it is – as a matter of fact – thought in a time and place – no matter when or where. Consequently there is no paradox so long as the principle's domain of application is precisely restricted to entities in their being.[17]

The crucial operative distinction here is that between the necessity of contingency *qua* referent of thought and the contingency of the (factual) existence of the thought that everything is necessarily contingent. The question then is: How does Meillassoux propose to account for this separation between the contingent existence of thought and the necessary existence of its referent? Clearly, this separation is intended to safeguard the coherence of the principle, as well as the materialist primacy of the real over the ideal, by ensuring a strict differentiation between thought and reality. But given that, for Meillassoux, thought's purchase on reality is guaranteed by intellectual intuition, it follows that it must also be the latter which accounts for this distinction between thought and referent. Accordingly, it would seem that it is in and through the intellectual intuition of absolute contingency that the contingency of the thought is separated from the necessity of its referent. Everything then hinges on how Meillassoux understands the term 'intellectual intuition'.

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[17] *Ibid.*

Clearly, he cannot be using the term in its Kantian acceptation, since, for Kant, intellectual intuition actively create its own object, unlike sensible intuition, which passively receives an independently existing object. According to Kant, only the intuitive understanding of an 'archetypical' intellect (*intellectus archetypus*) unburdened by sensibility – such as God's – possesses this power to produce its object; for our discursive understanding, mediated as it is by sensibility, it is the synthesis of concept and intuition which yields the cognitive relation between thought and its object. Meillassoux clearly rejects Kant's representationalist account of the relation between mind and world, just as he must refuse phenomenology's appeal to an intentional correlation between thought and referent. Yet it is far from evident what plausible theory of intellectual intuition could simultaneously ensure the scission between the contingency of thought and the necessity of its referent – which Meillassoux takes to be sufficient to stave off contradiction – while circumventing representational and intentional correlation as well as abjuring the archetypical intellect's production of its object (since the claim that intellection creates its object is clearly incompatible with any commitment to materialism). Though Meillassoux insists that the paradox of absolute contingency can be obviated by restricting the principle's domain of reference to 'entities in their being', he does not explain how he proposes to enforce this rigid demarcation between the principle's contingently effectuated *intension* and what he deems to be its 'eternally' necessary *extension.*

'Reference', of course, is intimately related to 'truth', but though Meillassoux claims that the truth of the principle is guaranteed by its ontological referent, this connection is anything but semantically transparent, since the extension of the expression 'absolute contingency' is no more perspicuous than that of the term 'being'. The customary prerequisite for realist conceptions of truth is an extra-theoretical account of the relation between intension and extension, but Meillassoux's attempt to construe the latter in terms of intellectual intuition makes it exceedingly difficult to see how it could ever be anything other than intra-theoretical.[18] Indeed, it is unclear how the referent 'absolute contingency' could ever be rendered intelligible in anything other than a purely conceptual register. Consequently, Meillassoux presents us with a case in which the determination of extension, or 'truth', remains entirely dependent upon a conceptually stipulated intension, or 'sense' – the referent 'absolute contingency' is exclusively determined by the sense of the contingently existing thought 'everything that is, is absolutely contingent'. But if the only way to ensure the separation between the (contingently existing) ideality of meaning and the (necessarily existing) reality of the referent is by making conceptuality constitutive of objectivity, then the absolutization of the non-correlational referent is won at the price of an absolutization of conceptual sense which violates the materialist requirement that being not be reducible to thought. Far from reconciling rationalism with materialism, the principle of factuality, at least in this version, continues to subordinate extra-conceptual reality to a concept of absolute contingency.

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[18] *Cf.* Hilary Putnam, 'The Meaning of 'Meaning'' in *Mind, Language, and Reality: Philosophical Papers* Volume 2 (Cambridge: Cambridge University Press, 1975), 236.

Although Meillassoux's speculative overcoming of correlationism strives to deploy the latter's strongest weapons against it – as we saw with the principle of factuality itself – the distinction between the real and the ideal is part of the correlationist legacy which cannot be mobilized against it without first undergoing decontamination. For correlationism secures the transcendental divide between the real and the ideal only at the cost of turning being into the correlate of thought. Meillassoux is right to insist that it is necessary to pass through correlationism in order to overcome it, and in this regard we should follow his recommendation and find a way of deploying the distinction between real and ideal against correlationism itself. But precisely here a fundamental speculative problem reveals itself, namely: Can we think the diachronic disjunction between real and ideal while obviating any recourse to a transcendental divide between thinking and being?

Potentiality and Virtuality[1]

Quentin Meillassoux

1. A DISSOLVED ONTOLOGICAL PROBLEM

'Hume's problem', that is to say, the problem of the grounding of causal connection, has known the fate of most ontological problems: a progressive abandonment, legitimated by the persistent failure that various attempts at resolving it have met with. Thus Nelson Goodman, in a famous article[2] can affirm without hesitation the 'dissolution of the old problem of induction'. This dissolution, as laid out by Goodman, concerns the ontological character of Hume's problem, which obliges whoever accepts its terms to accept the necessity of a principle of the uniformity of nature, a principle the proof of whose existence will then be attempted. The argument

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[1] Originally published as 'Potentialité et virtualité' in *Failles* no. 2 (Spring 2006).

[2] N. Goodman, N, *Fact, Fiction and Forecast* (Camb., MA: Harvard University Press, 1983 [4th. Ed.]), Ch. 3.

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which, in Goodman, concludes with the dissolution of the 'old problem of induction' is as follows:

- The problem of induction as formulated by Hume consists fundamentally in asking how we can justify that the future should resemble the past.
- Goodman, following Hume, fully affirms that we simply cannot do so: this justification is impossible by rational means.
- We must therefore abandon this undecidable problem, in order to pose it under another form, in which it will once again become amenable to treatment, namely: which rule, or set of rules, do we apply when we – and above all, when scientists – make inductive inferences? The question therefore no longer consists in proving the resemblance of the future and the past, but in describing an existing practice (induction) so as to try to extract its implicit rules. The dissolution of the ontological problem is thus accompanied by its methodological and epistemological reformulation: instead of vainly trying to prove the necessity of observable constants, we must set ourselves the task of describing the precise rules which scientists apply, usually implicitly, when they present us with inductive inferences. Thus Goodman can consider Hume's solution of his own problem – that our belief in induction derives from habit and not from consequent reasoning – correct in principle, however partial it might be: because in passing from the insoluble problem of the justification of an ontological principle to that of an effective genesis in the mind, Hume had already registered the intuition that the only adequate treatment of such a problem would consist

in describing the effective process by which we draw inductions, not in seeking a metaphysical foundation for it. Consequently, Goodman proposes to follow such a path, forsaking however the psychological description of the spontaneous behaviour of individuals to which Hume confined himself (*viz.*, that we believe in our inductive inferences because of our faculty of believing more and more intensely in recurrent phenomena) in favour of a description of the practices and procedures of the scientific community.

In short, the dissolution of the problem of induction comprises two phases:

- A negative phase of abandonment of the supposedly insoluble problem.
- A phase of recomposition or reformulation of the problem, which consists in passing from an ontological question – is there something like a necessary connection between events? – to a question which evacuates all ontological problems, applying itself instead to the description of effective practices by which scientific inductions are carried out.

2. PRECIPITATION OF THE PROBLEM

My proposal is as follows: to contest the dissolution of Hume's problem, that is to say the abandonment of the ontological formulation of the problem, by maintaining that the latter can be resolved in a way which has, so it would seem, been hitherto neglected. I will intervene, then, only in the first stage of dissolutory reasoning – which is presupposed by the second (the recomposition of new problems): the proposition that the ontological problem of induction must be abandoned, since it is insoluble.

To open anew the ontological problem of the necessity of laws, we must distinguish this problem from that posed by Hume, which is in fact a *particular, already oriented,* formulation of this problem taken in its full generality.

Hume's formulation of the problem is as follows: Can we prove the effective necessity of the connections observed between successive events? The presupposition made both by Hume and by Goodman is that, if we cannot, then *any* ontological treatment of what is called real necessity (that is to say, of the necessity of laws, as opposed to so-called logical necessity) is consigned to failure, and consequently must be abandoned. I believe that it is possible at once to accept the Hume-Goodman verdict of failure, and yet to dispute that it follows that every ontological approach to the problem is thereby disqualified. For the ontological question of real necessity, formulated in its full generality, is not married to the Humean formulation, but rather can be formulated as follows: Can a conclusive argument be made for the necessity *or the absence of necessity* of observable constants? Or, once again: is there any way to justify either the claim that the future must resemble the past, *or* the claim that the future might *not* resemble the past? In the latter case, it is a question of establishing, not that the observable laws must change in the future, but that it is contingent that they should remain identical. This perspective must be distinguished from any thesis affirming the necessity of the changing of laws – for such a thesis would be a variant of the solution envisaged by Hume: this changing of laws, precisely in so far as it is necessary, would suppose yet another law, in a higher sense – a law, itself immutable, regulating the future changes of current constants. Thus it would lead straight back to the idea of a uniformity of nature, simply pushing it back one level.

On the contrary, the ontological approach I speak of would consist in affirming that it is possible rationally to envisage that the constants could effectively change *for no reason whatsoever*, and thus with no necessity whatsoever; which, as I will insist, leads us to envisage a contingency so radical that it would incorporate all conceivable futures of the present laws, *including that consisting in the absence of their modification.* It is thus a question of justifying the effective existence of a radical contingency not only of events submitted to laws, but of laws themselves, reduced to factical constants, themselves submitted to the eventuality of an ultimately chaotic becoming – that is to say, a becoming governed by no necessity whatsoever.

Let us be sure to grasp the significance of such a position, and what it involves. The problem of induction, as soon as it is formulated as the problem of the effective necessity of laws, issues in an avowal of the defeat of reason, because nothing contradictory can be detected in the contrary hypothesis of a changing of constants. For reason does not seem to be capable of prohibiting *a priori* that which goes against the purely logical necessity of non-contradiction. But in that case, a world governed by the imperatives of reason, would be governed only by such logical imperatives. Now, this would mean that anything non-contradictory *could* (but not *must*) come to pass, implying precisely the *refusal* of all causal necessity: for causality, on the contrary, asserts that amongst different, equally conceivable events certain of them must come to pass rather than others. This being so, we would indeed have to agree that *in a rational world everything would be devoid of any reason to be as it is*. A world which was entirely governed by logic, would in fact be governed *only* by logic, and consequently would be a world where nothing has a reason to be as it is rather than otherwise, since nothing contradictory can be perceived in the possibility of such a being-otherwise. Every determination in this world would therefore be susceptible to modification: but no ultimate reason could be given for such modifications, since in that case a prior cause would have to be supposed, which it would not be possible to legitimate in preference to another, equally thinkable. But what would such a world be? To speak in Leibnizian terms, it would be world *emancipated from the Principle of Sufficient Reason* – a world discharged of that principle according to which everything must have a reason to be as it is rather than otherwise: a world in which the logical exigency of consistency would remain, but not the metaphysical exigency of persistence.

Hume's discovery, according to our account, is thus that *an entirely rational world would be by that very token entirely chaotic*: such a world is one from which the irrational belief in the necessity of laws has been extirpated, since the latter is opposed in its very content to what constitutes the essence of rationality. If, contrary to our hypothesis, one were to *supplement* logical necessity with real necessity, if one were to doubly limit the possible both by non-contradiction and by actual constants, one would then create an artificial riddle irresoluble by reason, since such an hypothesis would amount to the explicit, wholesale fabrication of a necessity foreign to all logic. *The Principle of Sufficient Reason is thus another name for the irrational* – and the refusal of this principle, far from being a way of doing away with reason, is in my opinion the very condition of its philosophical reactualisation. The refusal of the Principle of Sufficient Reason is not the refusal of reason, but the discovery of the power of chaos harboured by its fundamental principle (non-contradiction), as soon as the latter is no longer supplemented by anything else – the very expression 'rational chaos' from that moment on becoming a pleonasm.

But such a point of view also provides us with a new understanding of the 'end of metaphysics'. If metaphysics is essentially linked to the postulation – whether explicit or not – of the Principle of Sufficient Reason, the former cannot be understood, in Heideggerian fashion, as the final accomplishment of reason, but as the final accomplishment of real necessity, or again of what I call the reification of rational necessity. From this point of view, I understand by metaphysics, any postulation of a real necessity: so that it would constitute a metaphysical postulation that all or certain given determinate situations in this world are necessary (a determination being definable as a trait capable of differentiating one situation from another, equally thinkable situation). A metaphysics would thus affirm that it is possible, and moreover that it is the very task of reason, to establish why things must be thus rather than otherwise (why some particular individuals, law(s), God(s), *etc.*, rather than other individuals, laws, etc.)

3. ONTOLOGICAL REFORMULATION

The question now is as follows: in accepting the possibility of a change in natural constants, have we not suppressed the problem of induction itself? In other words: once the idea of a necessary constancy of laws is refused, can Hume's question still be posed in the form of a *problem* to be resolved, and more precisely as an ontological problem? It certainly can.

I would affirm that, indeed, there is no reason for phenomenal constants to be constant. I maintain, then, that these laws could change. One thereby circumvents what, in induction, usually gives rise to the problem: the proof, on the basis of past experience, of the future constancy of laws. But one encounters another difficulty, which appears at least as redoubtable: if laws have no reason to be constant, *why do they not change at each and every instant*? If a law is what it is purely contingently, it could change at any moment. The persistence of the laws of the universe seems consequently to break all laws of probability: for if the laws are effectively contingent, it seems that they must frequently manifest such contingency. If the duration of laws does not rest upon any necessity, it must be a function of successive 'dice rolls', falling each time in favour of their continuation or their abolition. From this point of view, their manifest perenniality becomes a probabilistic aberration – and it is precisely because we never observe such modifications that such an hypothesis has seemed, to those who tackled the problem of induction, too absurd to be seriously envisaged.

Consequently, the strategy of the reactualision of the ontological problem of induction will be as follows:

1) We affirm that there exists an ontological path which has not been seriously explored: that consisting in establishing, not the uniformity of nature, but the contrary possibility of every constant being submitted to change in the same way as any factual event in this world – and this without any superior reason presiding over such changes.

2) We maintain that the refusal to envisage such an option for the resolution of the problem is based on an implicit probabilistic argument consisting in affirming that every contingency of laws must manifest itself in experience; which amounts to identifying the contingency of laws with their frequent modification.

3) Thereby, we have at our disposal the means to reformulate Hume's problem without abandoning the ontological perspective in favour of the epistemic perspective largely dominant today. Beginning to resolve the problem of induction comes down to *delegitimating the probabilistic reasoning at the origin of the refusal of the contingency of laws*. More precisely, it is a matter of showing what is fallacious in the inference from the contingency of laws to the frequency (and thus the observability) of their changing. This amounts to refusing the application of probability to the contingency of laws, thereby producing *a valuable conceptual distinction* between contingency understood in this radical sense and the usual concept of contingency conceived as chance subject to the laws of probability. Given such a distinction, it is no longer legitimate to maintain that the phenomenal stability of laws compels us to suppose their necessity. This permits us to demonstrate that, without serious consequence, real necessity can be left behind, and with it the various

supposedly insoluble enigmas it occasioned.

In short, *Hume's problem becomes the problem of the difference between chance and contingency*.

4. PRINCIPLE OF THE DISTINCTION CHANCE/CONTINGENCY

To demonstrate why laws, if they can change, have not done so frequently, thus comes down to disqualifying the legitimacy of probabilistic reasoning when the latter is applied to the laws of nature themselves, rather than to events subject to those laws. Here is how such a distinction can, in my opinion, be effectively made: to apply a probabilistic chain of reasoning to a particular phenomenon supposes as given the universe of possible cases in which the numerical calculation can take place. Such a set of cases, for example, is given to a supposedly symmetrical and homogeneous object, a die or a coin. If the die or the coin to which such a calculative procedure is applied always falls on the same face, one concludes by affirming that it has become highly improbable that this phenomenon is truly contingent: the coin or die is most likely loaded, that is to say, it obeys a law – for example the law of gravitation applied to the ball of lead hidden within. And an analogous chain of reasoning is applied in favour of the necessity of laws: identifying the laws with the different faces of a universal Die – faces representing the set of possible worlds – it is said, as in the precedent case, that if these laws are contingent, we would have been present at the frequent changing of the 'face'; that is to say, the physical world would have changed frequently. Since the 'result' is, on the contrary, always the same, the result must be 'loaded' by the presence of some hidden necessity, at the origin of the constancy of observable laws. In short, we begin by giving ourselves a set of possible cases, each one representing a conceivable world having as much chance as the others of being chosen in the end, and conclude from this that it is infinitely improbable that our own universe should constantly be drawn by chance from such a set, unless a hidden necessity presided secretly over the result.[3]

Now, if this reasoning cannot be justified, it is because there does not truly exist any means to construct a set of possible universes within which the notion of probability could still be employed. The only two means for determining a universe of cases are recourse to experience, or recourse to a mathematical construction capable of justifying unaided the cardinality (the 'size') of the set of possible worlds. Now, both of these paths are equally blocked here. As for the empirical approach, obviously no-one – unless perhaps Leibniz's God – has ever been at leisure to survey the entire set of possible worlds. But the theoretical approach is equally impossible: for what would be attempted here would be to affirm that there is an infinity of possible worlds, that is to say of logically

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[3] It was through reading Jean-René Vernes' *Critique de la raison aléatoire* (Paris: Aubier 1981) that I first grasped the probabilistic nature of the belief in the necessity of laws. Vernes proposes to prove by such an argument the existence of a reality external to the representations of the Cogito, since it alone would be capable of giving a reason for a continuity of experience which cannot be established through thought alone.

As I have remarked elsewhere, I believe that an equally *mathematical* – more specifically, probabilistic – argument underlies the Kantian transendental deduction of the categories in the *Critique of Pure Reason.* Kant's argument – as elaborate as it might be in its detail – seems to me to be in perfect continuity with what we might call the argument of 'good sense' against the contingency of natural laws. I argue that Kant's deduction consists simply in exacerbating the thinkable worlds, which could only reinforce the conviction that the constancy of just one of them is extraordinarily improbable. But it is precisely on this point that the unacceptable postulate of our 'probabilist sophism' hinges, for I ask then: of which infinity are we speaking here? We know, since Cantor, that infinities are multiple, that is to say, are of different cardinalities – more or less 'large', like the discrete and continuous infinities – and above all that these infinities constitute a multiplicity it is impossible to foreclose, since a set of all sets cannot be supposed without contradiction. The Cantorian revolution consists in having demonstrated that infinities can be differentiated, that is, that one can think the equality or inequality of two infinities: two infinite sets are equal when there exists between them a biunivocal correspondence, that is, a bijective function which makes each element of the first correspond with one, and only one, of the other. They are unequal if such a correspondence does not exist. Further still, it is possible to demonstrate that, whatever infinity is considered, *an infinity of superior cardinality* (a 'larger' infinity) *necessarily exists*. One need only construct (something that is always possible) the set of the parts of this infinity. From this perspective, it becomes impossible to think a last

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'probabilistic sophism' critiqued in the present article, to the point where the following is argued: if laws were contingent, they would change so frequently, so frenetically, that we would never be able to grasp anything whatsoever, because none of the conditions for the stable representation of objects would ever obtain. In short, if causal connection were contingent, we would know it so well that we would no longer know anything. As can be seen, this argument can only pass from the notion of contingency to the notion of frequency given the presupposition that it is extraordinarily *improbable* that the laws should remain constant rather than being modified in every conceivable way at every moment. ('Temps et surgissement ex nihilo', presentation in the seminar series *Positions et arguments* at the École Normale Supérieure, April 2006. See http://www.diffusion.ens.fr/index.php?res=conf&idconf=701).

infinity that no other could exceed.[4]

But in that case, since there is no reason, whether empirical or theoretical, to choose one infinity rather than another, and since we can no longer rely on reason to constitute an absolute totality of all possible cases, and since we cannot give any particular reason upon which to ground the existence of such a universe of cases, we cannot legitimately construct any set within which the foregoing probabilistic reasoning could make sense. This then means that it is indeed incorrect to infer from the contingency of laws the necessary frequency of their changing. So it is not absurd to suppose that the current constants might remain the same whilst being devoid of necessity, since the notion of possible change – and even chaotic change, change devoid of all reason – can be separated from that of frequent change: *laws which are contingent, but stable beyond all probability, thereby become conceivable*.

We must add, however, that there are two possible versions of such a strategy of resolution:

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[4] The set of parts of a set is the set of subsets of that set, that is to say the set of all possible regroupings of its elements. Take, for example, the finite set comprising three elements: (1, 2, 3). The set of its parts comprises (apart from the empty set, which is a part of every set): (1), (2) and (3) (the 'minimal' parts composed from its elements alone), (1,2), (1,3), (2,3), and (1,2,3) – this last part (1,2,3) being considered as the maximal part of the set, identical to it. It is clear that this second set is larger (possesses more elements) than the first. It can be proved that this is always the case, the case of an infinite set included. It is thus possible, for every infinite set, to construct a set of superior cardinality: the infinity which comprises the set of its parts. But this construction can equally be carried out on this new infinity, and so on indefinitely. For a clear introduction to axiomatic set theory, see Laurent Schwarz, *Analyse* I (Paris:Hermann,1991). The reference work on the philosophical importance of set-theory remains for me Alain Badiou's *L'être et l'événement* (Paris: Seuil, 1988), translated by Oliver Feltham as *Being and Event* (London: Continuum, 2006).

- A 'weak version' – a critical version, let us say – that would consist in limiting the application of aleatory reasoning to cases already submitted to laws (to observable events governed by the constants determining the universe where the calculation is carried out) but not to the laws themselves. Thereby, one would not be able to demonstrate positively the absence of real necessity, but only that its presupposition is of no use in giving an account of the stability of the world. One would content oneself with emphasising the theoretical possibility of contingent but indefinitely stable laws, by disqualifying the probabilist reasoning which concludes that such an hypothesis is aberrant. The two terms of the alternative – real necessity, or the contingency of laws – being equally non-demonstrable, the heuristic advantage of choosing the second hypothesis is invoked, by showing that it would obviate certain classical speculative enigmas linked to the unchallenged belief in the uniformity of nature.
- A 'strong', that is to say, speculative, version of the response to Hume's problem, would consist in maintaining positively the contingency of laws. Such an approach would incorporate the assets of the argument from heuristics in the above approach to its profit, but would go further, claiming to effectuate the consequences of the Cantorian intotalisation.

My overall project is to not limit myself to the critico-heuristic path, but to reactivate a speculative path (claiming to speak for the things themselves, despite the critical proscription), without ever reactivating metaphysics (that is to say, the absolutisation of a real necessity). Since it is impossible to give the full details of such an approach here, I will content myself with isolating the principal aspects of the critico-heuristic path.[5]

5. ONTOLOGICAL CONSEQUENCES OF THE NON-ALL.

We will adopt the following perspective: we suppose the ontological effectivity of the intotalisation of cases, in order to draw the consequences of such an hypothesis upon the notion of becoming, and to envisage its speculative advantages over the inverse hypothesis of the pertinence of real necessity.

In order to do this, let us reconsider the notion of the contingency of laws by restricting the notion of law to what constitutes its minimal condition, if not its complete definition: namely a determinate set, finite or infinite, of possible cases – a law, deterministic or aleatory, always comes down to a specific set of indexed cases.[6] We will try to determine the sense of a becoming within which laws themselves would be contingent, by comparing such a conception with the traditional vision according to which becoming is only thinkable as governed by immutable laws.

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[5] For further indications as to the exigency of this reactivation, see my *Après la Finitude: Essai sur la nécessité de la contingence* (Paris:Seuil, 2006). I lay out the possible principles of the speculative approach in a forthcoming paper to be published by Éditions Ellipses (proceedings of Francis Wolff's Nanterre 2001 seminar series *Positions et arguments*).

[6] I obviously do not claim that a law can be reduced to a set of possible cases, but that a condition of every law consists in the supposition that a determinate set of possible 'reals' can be discriminated amongst mere logical possibilities. I am thus adopting an argument *a minima*: I challenge the idea that one can even consider that there exists a set such that it would permit make of laws themselves cases of a Universe of laws (of a set of possible worlds determined by different laws). Since even this minimal condition of every law which is the definition of a determinate set of cases is not respected, this disqualifies *a fortiori* every attempt to think such laws in the same way as an event submitted to a law. To review the most important contemporary discussions of the notion of law, *cf.* A. Barberousse, P. Ludwig, M. Kistler, *La Philosophie des sciences au XXè siècle* (Paris: Flammarion, 2000), Chs. 4 and 5.

Every postulation of a legality, whether determinist or aleatory, identifies the world with a universe of possible cases indexable in principle, that is to say, pre-existing their ultimate discovery, and thereby constituting the potentialities of that universe. Whether a supposed law is considered probabilistic or deterministic, it posits in any case a pre-given set of possible cases which no becoming is supposed to modify. The affirmation of a fundamental hazard governing becoming thus does not challenge, but on the contrary presupposes, the essential fixity of such a becoming, since chance can only operate on the presupposition of a universe of cases determined once and for all. Chance allows time the possibility of a 'caged freedom', that is to say the possibility of the advent without reason of one of those cases permitted by the initial universe; but not the freedom of extracting itself from such a universe to bring forth cases which do not belong to the set thus defined. One cannot, within the aleatory vision of the world, deduce in univocal fashion the succession of events permitted by the law, but one can in principle *index* these events in their totality – even if, in fact, their apparent infinity prohibits for all time the definitive foreclosure of their recollection. In our terminology, such a belief in the aleatory legality of the world would constitute a *metaphysics of chance*, in so far as chance supposes the postulation of a law which would prescribe the fixed set of events within which time finds itself free to oscillate without any determined order. The belief in chance is inevitably a metaphysical belief, since it incorporates the belief in the factual necessity of determinate probabilistic laws, which it is no longer possible to account for except via the necessity of supposed deterministic laws.

In the guise of a radical evolution, it seems that since the Greeks, one conception, and one only, of becoming, has always imposed itself upon us: time is only the actualisation of an eternal set of possibles, the actualisation of Ideal Cases, themselves inaccessible to becoming – this latter's only 'power' (or rather 'impotence') being that of distributing them in a disordered manner. If modernity is traditionally envisaged, as in Koyré's expression, as the passage from the closed world to the infinite universe, it remains no less true that modernity does not break with Greek metaphysics on one essential point: finite or infinite, the world remains governed by the law – that is, by the All, whose essential signification consists in the subordination of time to a set of possibles which it can only effectuate, but not modify.

Now, it is such a decision, common to the Greeks and to the moderns, from which we believe to have extracted ourselves, *by detotalising the possible*, and as a result liberating time from all legal subordination. In supposing the ontological legitimacy of the Cantorian conception of the infinite, we distinguish the infinite from the All, since the infinity of the possible cannot be equated with its exhaustion (every infinite set has a determinate cardinality, which another infinity is capable of exceeding). From this decision results the possibility of clearly distinguishing between the notions of contingency and chance, and indeed between the notions of potentiality and virtuality. *Potentialities* are the non-actualised cases of an indexed set of possibilities under the condition of a given law (whether aleatory or not). *Chance* is every actualisation of a potentiality for which there is no univocal instance of determination on the basis of the initial given conditions. Therefore I will call *contingency* the property of an indexed set of cases (not of a case belonging to an indexed set) of not itself being a case of a set of sets of cases; and *virtuality* the property of every set of cases of emerging within a becoming which is not dominated by any pre-constituted totality of possibles.

In short: I posit that the law can be related to a universe of determinate cases; I posit that there is no Universe of universes of cases; I posit that time can bring forth any non-contradictory set of possibilities. As a result, I accord to time the capacity to bring forth new laws which were not 'potentially' contained in some fixed set of possibles; I accord to time the capacity to bring forth situations *which were not at all contained in precedent situations*: of creating new cases, rather than merely actualising potentialities that eternally pre-exist their fulguration. If we maintain that becoming is not only capable of bringing forth cases on the basis of a pre-given universe of cases, we must then understand that it follows that such cases irrupt, properly speaking, *from nothing*, since no structure contains them as eternal potentialities before their emergence: *we thus make irruption* ex nihilo *the very concept of a temporality delivered to its pure immanence*.

This merits further explanation. If one thinks becoming in the mode of a temporality which does not supervene upon any determinate law, that is to say, any fixed set of possibles, and if one makes of laws themselves temporal events, without subordinating the possible passage from one law to another to a higher-level law which would determine its modalities, time thus conceived is not governed by any non-temporal principle – it is delivered to the pure immanance of its chaos, its illegality. But this is just another way to emphasise – something Hume was the first to maintain – that from a determinate situation, one can never infer *a priori* the ensuing situation, an indefinite multiplicity of different futures being envisageable without contradiction. Grafting the Humean thesis onto that of Cantorian intotality, we see emerging a time capable of bringing forth, outside all necessity and all probability, situations which are not at all pre-contained in their precedents, since according to such a perspective, the present is never pregnant with the future. The paradigmatic example of such an emergence, to which we shall return, is obviously that of the appearance of a life furnished with sensibility directly from a matter within which one cannot, short of sheer fantasy, foresee the germs of this sensibility, an apparition which can only be thought as an supplement irreducible to the conditions of its advent.

As it emerges according to the model of intotality, time might either, for no reason, maintain a universe of cases, a configuration of natural laws, within which it is possible to index a determinate set of recurrent situations constituting its 'potentialities' – or might, equally without reason, cancel the old universe, or supplement it with a universe of cases which were not at all pre-contained in the precedents, nor in any other Substrate wherein the possibilities of being would be ranged for all eternity. We must thus grasp the fact that the inexistence of a pre-constituted All of possibles makes of the emergence of a possible anticipated by nothing in the preceding situation, the very manifestation of a time underwritten by no superior order: every emergence of a supplement irreducible to its premises, far from manifesting the intervention of a transcendent order in rational becoming, becomes the rigorous inverse: a manifestation of a becoming which nothing transcends.[7]

Thus, for 'potentialism' (the doctrine that sees in each possibility only a potentiality), time can only be the medium by which what was already a possible case, becomes a real case. Time, then, is the throw with which the die offers us one of its faces: but in order for the faces to be presented to us, it must be the case that they pre-existed the throw. The throw manifests the faces, but does not engrave them. According to our perspective, on the contrary, time is not the putting-in-movement of possibles, as the throw is the putting-in-movement of the faces of the die: time creates the possible at the very moment it makes it come to pass, it brings forth the possible as it does the real, it inserts itself in the very throw of the die, to bring forth a seventh case, in principle unforeseeable, which breaks with the fixity of potentialities. Time throws the die, but only to shatter it, to multiply its faces, beyond any calculus of possibilities. Actual events cease to be doubled by phantomatic possibilities which prefigure them before they occur, to be conceived instead as pure emergences, which before being are nothing, or, once again, which do not pre-exist their existence.

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[7] To be more precise, we must say that the distinction potentiality/virtuality is gnoseological rather than ontological, in so far as it designates essentially a difference in our cognitive relation with temporality. The perpetuation of a Universe of already-known cases (the constancy of laws) itself also escapes all consideration in terms of potentiality. For if one can determine potentialities within a determinate set of possibles, the maintenance across time of a determinate law itself cannot be evaluated in tems of potentiality (one possible case in a set of others). Even if the case which comes to pass is already indexed, it is only foreseen upon condition – an unforeseeable and improbabilisable condition – of the maintenance of the old set of

In other words, the notion of virtuality, supported by the rationality of the Cantorian decision of intotalising the thinkable, makes of irruption *ex nihilo* the central concept of an immanent, non-metaphysical rationality. Immanent, in that irruption *ex nihilo* presupposes, against the usually religious vision of such a concept, that there is no principle (divine or otherwise) superior to the pure power of the chaos of becoming; non-metaphysical in that the radical rejection of all real necessity assures us of breaking with the inaugural decision of the Principle of Sufficient Reason.

The most effective way to grasp properly the sense of the thesis proposed here is perhaps, as mentioned, to subtract it from the heuristic interest. This separation can be carried out through a series of elucidations permitted by such a model – elucidations of problems generally held to be insoluble, and thus sterile.

Firstly, as we have already said, such a model permits us to dissociate the notion of the stability of the empirical world from that of real necessity. The reprise of the problem of induction sought to show that it is possible to abandon the idea of a necessary constancy of laws, without this abandonment leading to the opposite idea of a

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possibles. Ultimately, the Universe can be identified with the factual re-emergence of the same Universe on the ground of non-totality. But the virtualising power of time, its insubordination to any superior order, lets itself be known, or is phenomenalised, when there emerges a novelty that defeats all continuity between the past and the present. *Every 'miracle' thus becomes the manifestation of the inexistence of God*, in so far as every radical rupture of the present in relation to the past becomes the manifestation of the absence of any order capable of overseeing the chaotic power of becoming.

necessarily disordered world. For the disqualification of the probabilist reasoning which implicitly founds the refusal of a contingency of laws suffices to demonstrate that the possible changing of constants of this world does not indicate their necessary continual upheaval: by affirming that the world could really submit its laws to its own becoming, one posits the concept of a contingency superior to all necessity, *one whose actualisation is therefore subject to no constraint* – and above all not that of a frequential law supposed to render more and more improbable the non-effectuation of certain possibilities. For to affirm that the changing of laws, if it *could* happen, *must* happen, is to subordinate anew the contingency of becoming to the necessity of a law, according to which every possible must eventually be actualised. An entirely chaotic world – submitting every law to the power of time – could thus in principle be phenomenally *indiscernible* from a world subject to necessary laws, since a world capable of everything must *also* be able *not* to effect all that it is capable of. Thus it becomes possible to justify the postulate of all natural science – namely the reproducibility of experimental procedures, supposing a general stability of phenomena – whilst assuming the effective absence of a principle of uniformity of nature, and by the same token abandoning the canonical enigmas linked to the hypothesis of a necessity of laws. But this abandonment does not proceed, as in Goodman, from a simple refusal to think the problem, a refusal justified by its supposed insolubility: it proceeds from the conviction that one can think the contingency of constants compatibly with their manifest stability.

The critique of the probabilistic sophism given above can also be extended to its application in various analogous arguments, which generally seek to restore a certain form of finalism. I will content myself here with mentioning one example of such an extension of the critical analysis, that of anthropism.

The thesis of anthropism – more precisely, of what is known as the Strong Anthropic Principle – rests fundamentally upon the following hypothesis:[8] one imagines oneself able to vary in an arbitrary fashion the initial givens of a universe in expansion, such as the numbers which specify the fundamental laws of contemporary physics (that is to say the relations and constants involved in these laws). One is then in a position to determine the evolution of these artificial universes, and one notes, in almost all cases, that these latter are incapable of evolving towards the production of the components indispensable for the emergence of life and, *a fortiori*, of intelligence. This result, which emphasises the extreme rarity of universes capable of producing consciousness, is then presented *as deserving of astonishment* – astonishment before the remarkable coincidence of the contingent givens of our universe (contingent in so far as there is no means to deduce their determinations – they can only be observed within experience) with the extremely restrictive physical conditions presiding over the appearance of conscious life: how is it that our universe should be so precisely furnished with the necessary characteristics for our appearance, whereas these characteristics prove to be of such rarity on the level of possible universes? *Such an astonishment thus rests upon reasoning that is clearly probabilistic*, relating the number of possible universes to the number of universes capable of life. The anthropist begins by being surprised by a coincidence too strong to be imputed to chance alone, and then infers the idea of an enigmatic finality having predetermined our universe to comprise the initial constants and givens which render possible the emergence of man. Anthropism thus reactivates a classical *topos* of finalist thought: the remarking of the existence of a highly-ordered reality (inherent to the organised and thinking being) whose cause cannot reasonably be imputed to chance alone, and which consequently imposes the hypothesis of a hidden finality.

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[8] For a definition of the various versions of the Anthropic Principle, See J.D.Barrow and F.J.Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986), Introduction and Section 1.2.

Now, we can see in what way the critique of the probabilist sophism permits us to challenge such a *topos* in a new way. For such reasoning is only legitimate if we suppose the existence of a determinate set (whether finite or infinite) of possible universes, obtained through the antecedent variation of the givens and constants of the observable universe. Now, it appears that there are no legitimate means of constituting the universe of possibles within which such reasoning could make sense, since this means, once more, could be neither experimental nor simply theoretically: as soon as one frees oneself from the imperatives of experience, in the name of what principle can one limit, as the Anthropic Principle implicitly does, the set of possible worlds to those obtained solely by the linear variation of constants and variables found in the currently observable universe, and in whose name do we limit such a set of worlds to a determinate infinity? In truth, once the possible is envisaged in its generality, every totality becomes unthinkable, and with it the aleatory construction within which our astonishment finds its source. The rational attitude is not, in actual fact, to seek an explanation capable of responding to our astonishment, but to trace the inferential genealogy of the latter so as to show it to be the consequence of an application of probabilities outside the sole legitimate field of their application.

Finally, the abandonment of real necessity permits one last elucidation, this time concerning the emergence of new situations, whose qualitative content is such that it seems impossible to detect, without absurdity, its anticipated presence in anterior situations. So that the problem appears in all clarity, let us take the classical example of the emergence of life, understood here not merely as the fact of organisation but as subjective existence. From Diderot's hylozoism, to Hans Jonas' neo-finalism,[9] the same argumentative strategies are reproduced time and time again in philosophical polemics on the possibility of life emerging from inanimate matter. Since life manifestly supposes, at least at a certain degree of its evolution, the existence of a set of affective and perceptive contents, either one decides that matter already contained such subjectivity in some manner, in too weak a degree for it to be detected, or that these affections of the living being did not pre-exist in any way within matter, thus finding oneself constrained to admit their irruption *ex nihilo* from that matter – which seems to lead to the acceptance of an intervention transcending the power of nature. Either a 'continuism', a philosophy of immanence – a variant of hylozoism – which would have it that *all* matter is alive to some degree; or the belief in a transcendence exceeding the rational comprehension of natural processes. But such a division of positions can once more be called into question once irruption *ex nihilo* becomes thinkable within the very framework of an immanent temporality. We can then challenge both the necessity of the preformation of life within matter itself, and the irrationalism that typically accompanies the affirmation of a novelty irreducible to the elements of the situation within which it occurs, since such an emergence becomes, on the contrary, the correlate of the rational unthinkability of the All. The notion of virtuality permits us, then, to *reverse the signs*, making of every radical irruption the manifestation, not of a transcendent principle of becoming (a miracle, the sign of a Creator), but of a time that nothing subtends (an emergence, the sign of the non-All). We can then grasp what is signified by the impossibility of tracing a genealogy of novelties directly to a time before their emergence: not the incapacity of reason to discern hidden potentialities, but, quite on the contrary, the capacity of reason to accede to the ineffectivity of an All of potentialities which would pre-exist their emergence. In every radical novelty, time makes manifest that it does not actualise a germ of the past, but that it brings forth a virtuality which did not pre-exist in any way, in any totality inaccessible to time, its own advent.[10]

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[9] See for example H. Jonas, *The Imperative of Responsibility* (Chicago: University of Chicago, 1985), chap. 3, 4, 3b: 'The Monist Theory of Emergence'.

We thus glimpse if all-too-briefly, the outlines of a philosophy emancipated from the Principle of Sufficient Reason, and endeavouring, in this very recommencement, to maintain the double exigency inherent to the classical form of rationalism: the ontology of that which is given to experience, and the critique of representation.

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10. It might be objected that in the preceding arguments I tend to conflate potentialism – which makes of every possible a potentiality – and a continuism which claims to discern for every present novelty a past situation wherein all the elements of such a novelty already existed, if at a lesser degree. It will be objected that one might at once claim that the world is subject to immutable laws, and refuse the actualism of preformationism, which sees the world as a set of Russian dolls where everything is already effective before being manifest. I respond that I certainly do not conflate the two theses, but that potentialism and preformationism, having in common the refusal of virtuality, are equally incapable of thinking a pure novelty: potentialism, in particular, if it claims that sensation is a potentiality of matter which was not actualised by it before its emergence in the living, would accumulate disadvantages, since it would be constrained to combine the mystery of real necessity (matter is ruled by laws which give birth to sensitive contents under determinate conditions) and that of irruption *ex nihilo* (these contents are in no way contained in the conditions that make them emerge).

Dark Matter: Probing the Arche-Fossil

Interview with Roberto Trotta

Dr. Roberto Trotta[1] *coordinates Oxford University's* Dark Sector Initiative,[2] *an enterprise dedicated to elucidating the nature of 'dark matter' and 'dark energy'. The cross-disciplinary nature of this project – described as an intense collaborative work involving mathematics, theoretical physics, phenomenology and statistics – anticipates the problematic status of its objects. Trotta's work as a theoretical cosmologist takes place at the intersection of cosmology (the attempt to construct a coherent model and narrative of the origin and evolution of the universe), astrophysics (the description in physical terms of the objects observed in the universe), and theoretical physics (positing models of the elementary constituents of matter and their interactions). Observations of astrophysical entities are interpreted in cosmology within the framework of theoretical physics, drawing upon powerful statistical techniques to derive probabilistic inferences on the fundamental phenomena under scrutiny, even in cases where the astrophysical objects themselves are poorly understood. Equally, some of the most advanced and speculative theoretical physics finds its best (and sometimes unique) testing-ground in models of the early universe.*

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[1] See http://www-astro.physics.ox.ac.uk/~rxt/

[2] See http://www-astro.physics.ox.ac.uk/darksector/

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Collapse interviewed Trotta at the Beecroft Institute for Particle Astrophysics and Cosmology (BIPAC) with a view to understanding how the process of determination of this field of research on the 'outer edge' of science, bounded equally by technological, probabilistic and logical constraints, brings to light the process of scientific thought, and problematises its very conceptual foundations, thus emphasising its continuities with traditionally 'philosophical' concerns.

COLLAPSE: We would like to investigate with you the general question of the status of the objects of your research. Could you describe to us how empirical observation, theoretical postulation, and the aspiration towards a coherent cosmological model interact to create this problematic object of study – 'dark matter' – and compel scientists to posit its reality?

ROBERTO TROTTA: We are interested in this 'dark matter', or 'dark sector' of the universe primarily because it enters, in an unexpected way, into our observations. Many different fundamental explanations for dark energy have been advanced, but the need for its postulation was brought forward primarily by empirical evidence; indirect, sometimes, but still empirical evidence, interpreted within the framework of a certain cosmological model.

According to the current paradigm, about 5 percent of the matter-energy of the universe is visible, and of this 5 percent only a fraction goes to form stars or planets or other heavenly bodies – the largest part is in the form of gas. 95 percent of the universe is 'dark', in one way or another: about 25 percent dark matter, 75 percent what we call dark energy.

The existence of dark matter is both predicted by fundamental models of theoretical physics, such as supersymmetry, and required by cosmological observations highlighting the problem of the ‘missing mass’ of the universe. In fact, many pieces of evidence strongly suggest that there is much more mass in the universe than the visible counterpart in the form of galaxies and clusters we can see. It is postulated that the missing mass does not interact with light, and this would explain why it is dark. But its existence is revealed by its gravitational effect on other massive bodies, for instance the distribution of galaxies in the universe, or the overall gravitational dynamics of the cosmos. This is how dark matter enters the cosmological model.

C: And what about ‘dark energy’?

RT: The case for dark energy is even more puzzling: observations of stellar explosions called supernovae indicated that the expansion of the universe is accelerating, rather than slowing down as it should under the influence of gravity if its content were in the form of ordinary matter (both visible and dark) and radiation. The accelerated expansion thus requires the presence of a new ‘substance’ with negative pressure, which would act as an ‘anti-gravity’ of sorts on cosmological scales: this is what has been dubbed ‘dark energy’. In contrast to dark matter, at the moment we do not have many fundamentally motivated models for dark energy, except perhaps Einstein’s cosmological constant – which, however, has to be inserted by hand into Einstein's equations to explain the present-day acceleration of the universe. But cosmologists are an inventive lot, and people were quick to introduce into the game new, *ad hoc* forms of energy to explain the accelerated expansion, perhaps in the form of so-called scalar fields. Fittingly, such models have been christened 'quintessence', since dark energy would be a fifth substance in the universe on top of the known four, *i.e.* photons, neutrinos, baryons (*i.e.* visible matter) and dark matter.

It's a very unsatisfactory state of things, thinking that after all this work in cosmology, forty years after cosmology was born with Penzias and Wilson, eighty years after Hubble discovered the expansion of the universe, we are stuck with this most incredible situation: that 95 percent of the universe is 'dark'. But we do believe that we have good reasons – empirical reasons – to have to go out and explain this missing mass and energy.

And so, the research programme is cross-disciplinary in the sense that it is really a field where you have the empirical observations – which I'll describe in more detail – of dark matter and dark energy. You have theoretical modelling, which is used both to interpret the observations cosmologically, and to try to give us a framework to predict further phenomena, or to explain phenomena. Then you have statistics, which is used to govern the data, to interpret them in a statistically sound way. And you have mathematics, since all these formulations, all these theories, are heavily mathematical, and we're trying to use them to derive the logical consequences of our observations. But it's really all interrelated. You can jump into this cycle at any point. You can start the cycle from, say, observations;

this gives you evidence for unexplained phenomena. At this point, you get the observation right, then you gather the statistical evidence for the phenomenon you are interested in; then you model it within a certain theoretical framework, which gives you predictions which in turn can be tested against new observations. So it's a connected chain of reasoning.

C: Historically, which observations first suggested the need to postulate dark matter?

RT: One of the first pieces of evidence for the need for dark matter goes back to the 30s and has been confirmed ever since. It's something called the 'flat rotational curves' of galaxies, and it can be explained like this. If you have a galaxy, with the visible mass of that galaxy you see there is a bulge in the middle, and then it declines – so, if it's a spiral galaxy, you have less stars in the spiral arms. Now, the further out you go in respect to the centre of the galaxy, you'd expect the velocity of the stars orbiting this galaxy to be reduced, simply because – in rather the same way as, say, Neptune goes more slowly around the Sun than the Earth does, because it's further out in the solar system – if all the gravity comes from the visible part of the galaxy, then stars which are further out should circle the galaxy more slowly than the stars that are in the centre. But observations of these velocities actually show that the velocity is constant with radius – which means either that our theory of gravity is wrong, and Newtonian-Einsteinian gravity doesn't hold on galactic scales; or that we need more matter than the visible part to keep those stars on track.

C: Evidently, in defining research programmes, a certain decision is called for: which elements of the current theoretical paradigm to preserve, and which to relinquish. For instance, in the context of physics a century ago, a decision had to be made between abandoning the Maxwellian equations regarding the constancy of the speed of light, or abandoning the Newtonian postulate of absolute simultaneity and the aether. The correct decision seems obvious to us now – perhaps it was even obvious to Einstein at the time, who seems not to have been significantly influenced by the negative outcome of the Michelson-Morley experiment. But nevertheless, it constituted a real decision, a kind of branching-point for science. Now, since you have just described the issue of these empirical observations as pressing us into a decision, let us ask: is it a straightforward matter to know which part to jettison? In the case of dark matter, why is it more cogent to hypothesise missing mass rather than a correction to the fundamental laws? Since, up to this point – despite its reassuringly substantial-sounding name – 'dark matter' has remained the name for a particular *gap* in our systematic account of the universe, then, as you say, the possibility remains that it may be, for instance, the result of a shortcoming in our understanding of gravity rather than evidence of 'missing mass'. Are both possibilities pursued in a research environment?

RT: They are pursued in parallel, to a certain extent, even though the majority of scientists would say that the dark matter hypothesis in this case would be preferred to a change in the fundamental laws of gravity, for two reasons. One reason is that we are extremely reluctant to change a theory as successful as general relativity [GR], because it accounts for phenomena on all sorts of scales, and is an extremely successful theory that has been tested to a high degree of precision. So it would seem strange – you would really have to have a compelling reason – to abandon it. That's one reason. The second reason, more from the empirical point of view, is that recent observations of the collision of clusters of galaxies – as recently as August 2006, in fact – have shown that even within the paradigm of a modified gravity, you wouldn't be able to explain these kinds of observations. So there are both reasons of theoretical prejudice – we don't want to abandon GR unless we need to; and empirical reasons – empirical facts don't seem to fit with current brands of modified gravity.

C: The flat rotational curves were the first piece of evidence, then, but others followed.

RT: Yes, we have this indirect observation from the flat rotational curves which, admittedly, relies on the fact that we have a certain model for how things spin around, certain laws of gravity – this is one piece of evidence. Then we have gravitational lensing, which is the bending of light through a gravitational field, which again, gives spectacular results, and is actually a way of highlighting the distribution of matter in the universe no matter whether it is visible or dark. This again cannot be accounted for: in the so-called ‘strong’ gravitational lensing, we see these beautiful arcs, light from background galaxies being deflected and distorted by foreground masses, and the degree of deflection cannot be accounted for merely by invoking the visible part of the foreground mass. That’s another piece of evidence. Then we’ve got this ‘fossil’ of the cosmic microwave background radiation [CMBR]. Let’s go back to the discovery of CMBR by Penzias and Wilson in 1965. Those two guys had a radio telescope set up somewhere in New Jersey, they were not looking for the background radiation, they just happened to find it. For two years they pointed their telescope to the skies, and they found the same noise everywhere, no matter where they pointed it. And they didn’t know where this noise came from. They tried to clean the telescope, they tried to get rid of this noise, they couldn’t – and eventually they got the Nobel prize for this discovery, because they’d just discovered CMBR, which is nothing else but the fact that the light emitted by the Big Bang, while travelling to us, was stretched by the expansion of the universe, and now it fills the whole universe, with a very low temperature of 3 Kelvin – so that’s minus 269° C below zero. It’s all around us. So those photons, those particles of light, come straight from the Big Bang. And they found it no matter where they looked, no matter where they pointed their telescope, which was an indication of its cosmological origin – it was not some type of local stuff, coming from a galaxy, it was really everywhere at the same time.

The CMBR leads us to attribute a global geometrical property of flatness to the universe: we have measured this huge triangle – a ‘cosmic triangle’ – that is spanned by temperature differences in the CMBR thirteen billion light years away from us. So we have this cosmic triangle: we sit at one of the vertexes, with the other two vertexes being separated by the distance between fluctuations in the temperature of the CMBR, 13 billion light years away from us. Now we have measured the angle subtended by the distant side of the triangle, *i.e.* we have measured the angle between tiny temperature differences in the CMBR on the sky. This measurement tells us that we’re living in a three-dimensional space that is analogous to a flat piece of paper, rather than a closed sphere. If I were stuck on a piece of paper like this, I would have Euclidean geometry on this piece of paper, the usual axioms of Euclidean geometry, say that parallel lines do not cross, and things like that. And that piece of paper would be a flat universe, flat, a two-dimensional universe. If we take a sphere, for instance, instead, that’s a closed universe, we’ve got the great circles which intersect, we’ve got the angles of triangles on the sphere that do not add up to 180 degrees, but rather the sum has to be larger than 180 degrees, and so that’s a closed geometry. We can measure the angles in this cosmic triangle, and they add up to 180 degrees with an accuracy better than 1 percent.

Now, if the CMBR tells us that the universe’s spatial geometry must be flat, this means that we need something else to make up what’s missing from the visible part; since the visible part, the dark matter, the dark energy, everything that’s in the universe must add up to 1, in some appropriate units, if the universe is flat. And since in these units, the visible part is only 0.05, or 5 percent, we need another 0.95 to get up to 1, so that's another piece of evidence.

C: Again, an explanatory gap: the CMBR as a whole indicates overall flatness; the observations of visible matter give you a picture which can't be reconciled with that, and then the gap between them is the place where you postulate the dark matter.

RT: Yes, but again this is only one piece of evidence, there are at least three or four different lines of evidence coming from different observations that all add up to the same numbers. So it's not just one, there are many of them, all indicating the same thing.

This dark matter is puzzling, it's not visible yet. Even though we talk about 'detection', those are indirect pieces of evidence. Although there are lines of research that are being pursued now, putting big dark matter detectors deep in caves, to shield them from other influences – the strange idea of doing astronomy underground! – under kilometres of rock to shield them from influence. You put big tanks of whatever detectors you have, and just wait for the streaming dark matter particles to give you, every now and then, a signal in your detectors when they occasionally bounce of a proton. So that would be one way to visualise them, or to detect them for real – if you give the attribute 'reality' to the data from such a sophisticated apparatus.

There would be a nice analogy here, I think, with what happened in the 1930s when Wolfgang Pauli introduced the neutrino, a new particle, to solve the puzzle of the beta-decay of atoms. They didn't know how to solve this – there was missing energy, they didn't know where the energy went. So, he wrote this famous letter to his friends at the 'Radioactive Club', saying 'Dear Radioactive Friends, today I have done a terrible thing for a theoretical physicist, that is, to introduce a new particle that nobody will ever be able to see.' But sure enough, in 1954, Cowan and Reines detected it, and later on they got the Nobel prize for it, and now there are experiments which do detect neutrinos routinely. So, dark matter might be just the same.

Such experiments are big gambles on certain predictions of a certain scientific theory: like looking for the Higgs boson, which people reckon will be found, but there is no guarantee there. You've got theoretical predictions, and the important thing is that in these theoretical predictions you have the masses, that is to say, indications of where to look for these particles. These are just numbers that are not predicted by theory, they just have to be determined experimentally, so we don't know what those numbers represent.

C: Before we go on to discuss the other lines of evidence, perhaps we can suggest a counter-example to the analogy you have just mentioned, one which is arguably closer to the case in hand than the example of Pauli's postulation of neutrinos: namely, the infamous case of the planet Vulcan. 'Vulcan' was the name given by Urbain Le Verrier in 1859 to a 'hidden' planet that allegedly perturbed Mercury's orbit, and which thus 'explained' its observed deviations from the path predicted by Newtonian physics. For over half a century astronomers attempted to prove the existence of Vulcan, and there were numerous reports which claimed to have positively ‘detected’ the hypothetical planet. Now, as we know, despite serious efforts to prove its existence over a period of some five decades, and dozens of putative observations of the planet in transit, eventually Einstein’s GR theory came along and explained the observed perturbations of Mercury as a mere by-product of the Sun’s gravitational field. So here we have a case in which a ‘missing mass’ is postulated in order to provide an explanation of certain observed anomalies, and for a long time it is the only explanation in town. However, unlike in the case of Pauli’s neutrinos, here it turns out that what was needed was not a more sophisticated means of detecting some hypothetical ‘missing matter’, but rather a suitable modification of the laws of gravity. Now, you have said that the postulation of ‘dark matter’ *might turn out to be* analogous to the case of Pauli’s postulation of neutrinos. But then, by parity of logic, ought you not to also countenance the possibility that it might turn out instead to be rather more like the case of Le Verrier’s ‘Vulcan’?

This of course brings us back to the question raised earlier of why one should regard the postulation of dark matter as more scientifically compelling than the option of modifying the laws of gravity on galactic and intergalactic scales. In response to that you suggested that, apart from a general reluctance to attempt to modify a theory as successful as GR, there were also good empirical reasons for favouring the hypothesis of ‘dark matter’, some of these relating to very recent observations of galactic collisions.

The results of the observations in question were first presented back in August 2006 in a paper by Douglas Clowe *et al.* entitled 'A Direct Empirical Proof of the Existence of Dark Matter', which announced that the observations had enabled the 'direct detection of dark matter, independent of assumptions regarding the nature of the gravitational force law.'[3] A NASA press release promptly followed proclaiming that these observations constituted 'direct proof' and 'direct evidence' of the existence of dark matter[4] and the popular media was soon awash with headlines such as 'Dark Matter Observed', 'Dark Matter Witnessed After Galactic Collision', 'Galaxy Cluster Collision Proves Existence of Dark Matter', 'Scientists Offer Proof of Dark Matter' and so on. One could surely be forgiven for assuming that what had taken place here was a veritable *experimentum crucis*, indubitably proving the existence of dark matter once and for all and definitively ruling out all rival hypotheses. It was as if dark matter had suddenly been promoted in ontological status from its previously ethereal quasi-existence as hypothetical postulate to the rank of full-fledged 'substantial' reality. And yet, without wanting in any way to diminish the significance of these observations, it seems that, from what you have just said, things are not quite so assured as we might have been led to believe, that the postulation of dark matter remains something of a high-risk gamble. Is it not at least a little premature to say that dark matter is the 'only possible explanation' of the observations, as some cosmologists have been reported in the media as having

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3. http://arxiv.org/abs/astro-ph/0608407

4. http://www.nasa.gov/home/hqnews/2006/aug/HQ_06297_CHANDRA_Dark_Matter.html

claimed? Apart from the consideration that the postulation of a missing 95 percent of the universe represents perhaps the most audacious flouting of Ockham's razor in the history of modern science – especially when one considers that a mere tweaking of the laws of gravity might ultimately prove up to the job, even if none of the models so far constructed have done – is there not a case for saying that the kind of explanation proffered by the postulation of dark matter amounts to an example of 'explaining the obscure by the even more obscure'? To what extent is it the case that, even now, the very terms 'dark matter' and 'dark energy' serve less as names for a satisfactory explanation and more as a placeholders for possible explanations not yet envisaged?

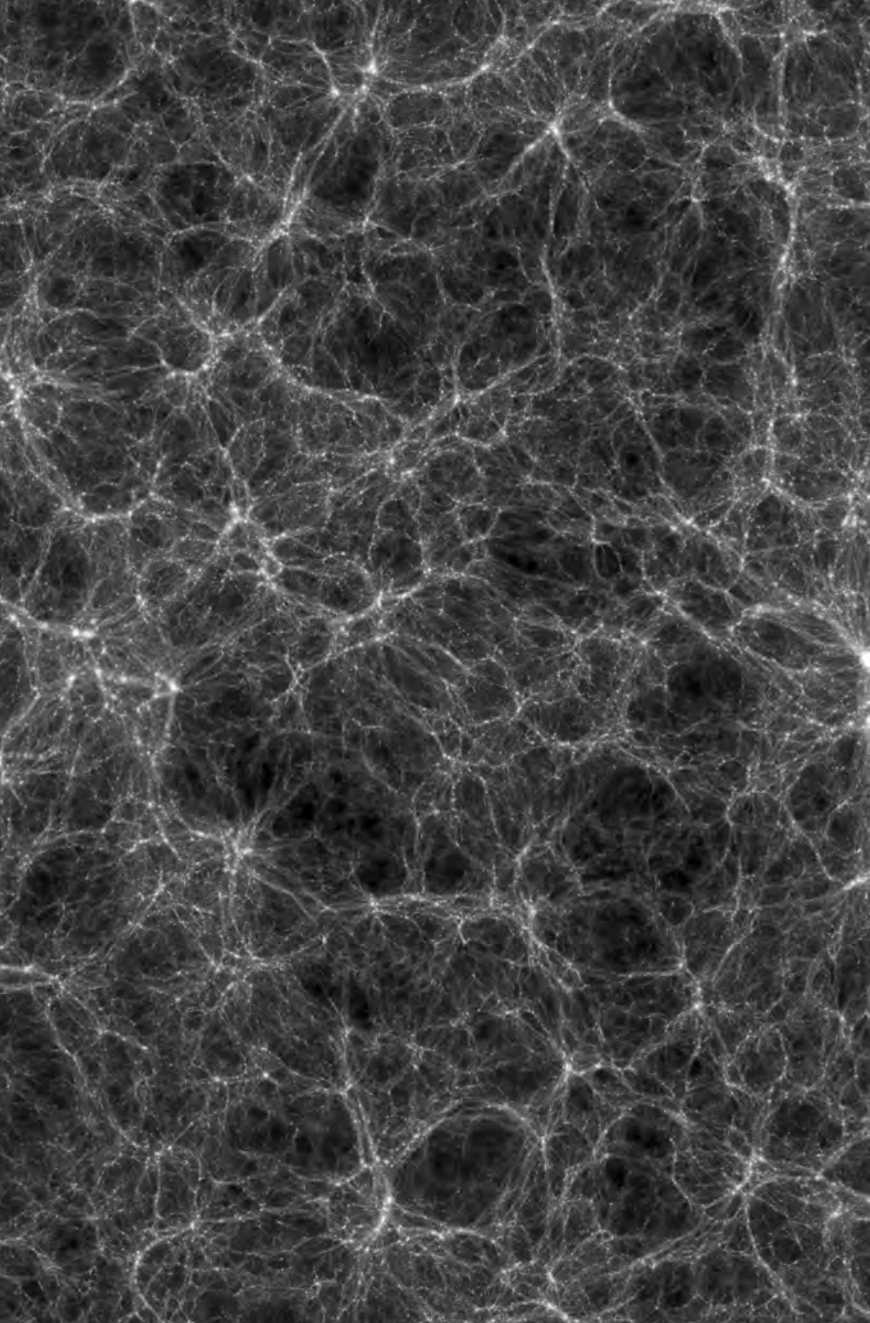
RT: As far as dark energy is concerned, yes, I would subscribe to the description you give of a placeholder for a more satisfactory explanation. In fact, one of the most pressing questions is to determine observationally whether dark energy lives on the right hand side or on the left hand side of Einstein equations. If it belongs to the left hand side – that's the side of the geometry of spacetime, where the structure of our gravity theory lives – then it's a manifestation of modified gravity of some sort, even if only in its mildest but actually quite disturbing incarnation, that's to say, Einstein's cosmological constant. If on the other hand it turns out that it belongs to the right hand side – that's where the matter-energy contents of the universe are written down – then it's really a new substance, and we have to think it over again in terms of a fundamental explanation of its physical origin.

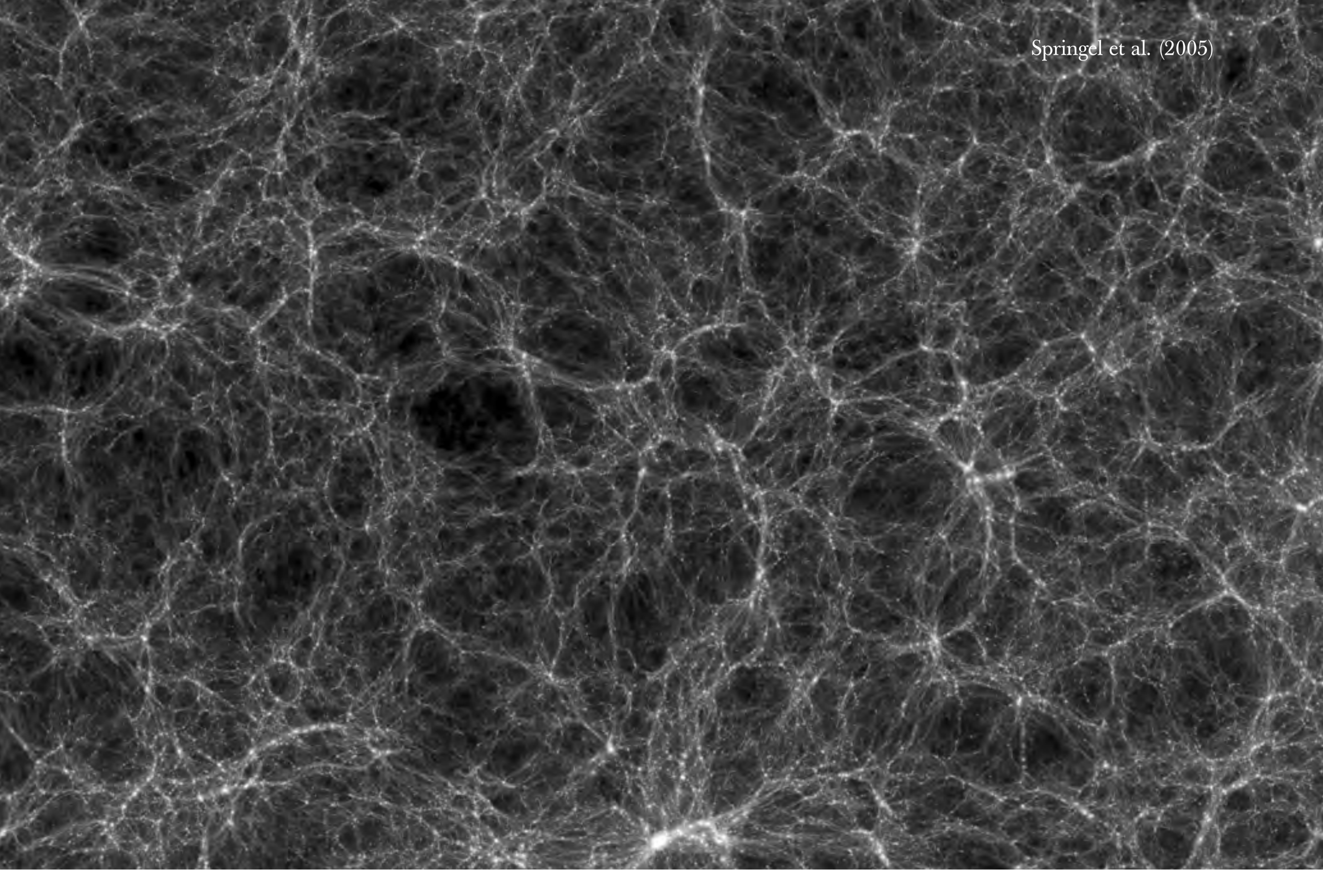
But if we are talking about dark matter, then its status is very different. I mentioned the multiple, orthogonal lines of evidence we have for it. I also briefly mentioned that we have many well-motivated candidates, usually in the form of some sort of particles beyond the Standard Model of particle physics. Now we know from other sources – for example, from the fact that neutrinos have mass – that the Standard Model cannot be complete. And we also have theories waiting in the wings to replace the Standard Model, theories that make many predictions about the existence of a plethora of new, yet-unobserved particles. For instance, in supersymmetry every known Standard Model particle acquires a so-called 'superpartner' – that's a new particle with the same properties as its Standard Model partner but with a much heavier mass. This immediately doubles the number of fundamental entities in the theory, but it seems there is really no other way around it if one wants to solve certain technical problems that we do not need to discuss now. So from the point of view of simplicity and economy, such a theory hardly ticks those boxes. But it also allows one to gain a much more complete picture of the particles and their interactions. In order to test such a theory, it remains to build a huge accelerator, smash together particles with very high energy and observe the products of the collision. Because energy is mass, if the energy achieved is large enough such collisions will transform energy into massive particles, and hopefully produce some of the heavy supersymmetric particles everybody hopes to detect. Unfortunately, the masses of the particles are just free numbers in the theory; they are not predicted, so nobody knows whether we are going to find them when the LHC is turned on later this year at CERN. People make educated guesses, but there is no guarantee. The point is that the lightest of these supersymmetric particles fits the bill for a dark matter candidate. Its properties are exactly the ones you need if you had engineered it to be the dark matter of the universe – and the thing is, you have not! The neutralino (that's the name of the particle) comes straight out of supersymmetry, and all of a sudden you realise that this could be what the cosmological dark matter is made of. So here you go, you have solved two problems at once, if only you could prove that supersymmetry exists and that the neutralino is the dark matter particle. And this is exactly what people are trying to do, both at CERN and by trying to detect dark matter particles directly.

But there is one more thing to consider, namely the fact that cosmology is fundamentally different from particle physics, or from any other brand of physics, in at least two respects. The first aspect is that cosmology is an observational science, not an experimental one. We simply cannot reproduce the universe many times, tweaking the parameters of the experiment to see whether our theory is correct. The second point is that the fundamental framework within which all observations are interpreted posits that the objects we observe are subjected to the very same laws of physics we have derived in our labs on Earth. This is an extremely strong assumption, if one keeps in mind that cosmological phenomena stretch over billions of light years in space, over the entire life of the universe in time, and over tens or hundreds of orders of magnitudes in energy. One might describe this as the ultimate scientific hubris. So in view of all this, it is important to recall that the status of the ‘substantial reality’ of cosmological objects must be understood within the limits imposed by the above considerations.

C: We’d like to come back to this question of the uniqueness of cosmology as an observational but non-experimental science a little later, but sticking for the moment with the question of the nature of the evidence for the ‘substantial reality’ of dark matter, one of the most intuitively accessible fruits of this research are the images which show the predicted distribution of dark matter in the universe [see pages 100-1]. Here we see something that to the naïve eye looks very ‘organic’, almost like a network of capillaries. Since dark matter is not visible, how are such images obtained?

RT: These images depict what we call the ‘cosmic web’ – fittingly, I think. And this is a computer simulation: this is what we think you should be able to see if you could see the dark matter distribution in the universe – those filamentary structures represent the dark matter distribution within the universe. But it’s computer-simulated: what you do is to take the initial universe, which was homogeneous, but not perfectly homogeneous – you had small initial fluctuations in density within it which were the seeds, that we still see today in the CMBR, and from which eventually those structures formed – you take this universe, put it into a supercomputer. Then you switch on gravity and you let gravity do its work. So regions that are





Springel et al. (2005)

dense will accrete matter from around them. Regions that are overdense would in time become critical overdense regions and this filamentary pattern appears during time.

So that's just a simulation. From the data we observe from gravitational lensing we are also able to extract some statistical properties of these filaments: we can quantify the filamentary structure itself, whether it's very filamentary or more sparse, more dense, and we can compare the numbers that we get out of the simulations with the observations. And this is the great game, to produce very many simulated universes with different values of parameters, to fit them to our observations, and to try to figure out which are the ones we actually observe in our universe.

C: Earlier you linked the 'puzzling' nature of dark matter with the fact that it is 'not yet visible', and indeed one of the ways in which the abstract mathematical sense given to 'matter' in contemporary physics is reconciled with our intuitive sense of materiality is through these kinds of images. There can be no doubt that images purporting to represent dark matter boast an all-important sense of immediacy which speaks to an interested general public. But is this engagement of the imagination also of significance for scientists themselves, providing a sort of milestone and an opportunity to 'zoom out' of the technical details of the research process?

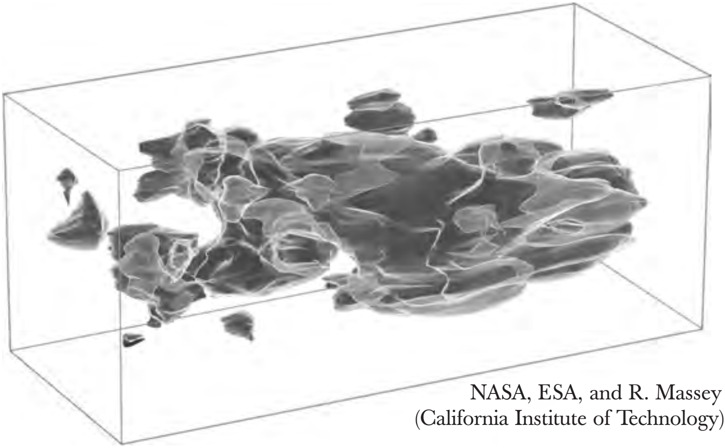
RT: Yes, I think that's a good point, in the sense that until a few years ago scientists – especially cosmologists – we didn't have those images to look at, we hardly had any of the data we have now. So in that respect having these images is a way of anchoring ourselves to the reality of those objects. Although images that you can really look at and just understand by looking at them are very rare. Most of them have to be interpreted through statistical analysis, distilling the statistical content of the image into spectra or probability distributions or whatever. Having the 'real object' – with whatever qualifications you want to give to the term 'real' here – having the real object in front of your eyes is a way of anchoring yourself to the object so as to understand it. Although, as I say, the images, as fantastic as they are for reaching out to the public, have little informative content for scientists. They must be heavily processed, they must be analysed, they must be cross-correlated, and most of those procedures do not happen in an image space; they happen in a mathematical space, a statistical space, spaces that are highly idealized and so, in a sense, also highly immaterial. So the images are just the starting point for a much more complex process that goes on behind the scenes. It's rarely just the image that gives you the answer you're looking for; it's the content of the image that's distilled through a heavily mathematical process, and that's what's interesting for the scientist. But the images are great as the first point of contact to try to convey what we get out of the image to the general public, in a more understandable way, a way which is less arid.

C: Is there a danger that they may serve to conceal – or so to speak, shortcut – uncertainties within the theoretical model? For instance, if you have an image purporting to show 'the distribution of dark matter', you're in a sense already guilty of reifying dark matter.

RT: Yes, but professional scientists, when they look at these images, are supposed to remember this. Sometimes the shortcut is taken consciously in order to make the image more 'saleable' to the public, in order to promote the field more effectively. But it's a thin line you have to tread. For example, what's described as the imaging of dark matter is actually the imaging of gravitational potentials, which has been recovered through a set of statistical techniques, transformed through false-colour images purporting to show dark matter. So yes, it is a shortcut that's consciously taken sometimes in order to make the content more directly accessible. But we should never forget that, in taking these shortcuts, we bypass our interpretation of the data we have gathered, which is done through the optic of a particular theory, and a particular narrative as to how these data have been gathered and what they mean. The point is that the very interpretation of the physical reality of the objects we observe is dependent on an underlying theory which explains them in the first place; so they're not objects we can relate to in an immediate way.

C: The essential theory-dependence or 'theory-ladenness' of observation is of course something very well-established in the philosophy of science, and it's something which has given rise to no end of philosophical debate – regarding, for example, instrumentalist versus realist interpretations of scientific statements. The very idea that knowledge is a matter of obtaining a faithful ‘copy’ of a reality-in-itself, as something knowable without theoretical mediation, is one which has lost favour in the philosophical tradition since Kant. We’d like to touch on some of these questions later, but for the moment, sticking to the point of view of a ‘naïve realism’, one might feel almost ‘cheated’ to learn that so much necessary theoretical and instrumental mediation is involved in gaining access to these objects. From the lay-person’s point of view the ‘substantial reality’ of a thing is precisely something that *ought to be* accessed in an ‘immediate’ way, without the kinds of theoretical contrivance you have described. Is there a sense in which all this necessary mediation amounts to a diminution of the reality itself, or is it rather the case that science has first to ‘constitute’ that reality in some sense – to ‘bring it into being’ almost – in order to determine it?

RT: I wouldn’t call it a diminution, I would call it an *enhancement* of reality. Perhaps an artificial enhancement to a certain extent – mediated by the theories and instrumental apparati we use – but a necessary one, for the simple reason that we simply do not have immediate access to the reality of those objects. I would even be tempted to say that the true, the most informative reality of those objects, often is *only* revealed *after* these very complex processes, and often only in a statistical sense, which is very impalpable, giving us only access to certain relations, probability distributions and so on, whose very interpretation, once again, rests on what our understanding of probability fundamentally is, rests on many assumptions on the way the world is *supposed* to behave even on a statistical level – even for



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(California Institute of Technology)

objects for which we don’t have a statistical realisation, such as the universe itself. So in conclusion I would say that this is an enhancement of reality that necessarily takes place in order to bring into the open underlying patterns and regularities that are not visible to the ‘naked eye’.

C: Coming back, then, to the images which purport to in some sense ‘represent’ dark matter, apart from the computer simulations – the ‘cosmic web’ images we’ve just been talking about – Hubble have very recently released 3-D images [see above] which were headlined in the media as ‘The First 3-D Images of Dark Matter’. How do these differ from the ‘cosmic web’ in terms of how they are produced?

RT: Well, they are supposed to be real observations showing exactly the same patterns which, as we've just said, are computer simulations. But as I said before, they are not direct observations of dark matter, since dark matter is, obviously, invisible. They are obtained by using the gravitational properties of dark matter, the gravitational distortion that dark matter is supposed to bring about, by using background galaxies as sources of light. Let me describe this in a little more detail. The light coming from background galaxies goes through a field of clumpy dark matter and gets distorted, the shapes of galaxies get distorted – this is what we call 'gravitational lensing' – in a special way depending on where the clumps of dark matter lie, just as a real lens distorts the image which sits behind it; a bending of light – but not really a bending since light travels always in a straight line in spacetime, but since spacetime itself is bent by the mass concentration, we experience this as a distortion. You see now already that in order even to formulate the observation we have to have this general-relativistic theory of spacetime, so you see how the significance of even our raw data is heavily dependent on our underlying world model.

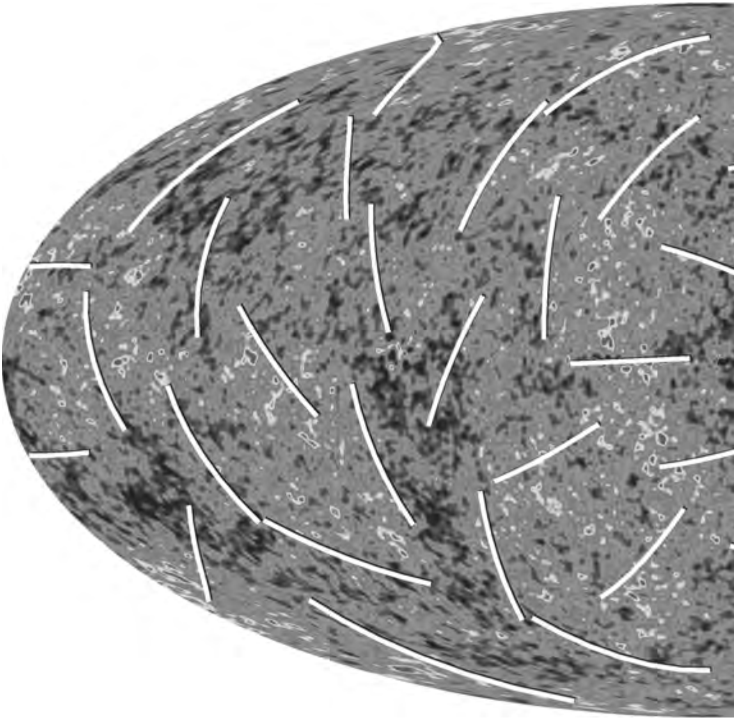
This relates back to what we were saying about the 'enhancing' aspects. There are pictures of visually impressive distortions of background galaxies that you can pick out 'by eye'; you can really see background galaxies being distorted in what we call 'Einstein rings' around the clumpy object – this is called 'strong gravitational lensing'. But that's not how the technique used to reconstruct the Hubble 3D images works. This technique is called 'weak gravitational lensing' and it works by observing tiny distortions of background galaxies, distortions in the shape of the galaxies. So if you had galaxies that were perfectly round as sources in the background and you observed them and saw their shape being distorted by 1 percent, or perhaps just a fraction of a percent, then you would be able to map exactly – by telling how the distortion behaves across the sky – the intervening dark matter distribution. Now, the thing is, we don't even have regular galaxies in the background. Instead we have galaxies that come in all different shapes and sizes, and so we are measuring distortions of shapes that we don't even know in the first place, because we don't have access to the undistorted shapes. That's where the enhancing techniques come in, because in order to get access to coherent distortions of galaxy shapes, you've got to make a statistical average. So, making the assumption that all galaxies are randomly oriented, with random shapes, if there were no coherent distortion, if you make an average, you ought to obtain zero. But since there is intervening dark matter – and that's where the enhancing techniques come in – you do these correlations, these statistical observations, and you find coherent patterns of distortions that do not average away because they are not intrinsic to the galaxies but are imprinted on them through the dark matter lens distortion. And, again, that's not something you could pick up by eye.

C: Another line of evidence is indicated by your work on acoustic oscillations of the early universe which are 'frozen' into the fabric of matter – a sort of primordial 'sound-fossil'.

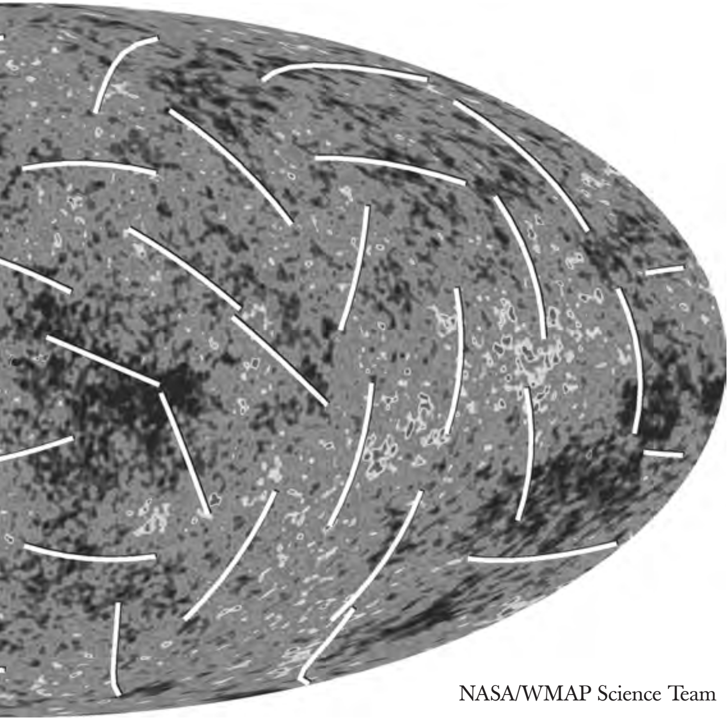
RT: Yes, these acoustic oscillations are, in a way, a natural fossil. The relevance of the sound waves of the early universe in general for cosmological parameters is that it's all relatively simple to calculate, because the universe was fairly young, and these density fluctuations which eventually grew to galaxies were still very small – actually one part in a hundred thousand. So they were so small that we can calculate them with very high accuracy, and we can follow their evolution up to the point where the CMBR was released, very accurately. And so from this we can confidently infer several properties of the universe at the time, for instance how much dark matter there was, how much visible matter there was, what were the characteristics of the seeds, how the seeds were sprinkled with scale, whether there were more seeds on small scales, on large scales, or whether they were uniformly sprinkled on all scales and so on. These sorts of things can be inferred from sound waves in the CMBR, because we know the physics very well. And so it's a nice spot between the very high-energy physics of the very beginning, which we don't fully understand, and the messy, non-linear physics of gravitational collapse and evolutionary structure that we do understand, but which gets difficult to follow because it gets very complicated, as you can see from the filamentary structures you obtain through the computer simulations we discussed.

C: How do you go about reading these 'recordings' of the Big Bang?

RT: We saw that the CMBR is very homogeneous because of its cosmological origin. But now we have very sensitive detectors, telescopes and satellites that measure this background radiation to a very high degree of accuracy. And if you look carefully enough, you will see that this CMBR is not perfectly homogeneous; it has temperature differences in it. So if you look with your telescope in this direction, we see a slightly colder spot, if we look in that direction we see a slightly hotter spot. We can build a map



[see below] of the sky, showing the temperature distribution of the background radiation. In order to measure the differences between the hot and cold spots with your telescope you need a sensitivity that's equivalent to the sensitivity you'd need with an optical telescope to see a mouse walking on the moon from the earth. So it's very tough. The guys who first did it in 1992 got the Nobel prize in 2006. These fluctuations you see in this map are the sound waves from the early universe, that's exactly



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what they are. When you throw a pebble in a pond you've got waves that go out in all directions; if you throw many pebbles in a pond you get a nice superposition of waves. In our case the pebbles were quantum fluctuations in the early universe, and they got frozen in at the moment this image was produced, and this is what we see – we really image them with our telescopes.

C: Calling them 'sound waves' is not just a figurative way of speaking, then?

RT: No, it's a technical definition: they're compression waves. The universe at this point was a plasma, that's a hot gas of electrons and protons, separated by the temperature, because the temperature was so high. So those were really acoustic waves, just like the waves in the air now as I speak, only they were travelling in the primordial plasma. And we can see them, as we can see in this map: it's real, it's been predicted, and we find this fantastic agreement with our models.

We usually talk about the CMBR being the uniform radiation coming to us from the Big Bang. When we talk about the temperature differences or anisotropies, we're talking about the very same radiation, but now looked at through a much more powerful telescope, so that you can highlight the temperature differences. It's one and the same thing, but you need a more powerful telescope to see the sound waves in it. I'm working more on the theoretical side of it, but people here also build such instruments. I'm interested in finding out how we can use those instruments to learn more about the conditions of the universe back then, or the conditions of the universe in the far future.

C: Let's return to the cosmological narrative, and to the 'seeds' you already mentioned briefly. For the first 300,000 years after the Big Bang, the universe is thought to have been remarkably homogeneous, surprisingly 'smooth'. The gravitational clustering which, it is supposed, ultimately structured this featureless continuum, was driven somehow by the properties of dark matter, via tiny fluctuations imprinted upon matter during the initial expansion.

Here dark matter seems to be invoked to answer a most traditional philosophical question: Why is the universe 'uneven' at all? Why does it consist of great voids and small concentrations of matter? Why is there something rather than nothing – or pure homogeneity, or chaos? The probing of anisotropy practiced by cosmologists rather recalls the original philosophical materialist, Lucretius, who, refusing divine intervention, posited an originary *clinamen* or 'swerve' which disturbed the atoms in freefall and led to the creation of nature. And unless some principle such as the *clinamen* intervenes, this heterogeneity, or what we could call the high information content of the universe, seems quite at odds with the received image of physical laws as linear and predictable. Are we to understand that some fundamentally nondeterministic processes must intervene at those crucial early stages to introduce these 'blueprints for differentiation'?

RT: Some fundamentally nondeterministic process, that's quite right, in fact. We just discussed the fact that these seeds are the ones that give rise to clusters, to galaxies, and eventually to all inhomogeneities in the universe. It's also the same seeds that we can observe in the CMBR from when the universe was very very young, 300,000 years after the Big Bang. And the ultimate origin of those seeds, we believe, lies in the very first fractions of a millisecond – actually 10^{-32} seconds after the Big Bang – during the period of very fast expansion which is called 'cosmological inflation', which takes the universe from a very small size up to cosmological scales. And at this point, since you are going so far back in time, the universe was compressed almost into a point, as it were. The overall size of the universe was so small that the microphysics governed by quantum mechanics [QM] was important. So you would have quantum fluctuations at the level of the whole universe, that then were stretched out to cosmological scales, and that's what the seeds were. Now, remember that all the evolution afterwards, the gravitational evolution of these seeds, is completely deterministic – we have the equations for gravity, we can follow them on the computer. But the 'seeding' of these fluctuations belongs to QM with its element of unpredictability, probability. The fundamental nature of it is quantum-mechanical, and so any understanding of this fluctuation is probably to be found in our understanding of what quantum-mechanical probability is.

C: This is where the intersection between fundamental physics and astrophysics comes in.

RT: Yes, it's where you close the circle: from the infinitely large scales of cosmology, you meet the infinitely small scales of particle physics, and quantum theory.

C: And presumably it's precisely here that the question of how to bring together GR with QM becomes a crucial and urgent one. To what extent does an adequate understanding of what happened in these first fractions of a millisecond after the Big Bang await the unification of these two foundational theories of modern physics in a successful quantum theory of gravity, whether that ultimately comes about in the form of some version of string theory, M-theory, loop quantum gravity, or something else altogether?

RT: Yes, that's absolutely fundamental, because all those big questions come together in the very first fraction of a millisecond, where all the interesting physics we don't yet know about happens. When, at the origin of the universe, we reach the highest possible energy scale, which is the Planck energy scale, at that point our theories essentially break down. That's the point where GR breaks down and we need to quantize spacetime itself. Remember, spacetime in our current vision of GR, is a sort of classical 'rubber–band' as it were, an arena in which quantum-mechanics take place. But when you get to this sort of energy scale, these types of miniscule length scales, it might be possible that fundamentally the quantization of spacetime itself begins to play a role. In other words spacetime stops being just an arena in which all the interactions of QM take place, but becomes a player in the quantum mechanical game, and nobody yet knows the rules of this quantum game.

C: GR and QM both break down – now, do they each break down independently in the sense that they no longer work at these extreme energy scales, so it's just a fuzzy area; or, do they break down because that's where they come together and you don't yet have a proper theory of how they can be combined?

RT: GR breaks down by itself because when you take the universe to size zero then – if you go analytically to zero in the equations describing the metric of spacetime – the zeros 'blow up' the equations, you end up with divisions by zero and our equations stop working. And the other problem is that no-one knows how QM and gravity work together because no-one is able to quantize gravity, for many different technical reasons. So yes, each breaks down on its own, and they break down together.

C: So that's a fuzzy area that's awaiting a successful theory of quantum gravity. Does it work that way, that you need a successful theory of quantum gravity in order to understand these very earliest fractions of a millisecond, these ten-millionths of a second after the Big Bang, or can cosmology itself help to solve the problem of the relation between QM and GR?

RT: Well, let me say that the fact that we don't have a successful quantum theory of gravity doesn't stop people from playing with some bold ideas. For instance, there is a scenario, called 'ekpyrotic universe', where the universe is supposed to be cyclic, that's to say it undergoes an infinite succession of expansions and contractions. So if you go back in time close to the moment of the Big Bang, when the universe is compressed at this incredibly high energy in this extremely small size, there might be some fuzzy physics, perhaps coming from extra dimensions, that makes it 'bounce back', rather than collapse to a point. Time does not start with the Big Bang, but rather you can describe the previous universes, as it were, before the Big Bang, by invoking some previously unknown phenomenon that actually prevents the Big Bang singularity, as we call it, from happening and gives you a bounce instead. So people do work on this kind of model at the level of their phenomenology, that's to say their effective description, but those are models that fundamentally are not strongly motivated at the moment. But people have these models in mind. So yes, it awaits resolution, but people are not *waiting* for it to happen.

C: The parameter z also plays a major role in constructing the cosmological 'narrative' of the universe. You are able to tell a story about what was happening at different stages of the history of the cosmos – *e.g.* 'the universe at $z = 20$'.

RT: This cosmological parameter z refers to redshift, and it has a very simple physical interpretation: it tells you that, for instance, if you're looking at the patch of the universe at $z = 20$, this is the state of the universe as it was when the size of the universe was twenty times smaller than it is today. This redshift is therefore not some abstract quantity, it's something we actually measure, by looking at the spectrum of whatever object we're observing. So if you look at a galaxy, the galaxy will contain certain elements, for instance hydrogen, iron, whatever. And these elements will emit light at particular wavelengths, particular colours: the 'signature' of the element. Hydrogen will have a particular line at a certain wavelength, iron will have a more complex signature consisting of a more elaborate pattern of lines. So we can determine, first of all, which elements are present in distant galaxies, because every element has got this set of colours which is particular to it, which comes from the quantum-mechanical structure of the atom. And by observing those lines, we can tell that on the Sun there is hydrogen, because we observe the hydrogen lines, and in the Andromeda galaxy there is hydrogen because we observe the very same lines. But the important thing is that the light of these spectroscopic signatures gets stretched while *en route* from distant galaxies to us, because of the expansion of the universe. So if the light gets stretched, that means that the wavelength of the light gets longer, and the light gets redder. In other words, we observe the same set of lines from a distant galaxy that we would observe from a local galaxy, but that set of lines is shifted towards the red end of the spectrum – what we call a 'redshift'. So by measuring the amount of redshift, we can measure how much of a stretch there has been between us and that galaxy. We can measure the redshift and we know whether this object is far away or nearby. It's uniformly shifted toward the red end of the spectrum.

Of course, as I mentioned before, there is an assumption which underlies everything here, and which is very strong, actually, especially from an ontological perspective. We assume all along – and we couldn't do without it – that the laws of physics are the same here, on Andromeda, and at the very beginning of time, which is a very major assumption. But there is little we can do if we don't make this very strong assumption.

C: Historically speaking, one might even say that it was just this very strong assumption of the uniformity of nature on the largest scales, of the universal applicability of the laws of physics, that inaugurated modern science itself. Copernicus' overcoming of the Aristotelian tradition of 'saving the appearances' by asserting the truth (rather than the mere empirical adequacy) of his cosmological system ultimately paved the way for Newton's synthesis of celestial and terrestrial mechanics via his law of universal gravitation. Of course we now know that, while the Newtonian laws of motion and gravity hold to an extremely good degree of approximation for almost all phenomena ordinarily encountered (*i.e.* for the everyday macroscopic world in which gravitational fields are relatively weak and objects move relatively slowly compared to the speed of light), they represent at best an approximate special case of the still more general laws of Einstein's GR, in which the notion of gravitational force acting instantaneously at a distance is replaced by that of the curvature of spacetime itself. But here, unlike the world described by Newtonian mechanics, which is more or less entirely consonant with the 'manifest image' of the world we derive from ordinary experience, the universe as described by relativity theory is, like that of quantum physics, deeply counter-intuitive. This is perhaps above all the case with regard to our commonsensical notions of space and time, to which the Minkowskian-Einsteinian notion of a four-dimensional spacetime continuum appears to bear little if any resemblance. The very idea that the beginning of the universe with the Big Bang was not an event which took place *in* space and time, but was rather the very coming into being of spacetime itself, is one which most people have a great deal of trouble coming to terms with. More difficult still is the related notion that there is no such thing as the 'objective present' – that there can no more be an objective division of the world into past, present and future than there can be an objective division of a region of space into east and west, or here and there. And at the submicroscopic levels where we enter into the utterly baffling world of quantum probabilities, things become a good deal stranger still. Here not just some but *all* of our habitual notions of space and time appear to break down completely, to become entirely meaningless.

All this gives rise to a number of questions relating to the very meaning of cosmological statements regarding time. For example, regarding the redshift observations which you have just been telling us about – by measuring the relative distances of observable galaxies in this way, you are also peering back into time, and determining things about the universe billions of years ago, when it was considerably smaller than it is today. These measurements, as you have indicated, are also crucial in estimating the age of the observable universe, which cosmologists have now dated rather precisely to 13.7 billion years. Such statements seem to be readily comprehensible and their meaning unproblematic. To what extent is this an illusion fostered by the isomorphism of such statements with everyday statements involving time? Must we not in some sense suspend our intuitive, commonsensical (and implicitly anthropomorphic) notions of time in order to properly comprehend statements about time in cosmology and in physics more generally?

RT: Well, as I was describing, the physically observable quantity is the redshift of the objects. It then turns out that the correspondence between redshift and cosmological time – when you do this mathematically through the equations of GR – depends on what the matter-energy content of the universe is. In other words, it depends on the relative amount of dark matter, dark energy, visible matter, radiation and so on. And so time becomes a function of the very properties we are trying to reconstruct.

C: Time evolves along with the universe.

RT: Yes, perhaps you could say that the link between the observable properties of the universe and its history as parameterized by cosmological time, goes through the very same properties of the universe, that is to say, its mass-energy density and its cosmic energy budget, which is interesting, because time becomes a function of them. At its heart this goes down to the fact that GR is a theory that links geometry on one hand, and the matter-energy content on the other. So we have matter which tells spacetime how to bend, and the bending of spacetime tells matter how to move. So we've got this inextricable mix of spacetime and matter-energy.

C: But if that is the case and if, according to GR, space and time are not to be regarded as anything like an absolute and universal stage against the background of which cosmic events play themselves out, but rather as flexible and dynamic actors – an integral part of the cast, as it were – in the cosmic drama itself, how is it that cosmologists are nevertheless able to define a concept of time that is applicable to the universe as a whole? Doesn't the passage of time depend on the speed of motion of the observer, and on the gravitational field in which the observer happens to be immersed?

RT: Well, in general, time *does* depend on the observer and the status of motion of the observer – different observers will observe different times – that's a generally acknowledged result of the theory of relativity, of course. But when you describe this evolving spacetime arena for the universe as a whole, then you introduce a sort of global co-ordinate system which you parameterise in terms of coordinates of time and space, *x*, *y* and *z*, and so the time you attach to this – which is the time that gets quoted as the age of the universe, and that I called above 'cosmological time' – would be the time that is measured by what we call a 'co-moving observer'. That is to say, a hypothetical observer that is swept along with the expansion of the universe, which we all are to a certain extent – our galaxy is swept along by the expansion of the universe. So that is what this time refers to: not just *any* observer, but an ideal observer that is postulated to be a co-moving observer, being swept along by the expansion of the universe.

C: But would the construction of this global spacetime co-ordinate system – this universal clock, so to speak – still be possible if the 'cosmic fossils' we have been discussing, such as redshift and the CMBR, revealed a non-uniform, non-homogeneous universe on the largest scales, rather than the surprisingly uniform, isotropic one which they appear to indicate? In a passage of his book *The Fabric of the Cosmos* which it seems appropriate to cite here, Brian Greene suggests that this background radiation not only 'gives astronomers what tyrannosaurus bones give paleontologists: a window into earlier epochs that is crucial to reconstructing what happened in the distant past', but that it is the *uniformity* of that radiation which is crucial in enabling cosmologists to define a concept of time applicable to the universe as a whole. The uniformity of the radiation is 'a fossilized testament to the uniformity of both the laws of physics and the details of the environment across the cosmos', and it is this homogeneity which, suggests Greene, makes it possible to meaningfully speak of a 'universal synchrony': 'if the universe did not have symmetry in space – if, for example, the background radiation were thoroughly haphazard, having wildly different temperatures in different regions – time in a cosmological sense would have little meaning.'[5]

RT: Yes, in fact the CMBR itself could be used by our comoving observer to define a cosmic clock, obtained by measuring the uniform temperature of the microwave radiation and monitoring it as it cools down with the cosmic expansion. But even in the extreme case where you had a cosmological expansion that proceeded differentially in different directions, a so-called 'anisotropic universe', instead of describing the expansion with just one number – redshift – then you would have one number for each direction. You could then possibly conceive of having different dimensions evolving differently with time. What is absolutely crucial, however, about the homogeneity of the CMBR that we observe, is that this informs us about the extreme uniformity of the conditions of the universe at the epoch when the CMBR was formed. The overall temperature of the CMBR is the same everywhere across the sky, even when we compare remote locations, points so far away from each other that light would not have had the time to travel between them by the time the CMBR was formed. So how is it that such distant points all have the same temperature today, if no causal mechanism could possibly have connected them? The answer is, again, 'inflation', the extremely short period of faster-than-light expansion of the universe that we encountered earlier when we discussed the mechanism that spread the quantum-mechanical seeds on cosmological scales. During

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5. Brian Greene, *The Fabric of the Cosmos* (London: Penguin Books, 2004), 227-8.

inflation, the size of the universe grew exponentially, and patches originally close-by were stretched out to cosmological distances. This would explain why we observe them to have the same temperature today: they were once in causal contact and were then separated by the inflationary expansion. So the expansion of the universe during inflation can happen faster than the speed of light without violating the basic tenet of GR, since in this case it is spacetime itself that is stretching faster than light, not a particle or other object within it that is moving faster than light. I should also add that the fundamental mechanism that drives and powers inflation has not yet been established, even though there is no shortage of speculative ideas, some of them linked to dark energy, for example.

C: Another issue regarding time we might just mention briefly is the problem of the so-called 'arrow of time'. Do cosmologists take it for granted that time has a definite *direction*?

RT: Yes, because causality is ingrained in the very structure of GR. It's unavoidable because GR comes out from two assumptions, two axioms: one of which is the constancy of the speed of light, the other being the causal structure of space-time. So yes, it's built in.

C: But is *asymmetrical* causality is built into GR? Are the equations themselves not time-reversal symmetric?

RT: Yes, they are on a microscopic level, but the global structure of spacetime is such that you distinguish between timelike and spacelike intervals, and timelike intervals are intervals between spacetime points between which there can be a causal flow of information, whereas spacelike intervals are intervals where there cannot be such a causal connection. And because of the finitude of the speed of light – which again, is built-in to GR – the two domains are disconnected: you can't make a timelike interval into a spacelike interval. So in other words, there are spacetime points that cannot be causally connected, the ones separated by spacelike intervals, because for instance, two events that are simultaneous for a given observer will not be for another observer. So by going from one observer to another you would be able to change the order of events, which would clearly result in paradoxes if the two events were causally connected. For example, you would be able to find an observer that would see the effect precede the cause. So this causality is built into GR in a hardwired way.

But let me just come back to what you said about our intuitive ideas of space and time breaking down and becoming meaningless. And my reaction is – why shouldn't they? After all, our intuitive perception of reality is an *immediate* perception of reality that has developed from our brains and our experience of the world shaped by evolution, and clearly evolution knows nothing of quantum reality, nor does it know anything about the vast expanse of time and space of cosmology. And so, it's not astonishing that those notions become counter-intuitive since we are actually extending our capability of making statements about realities way beyond the scales which our brains were designed to interact with. And so it's not an astonishing thing.

Let me give an example, the example of mathematical symmetries, which I think is very fitting in this context. We all know what a spatial symmetry is – a sphere is spherically symmetric because however we turn it in 3-D space it looks the same, so that's a spherical symmetry. So we know what a spherical symmetry is like in space, and can associate a mathematical description with this symmetry. For instance the mathematical group that describes this symmetry in space is called SO(3). But now it turns out that we can equally well define more abstract symmetries that apply to subatomic particles, symmetries that pertain to the postulated internal state of those particles – isospin, for instance. So those are just transformation groups that do not transform, do not move things around in real space; they move things around in an abstract mathematical space that we have defined to have certain properties. But then those symmetries – which have nothing to do with real symmetries, but which take their origin from our observations of real three-dimensional symmetries in the world that we *can* perceive – those symmetries turn out to play a fundamental role in describing the state of those particles, the possible energy levels that those particles can take, for example. So these principles of symmetry play an absolutely fundamental role in all of physics. I think this is a case where we start from the immediate experience of the world, where we have a symmetric configuration of things, and then we take the very same tool, put it in a completely abstract mathematical space that *a priori* has nothing to do with any domain of reality, physical or otherwise. We apply it in this other context and end up with predictions about phenomena that were not observed before and, again, can *only* be observed through these 'enhancing' powers that we discussed before, and actually turn out to be true. This is an incredible application of extending, reaching out, from the time and length scales, and also conceptual scales, of our immediate experience, into domains that are definitely beyond the realm of our immediate perception.

C: The comment about the deeply puzzling, counter-intuitive notions of space and time in fundamental physics was of course not to say – 'How astonishing, how can it be?!' – much less to make some objection to them on the grounds that they don't conform to our ordinary or commonsensical notions. But, when it gets translated into ordinary language, when we're talking about space and time on universal scales, we can't help but assimilate what we're being told to what we know intuitively, and the question is whether our intuitive concepts are adequate to even begin to comprehend what's being said in physics.

RT: But again, I think it's another example of the phenomenon we were discussing before, when were talking about weak lensing – images that we take almost for granted, making dark matter 'visible'; yet if you are equipped with knowledge of how the evidence is collected, and how those images are produced, you understand that you cannot quite interpret them in such an immediate way. And statements about the age of the universe, I think it's the same kind of 'filter' that ought to be applied to them.

C: What is perhaps most remarkable about this whole discussion from the perspective of contemporary philosophy is that the 'big questions' about the universe as a whole which philosophers themselves have long-since regarded as constitutively beyond the limits of human reason, have now quite suddenly – that is, over the past fifty years or so – reappeared, though this time not as subjects of *a priori* speculation, but rather as concrete objects of scientific, cosmological research.

Your particular field of research is theoretical cosmology – the scientific study of the large-scale structure, properties and evolution of the universe as a whole. But apart from its scope – as we have seen, taking in both the inscrutably small and unfathomably large scales of the universe – how does theoretical cosmology differ significantly from other scientific fields?

RT: Well, as I said before, I think it's important to highlight that cosmology is very different from any other physical science in one fundamental respect: namely, that we can't perform experiments. We can only perform observations of the universe, which are intrinsically limited by many factors.

C: The distinction being that with experiments you can control parameters?

RT: And that you can reproduce your data at will. If you're not satisfied after a hundred trials you can do a hundred more, and gather more data, whilst for the universe we are intrinsically limited by the fact that we have only one universe, and we cannot create the universe a second time, as it were. And that's a fundamental distinction, one that's very important to understanding the nature of the cosmological enterprise. We can only make observations, look for correlations among observations, and make inferences using probability theory. So that's where probability theory comes into the story. For instance, if I have a theory that predicts that blue galaxies are more massive, I cannot simply grow a massive galaxy in the lab and observe if it's blue. But what I *can* do is to go out, observe as many galaxies as I can with a telescope, and then ask of my data whether I do observe such a correlation, that is, whether the more massive galaxies in my sample tend to be the blue ones. But that's a statistical connection between observed properties.

So that's a fundamental aspect, and it's limited in non-trivial ways. You might think our work is limited by the need for a certain budget to build a telescope of a certain size, for instance. But that only holds up to a certain point. For instance, for the CMBR, we have an effect that is called 'cosmic variance', which means, in other words, that we cannot get to these fluctuations as precisely as we would like, even by building bigger and better telescopes. There is an intrinsic limit to the ultimate statistical precision we can obtain, set by the fact that we have only one universe to observe. We can't travel to a very distant galaxy and observe the differences from another perspective, we're stuck here. And so this sets a limit on the amount of information you can ever collect, process, and analyse about the universe.

C: With regard to these intrinsic limitations upon, or conditions of, cosmological research, isn't this also in part where so-called 'anthropic reasoning' comes in – because the very fact of these, as you say, non-trivial limits, is something which has to be explicitly taken into account and, as it were, factored into the results of one's research? Of course, taking into account and 'correcting for' the 'subjective biases' of one's observations is part and parcel of all empirical science worthy of the name. However, in the case of cosmology in particular, there's something more fundamental at stake, isn't there, which follows from the apparently trivial and platitudinous fact that we cannot observe in an environment that does not support our existence? In other words, apart from the specific kinds of limitations you've just mentioned, there is also the basic fact that our evidence about the universe is restricted by the conditions necessary for our presence as observers.

RT: Yes, this is the so-called 'Weak Anthropic Principle' [WAP]. The way to understand this properly, I think, is not as if we are saying that human beings, or humankind, has a special role as observers *per se*. Rather, the question you could ask is: What does the fact that there are observers such as ourselves, tell us about the global properties of the universe as a whole – if anything at all? Obviously, we have to live in a very special place in the universe in order for us to be here at all. It's not just an average, randomly-picked place in the universe; we have to have the right conditions for life to be here and to be able to ask the question in the first place. So I think the only reasonable way to approach this is to start from the observation that we exist, and then try to consistently take into account the fact that all of our observations are implicitly conditional on the fact that we must be here to make them, and then carry on from there, in terms of probability statements; all the probability statements we make – such as, is our universe probable or not – we have to take into account this piece of information.

C: Part of the difficulty with the use of probability in theoretical cosmology is that it's difficult to understand how the 'frequentist' paradigm, the idea that a probability relates to a number of possible cases, could make sense. The frequentist paradigm is not only related to the repeatability of scientific experimentation but also in its origins, to gambling, to being able to play the same game over and over.

RT: Yes, absolutely. Although, from the point of view of the history of science, the Bayesian framework was born first, with Laplace, who applied it to problems in celestial mechanics, but was then superseded by what became the orthodoxy in the early decades of the twentieth century, by the work of people like [Sir Ronald Aylmer] Fisher. The frequentist approach to probability may be natural in the case of particle physics, because you have a certain number of particles, you count how many of them you have, and you count relative outcomes. But the Bayesian way of understanding probability is arguably a way which is more natural, in the sense that it's probably connected with the way that a naturally-selected mind works. Let me give you an example. If I ask, what is the probability that if I cross the road now I will be run over by a car, I am asking a question of an experiment, and I am naturally making a Bayesian inference as to what are my chances of crossing safely or not in that particular situation – I certainly don't want to repeat the experiment a hundred times and see how many times I get run over! So, in nature, actually, you want to be able to assess probabilities, chances, in terms of situations that are intrinsically unique, that cannot and will not be repeated. Now, the universe is clearly one of those cases. We have one universe – or, if it *is* repeated we certainly have no access to the repetitions, to other organisations or different laws of physics in the multiverse. And so we have one sample to work with. And we should stick to that, by understanding probability statements not as an outcome of frequencies, but rather as a state of knowledge. In other words, probability is in the eye of the beholder, in a sense. Probability is my state of knowledge conditional upon all the information and prior beliefs.

C: The problem of the applicability of concepts such as probability and chance to the universe as a whole has a long history. In his *Dialogues Concerning Natural Religion* Hume argued that, since the cosmos only happens once, we cannot hope to gain any knowledge of any regularities in how it is created. One can question the very propriety of attributing 'probabilities' to these initial or overall conditions of the world at all. Attributions of probability, it has been argued, depend upon observed relative frequencies in the world from which probabilities are inferred. To talk about the probability of a universe is, for this point of view, incoherent.[6] In a recent paper co-authored by Glenn Starkman entitled 'What's the Trouble With Anthropic Reasoning?', you raise precisely this issue, and suggest that some of these difficulties might be addressed by taking what you call a 'fully Bayesian approach to the problem' which, as you were just saying, would understand the prior as 'an expression of our state of knowledge'.[7] Could you, in simple terms, explain how Bayesian methods, and this notion of probability as a state of knowledge rather than as a relative frequency of outcomes, can work for a singular-case scenario such as the cosmological one?

RT: Yes, there has been a misunderstanding here, historically speaking, in that there has been this notion of probability as frequency, and that an event which happens only once cannot be deemed either probable or improbable – it just happens. But the connection between frequency of outcomes and probability is a limited one, which doesn't necessarily cover much ground, and in particular not the ground we're interested in covering, which is events that are by definition non-replicable. I gave the example just now of walking across the road. As I've said, most situations in which we are interested in making predictions about the outcomes of future actions are intrinsically unrepeatable. Let's take the most basic probability example, that of tossing a coin – one of the paradigmatic examples. If asked to assess whether the coin is fair, most of us would think of tossing this coin perhaps a hundred times and seeing whether there are, say, fifty heads and fifty tails, or sixty and forty, and then based on that, we ask what is the probability of getting heads or tails, and if that's 50 percent, we deem the coin to be 'fair'. And so, when we do these kinds of tests, paradigmatic tests, we are setting out to establish, as it were, a physical property of the coin – that the coin is either fair or not, meaning that it's either well-balanced or not. A die can be loaded or not, for instance. But, if you think about it for a second you'll realise that there's no such thing as a *physical property of the coin* that determines the outcome of heads or tails. In fact, if I was skilled enough and made my 'random' throw with sufficient finesse and precision, regardless of whether the coin was 'intrinsically fair' or not, I could get it landing heads 100 percent of the time. In other words, when I'm doing random tosses of the coin, the *randomness* is the key ingredient. The randomness of the toss means that my skill in tossing the coin is not good enough in order to determine in advance what will be the final outcome. But in principle, if I could determine the initial conditions of the toss with a high enough precision, I would be able to predict exactly, or to achieve any particular sequence I wanted, by having a better knowledge of the initial conditions of the problem – since, for non-chaotic, classical systems at least, the physics is completely deterministic. So by tossing a coin, we're not testing it for fairness, we're not measuring a physical property of the coin. Rather, we're making a statement about our state of knowledge of the randomness of the toss. In other words, we're making a statement *about our knowledge of the initial conditions of the problem*.

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[6] These formulations of the objection are taken from C. Callender, 'Measure, Explanations and the Past: Should 'Special' Initial Conditions be Explained?', *British Journal of the Philosophy of Science* 55, 2004: 204 and L. Sklar, *Physics and Chance* (Cambridge: Cambridge University Press, 1993), 313, respectively.

[7] Roberto Trotta and Glenn D. Starkman, 'What's the trouble with Anthropic Reasoning?', *AIP Conference Proceedings* Vol. 878 (2006), 323-329.

So, how does this fit into the discussion of probability? Well, probability as a measure of *frequency* is one possibility: I define a probability intrinsic to the coin as a physical property of the coin, as the number of tosses divided by the number of tails of my series. But in the light of what I've just said, it's perhaps more useful to regard this not as a measurement of a physical property – since this property doesn't exist, as shown by the fact that I can completely change the outcome without changing physically the coin, just by changing my state of knowledge about the system I'm investigating … So it's perhaps more interesting to look at probability as expressing not an *intrinsic property of the objects* of study that has to do with their behaviour over long sequences of repetition, but rather to see that it has to do with *our state of knowledge of the object* based on our previous interaction with the object, the previous data. In this way, I can iteratively update my state of knowledge as new data come along. Based on previous knowledge – what we call the 'priors' – we can update it through new observations and get to a more informed state of knowledge.

Now, to go back to the universe, clearly we have no access to a repetition of the universe. But what we *do* have is access to information about the particular realisation we live in, and so by using this Bayesian technology, as it were, we can make statements not about the probability of an outcome of an infinite series of universes which is only posited *ad hoc* – which is ontologically debatable, in my opinion – but we can make statements about our state of knowledge of the particularisation that we happen to observe, which gets more and more informed and refined as we gather more and more information. Of course, all I've said here about probability holds at classical level – physical systems as deterministic. When we go over to the quantum level where probability is an intrinsic feature of the system, then the discussion has to take this into account, which opens up a completely new can of worms.

C: What you've said about Bayesian techniques certainly seems to problematise Quentin Meillassoux's recent critique of probabilistic arguments as applied to the universe itself, given that this critique appears to limit itself to narrowly 'frequentist' construals of probability.[8] But Meillassoux also takes issue with applications of anthropic reasoning which begin by envisaging a multitude of logically possible worlds – worlds in which the physical constants differ from those of the universe which we actually observe – and which then, having calculated that the probability of universes which permit the conditions necessary for life is astonishingly low, go on to infer that some hidden necessity must be at work which uniquely determines the constants of the observable universe.[9]

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[8] See present volume 64-7, and Q. Meillassoux, *Après la finitude* (Paris: Seuil, 2006), Ch. 4.

[9] See present volume 77-8.

Meillassoux's argument is pitched at a purely *a priori* philosophical level, but the problem of the so-called 'fine-tuning' of the physical constants of the observable universe is a rather precisely-defined problem for cosmology, one which would seem to cry out for an explanation. While one will agree with Meillassoux that these 'fine-tuning coincidences' in no way license the reintroduction of teleological explanations such as one finds in the so-called 'strong' versions of the Anthropic Principle [AP], there is nevertheless a very real question here, is there not?

RT: Yes, indeed, from the point of view of cosmology and theoretical physics, the issue of fine-tuning you refer to is precisely the question that string theory has set out to answer – and so far has *failed* to answer. Which is to say, the hope of string theory – which is a theory that hopes to explain in heavily mathematical fundamental terms all of the structure of the particles and interactions in the universe – the hope was that it would turn out that there was a single mathematically consistent and logically possible realization of the theory, one which would account for all phenomena, structures, symmetries, particles, interactions, and so on. It didn't turn out to be the case, however. We now know that string theory has many different possible 'realisations', different corners of string theory space that are all equivalent to each other in some way, but none of which is unique. So it doesn't seem that the promise of string theory of being *the* final theory of physics – in terms of being unique and explaining all the phenomena – will be realised.

C: The hope was that it would explain those twenty or so free parameters of the Standard Model – the values of the constants which have to be, so to speak, 'written in by hand' – that are always invoked in discussions about fine-tuning?

RT: Yes, the hope was to explain in a unique and fundamental way all the parameters, and all the symmetries as well. But now, this hasn't turned out to be the case, and so we're stuck in a position where string theory doesn't make a unique prediction, as one had hoped, since there are multiple realisations of string theory which give you what is called the 'landscape' of solutions, which is a multidimensional mathematical object. It's called a 'landscape' because it's configured in terms of 'mountains' and 'valleys', and it turns out that at the bottom of each valley there is what's called a 'vacuum state'. Now, each of these vacuum states at the bottom of every valley represents one possible outcome for the universe. All this, so far, is of course mathematical theory, and so the question is to know which of these valleys in the landscape *our* universe occupies. But the number of possibilities for these logically possible universes, which Meillassoux mentions in a philosophical context, possibilities which are actually realised in this mathematical theory, the number of these possible universes is huge – it's something like 10^{500} – a huge, huge number. So again we have to resort to statistical techniques in order to analyse this landscape of possibilities.

The question then is, given this 10^{500} universes, our universe corresponding to the realization has been singled out in reality – how do we go from these potential universes to the actual, realised universe that we observe? This is where AP comes in, in saying that we have to count how many of these valleys are habitable. And this will restrict enormously the number of viable possibilities. Of course, we could not happen to live in one of the valleys which do not support life, say because the constants of nature there are such that life is not possible. And so you see modern physics seems to flesh out, as it were, in a very mathematically hard way, in the form of the landscape of string theory, precisely this idea of logically possible universes mentioned by Meillassoux. And now AP comes in as a possible solution, to try to explain the contingency of *our* particular realisation. Whether it's successful or not remains to be seen.

I personally have this criticism of this landscape of string theory: first of all, it's all dependent on the assumption that the heavily mathematical theory that describes this landscape is correct in some sense. And secondly, it introduces this plethora of universes, or alternative realisations, that are non-observable in principle. It introduces lots of possibilities that remain in the domain of the potential, just in order to explain how it comes about that we appear to inhabit a particularly fine-tuned realisation. But the moment you open up the space of infinite different universes you cannot observe, I think you are falling on the other side of this thin line dividing scientific enquiry from pure speculation, which cannot be scientifically tested. Which is fine – I don't want to give you the impression that I'm against these kinds of speculations. I'm only against them when you claim that you are able to do quantitative tests on things which, meaningfully, cannot be tested.

C: Indeed, in the paper mentioned earlier you dismissed the multiverse scenario precisely because, firstly, it seems not to be very economical, in terms of Ockham's razor; and secondly, because, as you have just said, it's not testable. Now, to take up the second point, it's obviously not 'testable' in any straightforward positivistic or verificationist sense; yet we know that a lot of things in modern physics are not testable in *that* sense. Is it not perhaps conceivable, however, that a number of quite different theories, coming from different domains of physics, perhaps as solutions to quite disparate problems, might ultimately all seem to point in the same direction – that is, in the direction of the multiverse scenario? In other words, one might reject the idea that fine-tuning *alone* is strong enough evidence to postulate a multiverse, but what if it turned out that there were other, independent reasons, to favour it? One thinks, for example, of Everett's 'many-worlds' interpretation of QM, or the very fact, as you were just saying, that string theory seems to admit of a multitude of 'solutions', or possible realisations. Is it not conceivable that a number of such theories, or interpretations of theories, might ultimately amount to a sort of evidence – indirect evidence, granted, but mutually corroborative – for some version of the multiverse idea?

But if not, what are the remaining alternatives? Do we just say that the values of these free parameters are 'brute facts' that we simply have to accept without any further explanation? But to say that – to say, in effect, 'The universe had to be *some* way, so why not *this*?' – that seems to be against the spirit of science itself …

RT: Yes, absolutely. But you see I think the problem here is that with string theory and the landscape, and this accumulation of extra layers postulated to explain physical reality, what we are doing in effect is moving away from trying to find out what are the laws of the physical universe; we are effectively crossing the boundary into trying to determine *meta*-laws governing the laws we have discovered in the first place. So if you think of these constants – one can say this is merely a brute fact, that that's just the way the universe is, but as you say, we're not content with that, we want to push forward and dig out another explanation. And one hope would be that it was possible to use this very powerful principle that we've used very successfully in the last couple of hundred years, which is the principle of symmetries. As I discussed before, these symmetries do not have to be tied up with real world symmetries – they might be the most abstract symmetries that live in a mathematical space. If those symmetries were in place, one would perhaps be able to explain these constants, because only a specific set of symmetries would allow for those particular values. For example, if dark energy is a manifestation of a cosmological constant, than the value of this constant is a very small number, and yet it's non-zero. If it were zero, everybody would be happy because – even though on the real line of numbers zero has a dimension or length of none, of zero – in fact zero is an extremely special place, so if something is zero in physics there's a symmetry which requires, which demands it to be zero. But if something is non-zero but extremely small – say 124 orders of magnitude below what you'd expect it to be – this is an astonishing fact that cries out for explanation. It could just be a brute fact and we might have to accept it as such and that's the best we can do. But, what people really are trying to look for, is to uncover the fundamental structure that will explain the smallness of this number when compared to the known energy scales in physics. So we are looking into discovering the laws or the mechanisms that possibly underlie and explain those numerical values. But even if we were to discover those laws in the form of a Grand Unified Theory or whatever – and we are not there yet – the question would remain: What is the meta-law that singles out *that* specific set of symmetries in the first place?

C: There's the risk of an infinite regress.

RT: Yes, exactly. That's what I'm trying to say. So, we're not giving up yet, but I can already peel off this layer and see where we're going.

C: The fact that you might end up with an infinite regress isn't a reason to stop.

RT: No, absolutely not …

C: There's a regulative ideal in play, such that you keep pushing on …

RT: Yes, absolutely. But you were asking whether it was possible that this explanation for fine-tuning would be testable or whether there would be enough cumulative indirect evidence. Again, you can always push the game one layer down, and find yourself asking deeper and deeper questions, and this is an infinite regression that is difficult to break, whose solution is not in sight, especially after string theory didn't offer such a way out.

C: In this respect Meillassoux introduces his distinction between chance and contingency as a sort of shortcut, or regress-stopper – he says, in effect, that you *can't* go back another level since there's an absolute, radical contingency which can't be submitted to any law whatsoever …[10]

RT: Yes, whilst cosmologists have, at least in principle, these meta-laws governing even the contingency of our universe.

C: We said that your own rejection of the multiverse proposal rests firstly upon the impossibility of experimental confirmation, and secondly upon its apparent flouting of Ockham's razor. Again, sticking to the first point for the moment, what if it turned out that something like string theory *did* ultimately manage to consistently account for the phenomena on all scales – in such a case, would experimental confirmation still be important?

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[10] See present volume, 76.

RT: Certainly, yes, I would say so. I described before how our work involves a kind of cycle of data-gathering, modelling within a theoretical framework, and observational confirmation. The trouble in this loop comes when you get to a certain point where theories are constructed in such a way as to avoid experimental confirmation or falsification altogether. So when you get to the point where you need to postulate a possibly infinite number of unobservable parallel universes in order to explain why the constants of nature are the ones that we now observe – this, I think, crosses the boundary of scientific, verifiable theories; because for such theories, experimental or observational input is *designed* to be impossible.

C: And this brings us to your second objection, that such theories needlessly postulate entities. But isn't it possible that in the future you will be faced with the alternative of accepting theories which account very well for phenomena, but which cannot be experimentally confirmed, on the one hand, and experimentally-confirmed theories which permit a relatively inferior mastery of the phenomena, on the other? In other words, is there a disparity between the potential reach of speculative theories can have, and their grounding on experimental evidence?

RT: Yes, and dark matter is an instance of this. Some of this disparity is closed, or will be closed, by improvements in experimental instruments; so, we'll build bigger, better detectors, and we'll get there eventually – even though one has to bear constantly in mind the limitations to our knowledge that are peculiar to cosmology and that I was mentioning before. But the problem is where this theoretical reach is exercised in a domain where experimental proof or disproof cannot happen *in principle*. At this point I think you are losing all the power of theory, and from a scientific point of view you give in to pure speculation, which has no testable consequence and therefore is outside the proper realm of anything we could call scientific investigation. And I think the multiverse idea is an example of this, since even if these parallel universes were real in some sense, they are constructed to be undetectable because they are outside the reach of any particle, any possible experiment you could possibly do, and so you have to question what type of reality you could attribute to this theory, if any.

C: But hasn't the progress of modern science been precisely this movement towards extremely counter-intuitive ways of thinking? Most of us find even the most basic statements of modern physics counter-intuitive. They seem to be talking about a world entirely alien to that in which we live every day.

RT: Does the progress of science show us that we are going inevitably towards a realm where our intuition doesn't apply? I think there are a few things to mention here. One is what has been termed the 'unreasonable effectiveness of mathematics'[11] – why does mathematics describe the world in the first place? It can be argued that mathematics is ultimately just a product of the mind, which is arguably a manifestation of our brain structure, which, in turn, as a biological entity, must be a product of evolutionary forces that have shaped our cognitive behaviour in terms of responses to the world. But then this wouldn't explain why we're able to grasp things like QM or GR, of which we have no experience at all. I'm not sure whether there is an explanation for the fact that there are things of which we don't have any immediate experience – QM, something which is completely counterintuitive, weirder than you could possibly think – but which are accounted for by our mathematical constructs. This for me is the biggest puzzle of all – why should mathematics have anything to do with physical reality, and why should physical reality conform to this very abstract product of our minds? I don't have an answer for this question, but I think it is something that tends to be swept under the carpet, in operational terms.

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[11] Eugene Wigner, 'The Unreasonable Effectiveness of Mathematics in the Natural Sciences' in *Communications in Pure and Applied Mathematics* Vol. 13, No. 1 (New York: John Wiley and Sons, Inc., 1960).

C: It's perhaps precisely here that the convergence of physics and philosophy – their shared space of problems, so to speak – becomes most visible. Indeed, the very questions you have just posed – 'Why should mathematics have anything to do with physical reality?' and 'Why should physical reality conform to this very abstract product of our minds?' – are precisely the problems which Kant set out to definitively resolve in his *Critique of Pure Reason* and *Prolegomena to Any Future Metaphysics.* Kant's solution, of course, is comprised within what he called his 'Copernican experiment' in philosophy, which basically states that the reason why physical reality conforms to our mathematical concepts is that these concepts provide the 'synthetic *a priori*' *conditions* of natural science itself. In other words, empirical reality conforms to our concepts because these concepts are not derived *from* experience, but exist rather *for the sake of* experience: that is to say, they make experience, and the objects of experience (and for Kant this meant, first and foremost, the objects of natural science) *possible*. This was perhaps a compelling solution in terms of the mathematics and natural science of Kant's own day – that is, Euclidean geometry and Newtonian mechanics – which, as we were saying earlier, are more or less entirely isomorphic with the middle-sized world of our everyday experience. But as you have just remarked, when it comes to twentieth century physics – to QM and GR – one finds no such isomorphism, and so the problem becomes far more difficult.

This is perhaps an appropriate place to touch upon some questions we were hoping to broach regarding a certain parallel we had noticed between the use of so-called 'anthropic reasoning' in cosmology – which has already come up in our discussion several times – and certain aspects of the Kantian legacy in contemporary philosophy. Brandon Carter, who first introduced the term 'Anthropic Principle' in 1974,[12] later had some cause for regret that he had not called it something else – the 'Cognizability Principle' or some such – given the somewhat inevitable misunderstanding that it entails some of kind of anthropocentrism or 'anti-Copernicanism', whereas the real point has to do with possible 'observational selection effects' entailed by ‘observership’ in general, not *anthropos*, or *homo sapiens* in particular. Carter’s original point was that it is a mistake to infer from the fact that we do not occupy a privileged *central* position in the universe the conclusion that our situation cannot be ‘special’ *in any sense whatsoever*. The problem with what he called ‘exaggerated subservience to the “Copernican principle”’ is the risk that, from the presumption of our *non-specialness* we might infer that we are *average*, and from this that we are *representative*, and hence *neutral*. In striving to avoid anthropocentrism in this way we would, paradoxically, be reintroducing it in another form, because we would fail to take into account the specific limitations on our knowledge entailed by the fact of the very special physical conditions which must be in place if we are to exist as observers – and be the specific kind of observers we are – in the first place.

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[12] B. Carter, 'Large number coincidences and the anthropic principle in cosmology' in (ed.) M. S. Longair, *Confrontation of Cosmological Theories with Observational Data* (Dordrecht: D. Reidel, 1977), 291-8.

In this regard WAP invites comparison with Kant’s ‘Copernican experiment’ in philosophy. Kant faulted the metaphysical tradition which came before him precisely for failing to take into account the fact of the essential limits of our modes of cognition – that is, of the conditions which must be in place for cognition to be possible in the first place – and thus for assuming that the (epistemological) conditions of human knowledge were also the (ontological) conditions of things in themselves. In the most simple and general terms, Kant’s point was that one cannot know a thing in abstraction from the very conditions of cognition itself. Because previous metaphysics had not undertaken a properly ‘critical’ investigation of the epistemological conditions of its own inquiries, it had inevitably proceeded ‘dogmatically’ by assuming that its own conditioned vantage-point on things amounted to an unconditioned access to things as they are in themselves. Thus, as with WAP, rather than attempting to illegitimately infer metaphysically dubious anthropocentric conclusions from trivial or truistic premises, one might argue that Kant too was attempting to precisely *avoid* the anthropocentrism which follows from failing to take into account the non-trivial limitations upon and conditions of the possibility of cognition itself.

But however one interprets Kant on these matters, it has often been claimed that his 'Copernican turn' in philosophy, as a matter of historical fact, inaugurated a way of doing philosophy which, far from complementing the natural sciences by providing second-order epistemological critiques of their first-order claims, in fact runs counter to the 'Copernican' spirit of modern science itself by effectively placing man (or the knowing subject) back at the centre from which Copernicus had dethroned him. Meillassoux's *After Finitude* presents a particularly forceful example of such a cricitism.[13] According to Meillassoux, the mainstream of philosophy since Kant cannot but fail to make sense of the literal import of cosmological and other scientific statements about the universe so long as it remains within the paradigm of what he calls 'correlationism' – this being the name he gives to the long-prevailing consensus regarding the supposed absurdity of the idea of 'things-in-themselves' (i.e. the idea of obtaining knowledge of things as they are regardless of human experience), along with a positive doctrine which states that all possible objects must be understood strictly in terms of their correlation with either possible experience, subjective consciousness, intentional acts, language, conceptual schemes, or theories. A strong 'correlationist' position on dark matter would not merely claim (like WAP) that our cosmological models are necessarily conditional upon certain cosmological parameters which permit the empirical advent of life and of consciousness, thus putting us on our guard against neglecting these factors in our reasoning. It would affirm the much stronger thesis that in principle the very existence of dark matter is conditional upon our cognition of it, that astrophysical objects can only be said to *exist* by virtue of the conditions of our cognition – whether these conditions are intersubjective linguistic networks or the historical corpus of mathematical learning. In sum, dark matter exists, according to the correlationist, only 'for us' but not 'in itself'.

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[13] *Op. cit.* For a critical appraisal, see R. Brassier, present volume, 15-54.

Now, this seems particularly difficult to accept in the field of cosmology where, as Meillassoux points out, 'experimental science is capable of producing statements concerning events anterior to the appearance of life and of consciousness.'[14] How, within the 'correlationist' framework – which is happy to accept scientific statements only along with the caveat that they are true only 'for us' – can we understand the meaning of a statement which purports to provide us with knowledge of entities and events which existed billions of years *before* there was any 'us' to cognize them?

The question is fundamental: does scientific objectivity allow us to in some sense 'get out of ourselves', to transcend the conditions of our experience and to achieve genuine cognition of the universe in itself? WAP appears to be optimistic here, suggesting that, precisely by taking into account possible observational selection effects and other biases intrinsic to our existence as observers, this is precisely what can be achieved. What we might call the 'Correlationist Principle', on the other hand, forecloses the question immediately, in accord with its assumption that everything is necessarily conditional upon the conditions of our cognition.

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[14] Meillassoux, *op. cit.*, 24.

Now, these questions are obviously somewhat philosophically involved, and perhaps belong to epistemology rather than science proper. But one might think that, if anywhere in modern science they become urgent and uncircumventible, it is here, in the domain of cosmology. Similar questions have, of course, been central to the problem of the correct metaphysical interpretation of quantum physics for almost a century. Do you think that your own work, and modern cosmology in general, might ultimately be able to contribute something towards resolving these long-standing disputes? To what extent are such problems real and live ones for the working physicist or cosmologist? If a 'naïve realism' is no longer a real option, both because of what modern science has discovered and the sheer tide of philosophical arguments against it, what are the remaining alternatives?

RT: Well, first of all, I would certainly subscribe to the idea that the knowledge we gain of these objects which preceded the possibility of us experiencing them comes out of something like a time-shift – it's like time-travel. Because we have to remember that as we look back in time by observing distant objects we are witnessing different stages in the evolution of the universe. However, when we look at a distant galaxy we don't, of course, obtain knowledge of how the universe is 'now', as we observe it – indeed the whole concept of simultaneity is rather counter-intuitive in relativity, as we discussed. Rather, we have knowledge of the universe as it was when the light first left it. So now, when we look back to the very beginning of the universe, in a way we are looking at a point of the universe which may be billions of light years away, but since the Big Bang happened everywhere in the universe, and since we assume that the universe is isotropic – that there is no special place in the universe – then we are also looking at the universe as it was 'here', in a sense, in our location, only timeshifted.

But you asked whether scientific objectivity – perhaps supplemented by AP, purporting to correct for subjective bias – whether it allows us to have a genuine cognition of the world in itself. In science we can certainly have this sort of counter-intuitive narrative of disembodied entities, that we like ourselves to compare with. However, the selection effects expressed by AP remind us that such disembodied observers are an artifact of our cognitive process, and that quite on the contrary we have to carefully consider the physically and biologically necessary conditions for our presence. But we have to bear in mind that in order for AP to work, we have first of all to postulate, to apply this selection effect to a collection of samples, be it a class of objects in terms of realisations of the universe, different parts of the multiverse, multiple inflationary patches, whatever. And after that you need to define a reference class of observers – and this is the criticism I make in the paper you mentioned earlier. You have to define what counts as an observer in order to establish what is the probability of our being in such and such a universe. We have to define very precisely what it means for us to be observers: what is the reference class of observers we belong to – cockroaches, for instance – do they count as observers or not? That's a very fundamental point.

I think this is relevant to the question of the relation between AP and the 'Correlationist Principle' in the sense that, in order to achieve logical consistency when considering a reference class of observers, we must require consistency between the outcomes of inferences made by different members of the same reference class of observers. And this, I think, is very relevant with regard to correlationism. In other words, in order for probabilistic inference to work, we have to require that different observers, say us and some alien species on Andromeda – if we postulate that they use the same logic, that the rules of logic are valid throughout the universe, which is again one of the main postulates – we have to require that different observers in the same class of reference will necessarily achieve a consistent inference by making the same observations. And so I think that debunks, in a way, the Correlationist Principle. Because if this is true – AP supplemented by the requirement of logical consistency between observers in the same reference class – if this is true, then necessarily we don't have this freedom anymore for different observers in the same reference class to experience the world in a different way. In other words, the arche-fossil[15] has got to be an entity of its own that can't be processed at will by interaction with different observers of the same reference class – *if* AP is to work at all.

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[15] See R. Brassier, present volume, 15-6.

So in other words, I think what you have represented very nicely in your question is two different ends of the spectrum of possible cognitive experiences: correcting for subjective bias through a careful use of AP, on the one hand, and introducing a new way of subjectively experiencing the world in the correlationist approach. I suspect that the two of them can't live together. I would claim that for AP to work in a consistent way – if we accept logical consistency as one basic rule of inference, for instance, which it's hard to do without – then it requires consistency among observers in the same reference class, however defined. If this is the case then it means that the entities upon which we condition in our application of AP as a selection effect – those entities must have some common, intrinsic properties of their own, properties which every observer in the reference class of observers reasoning consistently has got to agree upon.

C: This introduces the problem of relativism, of alternative conceptual schemes. But correlationism need not necessarily entail relativism, since even if all observations agreed, and even agreed *necessarily* – as in Kant's case, where the transcendental conditions are *a priori* (that is, universal and necessary) – the correlationist would still insist that intersubjective consensus is an insufficient basis upon which to claim that such observations reveal properties of things *as they are in themselves*. In fact, the correlationist would claim that it is precisely this consensus amongst observers in the same reference class which makes the objectivity of objects possible, thus collapsing the ontological problematic into a matter of intersubjective agreement or heuristic pragmatism,[16] which is precisely what the critique of correlationism seeks to avoid.

To put it as starkly as possible, the fundamental question here is whether there is any prospect of obtaining knowledge of things as they are in themselves – regardless of there being actual or possible observers – or whether it is something constitutive about cognition that it will always be a matter, not of 'nature in itself', but only of 'nature as exposed to our method of questioning' (Heisenberg)?[17] Kant's metaphor was one of reason as a judge, 'constraining nature to give answers to questions of reason's own determining',[18] and perhaps in your account of the methods and objects of theoretical cosmology you have already implicitly ratified this metaphor, whilst making it clear that it is nevertheless by no means a question of a simplistic 'correlationism'.

Another way of approaching the issue is in terms of the problem of the theory-dependency of observation which we touched upon earlier. You said that all the necessary theoretical and instrumental mediation required to access cosmological objects amounted not to a diminution but to an ‘enhancement’ of reality – almost as if there is a sense that one is ‘producing’ the reality. Does scientific knowledge, as you understand its process, fit more closely with the classical philosophical idea of knowledge as a kind of ‘copying’ or ‘representing’ of an already fully-determinate reality, or is there a sense in which the objects of physics have to be ‘constituted’ via the theoretical and technical ‘mediating processes’ you were describing earlier?

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[16] See Meillassoux's critique of Goodman, present volume, 56-9.

[17] 'In classical physics science started from the belief – or should we say from the illusion? – that we could describe the world or at least parts of the world without any reference to ourselves […] [But] we have to remember that what we observe is not nature in itself but nature as exposed to our method of questioning.' W. Heisenberg, *Physics and Philosophy: The Revolution in Modern Science* (NY: Harper & Row, 1962), 43, 46. See also Kristian Camilleri's 'Heisenberg and the Transformation of Kantian Philosophy' in *International Journal of the Philosophy of Science* Vol. 19, No. 3, 2005: 271-287.

RT: Let me give you an example which I think illustrates how a reality comes into being through the scrutinizing power of the scientific methodology. Leaving cosmology for a while and turning to quantum physics – another field which is often on or across the boundary of interpretation and reality – if you take for example a *two-dimensional electron gas*, which is something that has been realized only in the last few years, thanks to various developments in sub-microscopic technology. This two-dimensional electron gas has a set of nice properties that we can investigate: we can

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18. ‘When Galileo caused balls, the weights of which he had himself previously determined, to roll down an inclined plane; when Toricelli made the air carry a weight which he had calculated beforehand to be equal to that of a definite volume of water […] a light broke upon all students of nature. They learned that reason has insight only into that which it produces after a plan of its own, and that it must not allow itself to be kept, as it were, in nature’s leading-strings, but must itself show the way with principles of judgment based upon fixed laws, constraining nature to give answer to questions of reason’s own determining. […] Reason, holding in one hand its principles, according to which alone concordant appearances can be admitted as equivalent to laws, and in the other hand the experiment which it has devised in conformity with these principles, must approach nature in order to be taught by it. It must not, however, do so in the character of a pupil who listens to everything the teacher has to say, but of an appointed judge who compels the witnesses to answer questions which he has himself formulated.’ I. Kant, *Critique of Pure Reason* (trans. N. K. Smith, Basingstoke: Macmillan Press, 1929 [1789]), B xii-xiii.

put it into magnetic fields and see how it behaves, see quantised energy levels, and different types of effects which, in a way, are the expression of a potentiality which is in nature or in the laws of nature that we've discovered. But in a way it's a purely technological object – it was potentially in the structure of nature, but one might surmise that it has never been created before in the history of the universe, because it's a very particular object that needs to be very carefully engineered in order for those electrons to bind up in a certain type of state and then express or substantiate those abstract potential properties that our theories describe they have, and then go there, measure it and see what is real. So in a sense this is not just a step ahead of the process of setting up an experiment and making a verification; this is more about *creating a particular state of nature*, actualising potential properties of an object in order to display them in such a way that we can verify them. So in this sense we have achieved in some domains a level where we have a description of nature in terms of its fundamental properties, and we can engineer physical systems, and push them across boundaries that arguably have never been crossed in natural systems because of the very particular set-up that this requires, and so design and engineer new natural conditions that are actually artificial – new artificial natural conditions – which actualise the potentiality of our theory. And here you are at the boundary where you can ask of this system: well, that's a natural system because its actual properties are governed by laws which are natural laws, of course, but those particular properties that you are looking for, their actualisation is only possible in a highly artificial, highly engineered environment that we have now created.

C: A longstanding philosophical problem is how to separate out what belongs to the human input to reality and what belongs to reality itself. In the context of physics generally, and more specifically in the context of the kind of example you've just given, is that in principle even intelligible, this process of 'factoring-out'?

RT: No, I don't think that we can draw a clear boundary between the two. This is an example where we have a little liberally gone across the boundary both ways, and there's no way you can draw a line, but it's just a suggestion to say that there are systems that sit beyond the Galilean distinction of the impartial observer who sets up the experiment and then simply lets it go ahead on its own. We know that the observer plays a crucial role in quantum mechanical observations, and the whole paradigm of setting up an experiment and letting nature run its course in an impartial neutral way, I think it belongs to the past, since our decisions of which properties to observe and which to ignore, for example, will directly influence the system. So there are limitations to the Copernican Principle of the separation between observer and nature. I think science is going in this direction. In one way we are getting more and more sophisticated observations of reality, and at the same time those same observations, to an extent that is difficult to define, determine which reality one can observe in the first place, at both extremes of the spectrum – the microscopic world of QM, of course, and cosmology.

And the other thing that has to be said here is, if you peel away all the layers of the onion, for me it comes down to the issue of consciousness. Why consciousness? We have this 'correlationist' idea that the world wouldn't be there if there was no observer to observe it, but what do we mean by 'observer'? It's a problem that goes back all the way to the root of QM, Schrödinger's cat: What makes the wave function collapse, what makes the cat go from a position of living *and* dead to either living *or* dead? And again it's a fundamental problem for which there is no agreed explanation. It's more about the interpretation we give to the quantum theory. In and of itself, QM works perfectly well, it's only the interpretation as to the reality of the wave function that is disputed. Let me briefly summarise the interpretations. Firstly there's what is called the 'Copenhagen interpretation', which says that the wave function collapses into one of two states when the observer observes it. Now at this point we can question whether the observer is a machine, an electron or photon that hits the object we observe – so the universe would be observing itself all the time; or whether there is space, as people such as Roger Penrose would argue, for a special role for consciousness: consciousness would play the role of the fundamental observer that would make the wave-function of the universe collapse, like in quantum cosmology: in quantum cosmology you have the wave function of the whole universe.

C: But then you're introducing a strange gap into causality: a special agent.

RT: But that gap is in the equations, that's exactly the point: the equations of QM are deterministic. We've got the Schrödinger equation, and we've got initial or boundary conditions. And then the equations will evolve through time this mysterious wave-function, whose square gives you the probability of events happening. And when there is an observation the wave-function collapses from a superposition of different events to just the event that is observed. And so, the point is, everything is deterministic up to the point where the collapse happens, and we don't know what makes the collapse happen, and we cannot give deterministic predictions for the collapse, only probabilities. That's why the deterministic picture breaks down, we can only make probabilistic predictions about what happens: in the case of the cat, in the case of the seeds for the quantum fluctuations, and in the case of the universe. And there are different views. The Copenhagen interpretation will tell you that it is the observation that makes the wave-function collapse, and the alternative will die out, mysteriously. Then there is the 'many-worlds' interpretation, which tells you that at the moment an observation is made, the observer splits into multiple copies, each one of them observing at the same time different events, all possible events that can happen *do* happen, and that our particular reality is but one branch of this unimaginably vast tree. And to a certain extent there are testable predictions that have been done, that have excluded certain interpretations – the hidden variables interpretation, which was put forward by Einstein, has been partially excluded by tests of the so-called 'Bell inequalities'. But this remains very much a contentious issue, I think, and so we cannot really make up our minds as to what makes a wave-function collapse here and there, much less what makes the wave-function of the whole universe collapse, if anything at all.

But you see I think the whole point is that we try to make a narrative out of the scientific framework we're working in, so we tend to talk about cosmological time in pretty much the same way as if we were talking about our subjective time as we know it, we talk about the collapse of the wave-function without really knowing whether this object is just a model of reality or whether it has anything to do with the fundamental reality of the object, the object of the scientific enterprise. The fundamental reality of the 'nature' we're trying to investigate in particle physics and cosmology, I think, comes out from a hundred years of mathematical explanation as one or two things. One is a set of mathematical symmetries, which live in an abstract mathematical space and which give reality its structure. So for instance, conservation of impulse – as we know, if you throw a ball and there's no friction it will keep on going forever – comes from translational symmetry. Conservation of angular momentum comes from rotational symmetry. And then at the deeper level, you can say that conservation of mass, conservation of energy, come from other types of symmetry that are ingrained in the mathematical structure that we ascribe to reality. Now, when we try to uncover this structure through observations, the question arises: even if we were able, with supersymmetry or string theory, to uncover the fundamental structure of nature, the question would be, what principle put this structure in place in the first place? And the hope of string theory, for example, was that you'd find a mathematical theory which could only be consistently formulated within a certain structure: there was no other structure within which it could be formulated. And that would answer the question. But it didn't turn out that way: as we discussed, string theory has failed to yield that kind of paradigm, and Gödel's theorem, perhaps, puts a fundamental limit on how far such a programme can be carried out.

C: Yes, we note that you finish one of your public lectures[19] by juxtaposing a quote from Einstein where he asks 'whether God had a choice in creating the universe' with one from Gödel: 'If an axiomatic system can be proven to be consistent and complete from within itself, then it is inconsistent. It is impossible to find an all-encompassing axiomatic system which is able to prove all mathematical truths.'

RT: Gödel comes in precisely at this level of speculation, when you're trying to push your mathematical tools to the very extreme, to say, will I ever be able to formulate the structure of physical reality in terms of a set of mathematical symmetries that will describe reality in some sense, and then demonstrate, by requiring mathematical consistency, that this is the only possible set? The correlative Einstein quote I use is: 'what I'm interested in understanding is whether God had a choice in creating the universe' – *i.e.*, in imposing this set of symmetries. And Gödel's theorem, apparently sets a limit to this programme, tells us that there is no way every axiomatic consistent set of rules – mathematics – can be complete: for every such system there will always be a statement that is true, but cannot be proven from inside. So this seems to put outside the grasp of any such tool such a fundamental question, it seems to me.

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[19] See http://www-astro.physics.ox.ac.uk/~rxt/html/public.htm#course

C: Thus leaving room for something to have 'planted' the seeds, so to speak …?

RT: It's a possibility. The fascinating thing is that everybody can make up his or her own mind on this. Leaving the door open for a designer – I don't know about that. But in trying to get out of intelligent design, if the solution is invoking an infinite set of universes that only exist in our mind, then I don't know whether this is any kind of solution. It doesn't seem to be a fundamental explanation in the sense in which we have always understood fundamental explanations before in physics.

If 'correlationism' insists that we can only posit objects as objects of possible experience, it seems to me that if we think of this idea of the multiverse – broadly speaking, this idea of 'pocket universes' everywhere, in some higher-dimensional space, with different laws of physics – it seems to be that by resorting to this kind of extreme complexification of reality, science has gone full-circle and is actually positing a series of objects which are definitely, by construction, outside the domain, not only of our experience, but of *any* possible experience. So, rather than reconciling philosophy with science, it seems to me that if you go down this route of the multiverse, you would be going full-circle and bringing science in line with philosophy, rather than vice-versa.

C: In that science would become extremely speculative?

RT: More than that, I think, it would really embrace the idea that in order to explain the one universe we observe, you need to postulate a series of unobservable universes devoid of any possible experience – so it seems to me that it's ironical, paradoxical, that certain ways of thinking of this problem will lead you to such a 'solution'.

C: Yet one might argue that the 'many-worlds' interpretation of QM, for example, while doubtless ontologically profligate, does at least possess the very real virtue of providing an interpretation which is both fully consistent with the equations and which avoids the idealistic, dualistic and vitalistic consequences of other influential interpretations. Leading proponents of the Copenhagen interpretation, on the other hand, have been prone to espouse an idealism so radical it would 'make even Berkeley blush' – one thinks, for example, of Wheeler's notion of a 'participatory universe' according to which 'the observer is as essential to the creation of the universe as the universe is to the creation of the observer.'[20] Similarly, the postulation of a 'multiverse' or 'ensemble universe' as an answer to the fine-tuning problem, AP being introduced in order to explain the apparent 'coincidences' in terms of an observational selection effect, seems in many ways more compelling than a teleological interpretation which would make life and observership a necessary outcome of uniquely specified laws.

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[20] J. A. Wheeler, 'Genesis and Observership' in R. Butts and J. Hintikka (eds.), *Foundational Problems in the Special Sciences* (Dordrecht: D. Reidel, 1977), 27.

So with regard to what you have just said about the impossibility of separating out reality in-itself and our theoretical donation, or nature and the observer, would you put the point as a purely epistemological or methodological one – that it's simply too messy in practice – or would you say there's some legitimacy in this idea of a 'participatory universe', that observership is in some sense necessarily interwoven with the very fabric of the universe?

RT: Again, you'll find the whole spectrum of views on this, from the idea of the participatory universe, or the whole universe as a huge living being, to the most rationalist, scientistic point of view which says that the brain is just a very complex computing machine, consciousness just an emergent phenomenon. So you'll find a lot of different points of view. If I were to give an 'average position' of scientists I know, to position them on this scale, I would put most of them on the rationalistic, positivistic side of it. But having said that, clearly if one wants to be rational and consistent throughout, this implies restricting one's point of view regarding the possibilities of human experience to experiences that are open to any other physical system – you have to abide by the laws of nature without room for any other phenomena that might go beyond them. So far, consciousness is the one phenomenon that seems to be peculiar to humans, and whether this will ever be explainable in the same way we can explain the working of, say, a diesel engine, is a very open debate.

C: You've said a couple of times that, when it comes to the ultimate ontological interpretation of science, 'everyone can make up their own minds' – almost as if it's simply a matter of personal preference. Is this not a huge problem? In a way one might be disappointed, after all the great progress of science, in particular over the last century, to be told that science itself is unable to instruct us regarding its own ontological interpretation. It seems as if you're saying that one can 'cherry-pick' whatever interpretation one wishes, that science itself doesn't place any constraints upon the kinds of metaphysics one might be able to extract from it. But one might have hoped that science would have offered us clues – indeed, more than just clues – to these questions about the ultimate nature of reality.

RT: I think it's too much to hope from or to ask of science, to put the onus of making this decision, passing this judgement, on science itself.

C: But if not science, then who?

RT: I think the methodology of science itself finds its expression and its field of applicability within a domain that is ever-growing but that is delimited by the way science explicates itself in a reflective way. So the main way you can apply science is defined by its methodology; but the context in which you place this methodology and this narrative cannot be analysed by the same methods. In other words you need a bigger arena in which to place science, and I think it's ill-conceived to try and ask of science to determine those answers – they should come as an input from the outside, as a different discourse.

C: But we *do* look to science to guide us in these questions, and if science is itself not capable of providing these guidelines for its own ultimate interpretation, or if the question of its ontological or metaphysical interpretation is something extraneous to science itself, then it seems as if science itself will never be able to do what it is its explicit aim to do, which is to tell us what the structure of reality is.

RT: I disagree that this is the goal of science – to tell us about the structure of reality itself. I think we can only describe it as a logically-consistent narrative of the structures of our models, models that conform to the observed inputs of the world, and in those terms the most we can ask of it is for it to be *consistent*. In fact that's the way we expand its domain of applicability. But we ask only for a consistent narrative of the world – I think it's hopeless to ask of science to give us a 'true reflection of reality'. The only thing we can ask from science is to provide us with a logically-consistent, experimentally observable, predictive narrative of a model of reality. Apart from that, in order to interpret this model, to delimit its applicability, we need another form of discourse which necessarily sits beyond the methodology of science itself.

C: A philosophy of science?

RT: Yes. Because science itself, in its becoming, is mindless.

C: So it would seem, from all that you've said, that cosmology works precisely on the boundary between this 'becoming of science' and philosophy.

RT: Yes, because it's by no means a sharp cut-off point: there is a foggy region where you don't really know what you're doing.

C: And presumably that is the most exciting region to be working in?

RT: Yes, it's a region where you don't know where the boundaries are. It's very exciting to be able to give a small contribution towards clearing this fog, and mapping this region. But I don't think it's clear. There might be an actual gap somewhere, only we don't know where it is. So we keep pushing forward.

On Vicarious Causation

Graham Harman

This article gives the outlines of a realist metaphysics, despite the continuing unpopularity of both realism and metaphysics in the continental tradition. Instead of the dull realism of mindless atoms and billiard balls that is usually invoked to spoil all the fun in philosophy, I will defend a weird realism. *This model features a world packed full of ghostly real objects signaling to each other from inscrutable depths, unable to touch one another fully. There is an obvious link here with the tradition known as occasionalism, the first to suggest that direct interaction between entities is impossible. There is another clear link with the related sceptical tradition, which also envisions objects as lying side-by-side without direct connection, though here the objects in question are human perceptions rather than independent real things. Yet this article abandons the solution of a lone magical super-entity responsible for all relations (whether God for Malebranche and his Iraqi forerunners, or the human mind for sceptics, empiricists, and idealists), in favor of a vicarious causation deployed locally in every portion of the cosmos. While its strangeness may lead to puzzlement more than resistance, vicarious causation is not some autistic moonbeam entering the window of an asylum. Instead, it is both the launching pad for a rigorous post-Heideggerian philosophy, and a fitting revival of the venerable problem of communication between substances.*

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The phrase 'vicarious causation' consists of two parts, both of them cutting against the grain of present-day philosophy.[1] Causality has rarely been a genuine topic of inquiry since the seventeenth century. The supposed great debate over causation between sceptics and transcendental philosophers is at best a yes-or-no dispute as to whether causal necessity exists, and in practice is just an argument over whether it can be known. What has been lacking is active discussion of the very nature of causality. This is now taken to be obvious: one object exerts force over another and makes it change physical position or some of its features. No one sees any way to speak about the interaction of fire and cotton, since philosophy remains preoccupied with the sole relational gap between humans and the world – even if only to deny such a gap. Inanimate relations have been abandoned to laboratory research, where their metaphysical character is openly dismissed. To revive causation in philosophy means to reject the dominance of Kant's Copernican Revolution and its single lonely rift between people and everything else. Although I will claim that real objects do exist beyond human sensual access to them, this should not be confused with Kant's distinction between phenomena and noumena. Whereas Kant's distinction is something endured by humans alone, I hold that one billiard ball hides from another no less than the ball-in-itself hides from humans. When a hailstorm smashes vineyards or sends waves through a pond, these relations are just as worthy of philosophy as the unceasing dispute over the chasm or non-chasm between being and thought. Neither Kant, nor Hegel, nor their more up-to-date cousins have anything to say about the collision of balls-in-themselves. In the past century, the doctrine of Parmenides that being and thought are the same has been implied by Husserl, stated explicitly by Heidegger, and restated quite emphatically by Badiou. But this equation of being and thought must be rejected, since it leaves us stranded in a human–world coupling that merely reenacts the breakthroughs of yesteryear. To revive the problem of causation means to break free of the epistemological deadlock and reawaken the metaphysical question of what relation means. Along with causation there is also the 'vicarious' part of the phrase, which indicates that relations never directly encounter the autonomous reality of their components. After thousands of years, 'substance' is still the best name for such reality. The widespread resistance to substance is nothing more than revulsion at certain inadequate models of substance, and such models can be replaced. Along with substance, the term 'objects' will be used to refer to autonomous realities of any kind, with the added advantage that this term also makes room for the temporary and artificial objects too often excluded from the ranks of substance.

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[1] The term was first introduced in my book *Guerrilla Metaphysics: Phenomenology and the Carpentry of Things* (Chicago: Open Court, 2005).

Since this article rejects any privilege of human access to the world, and puts the affairs of human consciousness on exactly the same footing as the duel between canaries, microbes, earthquakes, atoms, and tar, it may sound like a defense of scientific naturalism that reduces everything to physical events. But the term 'vicarious' is designed to oppose all forms of naturalism, by indicating that we still have no idea how physical relations (or any other kind) are possible in the first place. For as I will contend, objects hide from one another endlessly, and inflict their mutual blows only through some vicar or intermediary. For several centuries, philosophy has been on the defensive against the natural sciences, and now occupies a point of lower social prestige and, surprisingly, narrower subject matter. A brief glance at history shows that this was not always the case. To resume the offensive, we need only reverse the long-standing trends of renouncing all speculation on objects and volunteering for curfew in an ever-tinier ghetto of solely human realities: language, texts, political power. Vicarious causation frees us from such imprisonment by returning us to the heart of the inanimate world, whether natural or artificial. The uniqueness of philosophy is secured, not by walling off a zone of precious human reality that science cannot touch, but by dealing with the same world as the various sciences but in a different manner. In classical terms, we must speculate once more on causation while forbidding its reduction to efficient causation. Vicarious causation, of which science so far knows nothing, is closer to what is called formal cause. To say that formal cause operates vicariously means that forms do not touch one another directly, but somehow melt, fuse, and decompress in a shared common space from which all are partly absent. My claim is that two entities influence one another only by meeting on the interior of a third, where they exist side-by-side until something happens that allows them to interact. In this sense, the theory of vicarious causation is a theory of the molten inner core of objects – a sort of plate tectonics of ontology.

1. Two Kinds of Objects

While the phenomenological movement of Husserl and Heidegger did too little to overcome the idealism of the previous cluster of great philosophers, they and their descendants often show a novel concern with specific, concrete entities. Mailboxes, hammers, cigarettes, and silk garments are at home in phenomenology in a way that was never true for the earlier classic figures of German thought. Even if Husserl and Heidegger remain too attached to human being as the centerpiece of philosophy, both silently raise objects to the starring role, each in a different manner. While Husserl bases his system on intentional or ideal objects (which I will rechristen sensual objects), Heidegger restores real objects to philosophy through his famous tool-analysis. It is seldom realized that these two types of objects are both different and complementary. The interplay between real and sensual objects, if taken seriously, provides ontology with a radical new theme.

In the tool-analysis of Heidegger, which fascinates his opponents no less than his allies, we find perhaps the most enduring insight of twentieth century philosophy. Our primary relationship with objects lies not in perceiving or theorizing about them, but simply in relying on them for some ulterior purpose. This first step is useful enough, but misses the essence of Heidegger's breakthrough, which even he never quite grasps. If we remain at this stage, it might seem that Heidegger merely claims that all theory is grounded in practice, that we need to have an everyday relationship with leopards or acids before staring at them or developing a science of them. But notice that even our practical relation to these objects fails to grasp them fully.

The tribesman who dwells with the godlike leopard, or the prisoner who writes secret messages in lemon juice, are no closer to the dark reality of these objects than the theorist who gazes at them. If perception and theory both objectify entities, reducing them to one-sided caricatures of their thundering depths, the same is true of practical manipulation. We distort when we see, and distort when we use. Nor is the sin of caricature a merely human vice. Dogs do not make contact with the full reality of bones, and neither do locusts with cornstalks, viruses with cells, rocks with windows, nor planets with moons. It is not human consciousness that distorts the reality of things, but relationality *per se*. Heidegger's tool-analysis unwittingly gives us the deepest possible account of the classical rift between substance and relation. When something is 'present-at-hand,' this simply means it is registered through some sort of relation: whether perceptual, theoretical, practical, or purely causal. To be 'ready-to-hand' does not mean to be useful in the narrow sense, but to withdraw into subterranean depths that other objects rely on despite never fully probing or sounding them.[2] When objects fail us, we experience a negation of their accessible contours and become aware that the object exceeds all that we grasp of it. This predicament gives rise to the theme of vicarious causation. For if objects withdraw from relations, we may wonder how they make contact at all. Heidegger's tool-analysis opens the gates on a strange new realism in which entities flicker vaguely from the ocean floor: unable to make contact, yet somehow managing to do so anyway.

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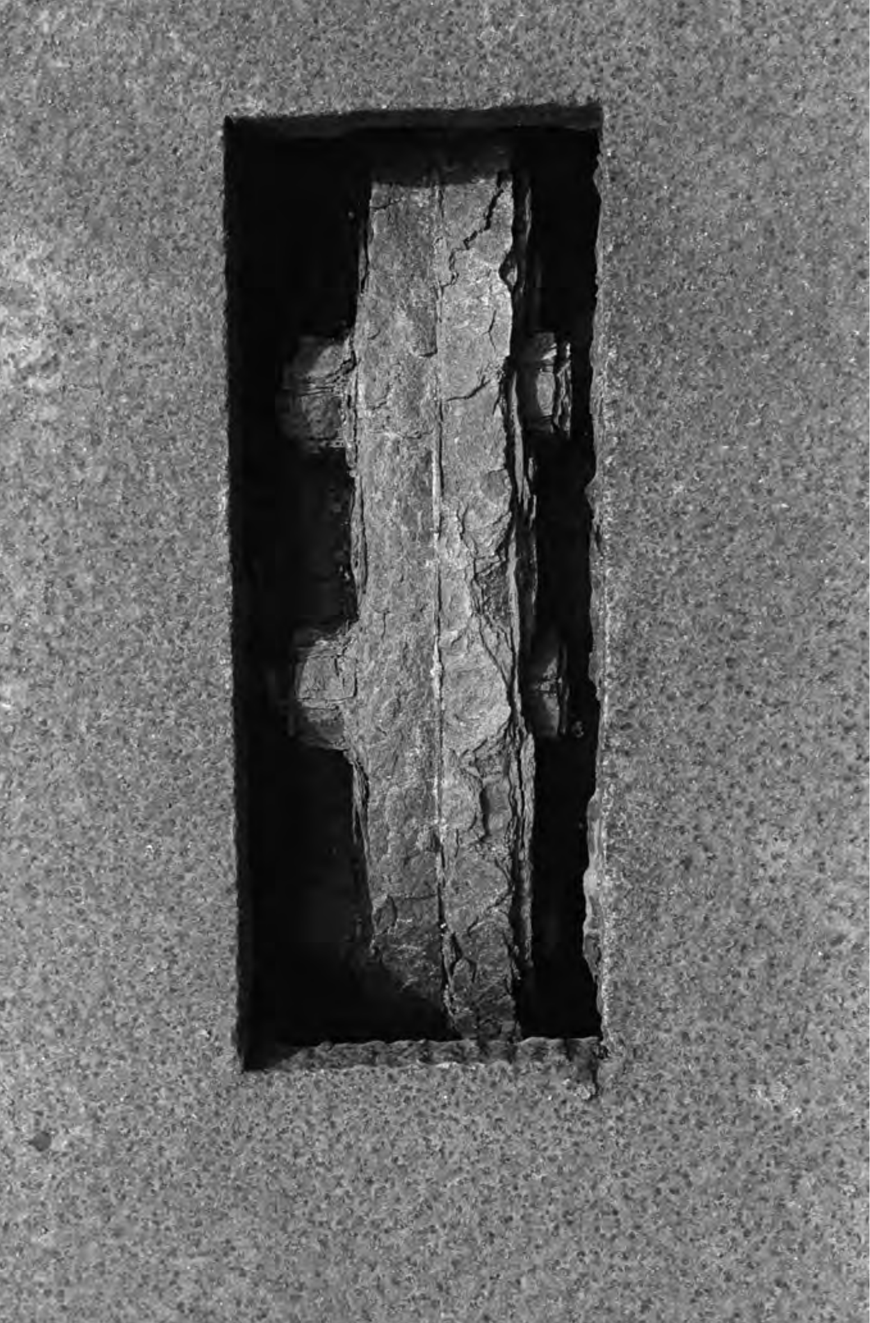
[2] For a detailed interpretation of Heidegger's tool-analysis, see my first book *Tool-Being: Heidegger and the Metaphysics of Objects*. (Chicago: Open Court, 2002.)

A different sort of object is the basis for Husserl's philosophy. Despite complicated efforts to save Husserl from charges of idealism, he does confine philosophy to a space of purest ideality. Phenomenology cannot speak of how one object breaks or burns another, since this would deliver the world to the power of scientific explanation, which employs nothing but naturalistic theories. For Husserl, the only rigorous method is to describe how the world is given to consciousness prior to all such theories. Philosophy becomes the study of phenomena, not real objects. But phenomena are objects nonetheless: in a new, ideal sense. For what we experience in perception is not disembodied qualities, as the empiricists hold; instead, we encounter a world broken up into chunks. Trees, mailboxes, airplanes, and skeletons lie spread before us, each of them inducing specific moods and sparkling with various subordinate qualities. Since we are speaking solely of the phenomenal realm, it does not matter if these things are hallucinations; even delusions perform the genuine labor of organizing our perception into discrete zones. Note already that sensual objects have a different fate from real ones. Whereas real zebras and lighthouses withdraw from direct access, their sensual counterparts do not withdraw in the least. For here is a zebra before me. Admittedly, I can view it from an infinite variety of angles and distances, in sadness and exultation, at sunset or amidst driving rain, and none of these moments exhaust all possible perceptions of it. Nonetheless, the zebra is already there for me as a whole in all its partial profiles; I see right through them and look to it as a unified object. Although some specific visual or conceptual profile of the zebra is needed for us to experience it, the unified sensual zebra lies at a deeper level of perception than these transient, mutable images. Each sensual profile is encrusted onto the unified zebra-object like a patina of brine. Whereas real objects withdraw, sensual objects lie directly before us, frosted over with a swirling, superfluous outer shell. But this difference seems to give sensual objects the opposite causal status of real ones. Given that real objects never touch directly, their causal relations can only be vicarious. But sensual objects, far from being withdrawn, exist side by side in the same perceptual space from the outset, since we encounter numerous phenomena simultaneously. This presents the contrary problem to vicarious causation: namely, why do all the phenomena not instantly fuse together into a single lump? There must be some unknown principle of blockage between them. If real objects require vicarious causation, sensual objects endure a buffered causation in which their interactions are partly dammed or stunted.

The situation is perplexing, but the general path of this article is already clear. Real objects withdraw into obscure cavernous underworlds, deprived of causal links. Sensual objects, by contrast, are so inclined to interact with their neighbors that we wonder why they fail to do so at every instant. In other words, the only place in the cosmos where interactions occur is the sensual, phenomenal realm. Against philosophies that regard the surface as formal or sterile and grant causal power only to shadowy depths, we must defend the opposite view: discrete, autonomous form lies only in the depths, while dramatic power and interaction float along the surface. All relationships are



superficial. For this reason, we must discover how real objects poke through into the phenomenal realm, the only place where one relates to another. The various eruptions of real objects into sensuality lie side by side, buffered from immediate interaction. Something must happen on the sensual plane to allow them to make contact, just as corrosive chemicals lie side by side in a bomb – separated by a thin film eaten away over time, or ruptured by distant signals.

2. A JIGSAW PUZZLE

It is well known that Husserl emphasizes the intentionality of consciousness. We are always conscious of something, always focused on a particular house, pine tree, beach ball, or star, and indeed on many such objects at once. It is not widely known that Husserl also stumbles across the fateful paradox that intentionality is both one and two. For in a first sense, my encounter with a pine tree is a unified relation; we can speak of the encounter as a whole, and this whole resists exhaustive description. But in another sense, I clearly do not fuse with the tree in a single massive lump; it remains distinct from me in the perception. This gives the strange result that in my intention of the tree, we both inhabit the interior of the total intentional relation. This seemingly dry observation by Husserl has not sparked much interest in his readers. Even so, if combined with Heidegger's insight into the withdrawal of real objects behind all relations, it provides all the pieces of a new philosophy.

To repeat, the pine tree and I are separate objects residing on the interior of a third: the intention as a whole.

But there is a fascinating asymmetry between the members of this trio. We cannot fail to notice that of the two objects living in the core of the third, I am a real object but the pine tree merely a sensual one. The I sincerely absorbed in the things it perceives is not the I as seen by others, but rather the real I, since my life actually consists at this moment in being occupied by these phenomena, not in being a sensual object for the gaze of others or even for myself. By contrast, the real pine tree does not inhabit the intention, since the real tree (assuming there is such a thing) lies outside any relation to it, withdrawing into depths never entered by outsiders. Finally, the intention as a whole must be classed as a real object rather than a sensual one: for even if my intention of the tree is the most depraved hallucination, the intention itself is in fact underway, quite apart from whether it relates to anything outside. To summarize, we have a real intention whose core is inhabited by a real me and a sensual pine tree. In addition, there is also a withdrawn real tree (or something that we mistake for one) lying outside the intention, but able to affect it along avenues still unknown. Finally, the sensual tree never appears in the form of a naked essence, but is always encrusted with various sorts of noise. Elsewhere I have called it 'black noise', to emphasize that it is highly structured, not the sort of formless chaos suggested by the 'white noise' of television and radio.[3] Black noise initially seems to come in three varieties. First, the sensual tree has pivotal or essential qualities that must always belong to it under penalty of the intentional agent no longer considering it the same thing. Second, the tree has accidental features shimmering along its surface from moment to moment, not affecting our identification of it as one and the same. Finally, the pine tree stands in relation to countless peripheral objects that inhabit the same intention (neighboring trees, mountains, deer, rabbits, clouds of mist).

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[3] *Guerrilla Metaphysics*, 183 ff.

We should also note five distinct sorts of relations between all these objects:

1. CONTAINMENT. The intention as a whole contains both the real me and the sensual tree.

2. CONTIGUITY. The various sensual objects in an intention lie side by side, not affecting one another. Only sometimes do they fuse or mix. Within certain limits, any sensual object's neighbors can be shuffled and varied without damaging the identity of that object, as when drifting mists do not interfere with my focus on the tree.

3. SINCERITY. At this very moment I am absorbed or fascinated by the sensual tree, even if my attitude toward it is utterly cynical and manipulative. I do not contain the sensual tree, because this is the role of the unified intention that provides the theater of my sincerity without being identical to it. And I am not merely contiguous with the tree, because it does in fact touch me in such a way as to fill up my life. I expend my energy in taking the tree seriously, whereas the sensual tree cannot return the favor, since it is nothing real.

4. CONNECTION. The intention as a whole must arise from a real connection of real objects, albeit an indirect connection. After all, the other possible combinations yield entirely different results. Two sensual objects merely sit side by side. And my sincere absorption with trees or windmills is merely the interior of the intention, not the unified intention itself. Hence, a real object itself is born from the connection of other real objects, through unknown vicarious means.

5. No relation at all. This is the usual state of things, as denied only by fanatical holists, those extremists who pass out mirrors like candy to every object that stumbles down the street. Real objects are incapable of direct contact, and indeed many have no effect on one another at all. Even the law of universal gravitation only applies among a narrow class of physical objects, and even then concerns a limited portion of their reality. And in a different case, the sensual tree has no relation to me at all, even though I am sincerely absorbed by it. The oxygen I breathe comes from the real tree, not from my perception of it. The sensual tree is a phantasm surviving only at the core of some intention, and takes up no independent relations even with its contiguous phantoms. They are only related vicariously, through me, insofar as I am sincerely absorbed with both.

The objects populating the world always stand to each other in one of these five relations. In *Guerrilla Metaphysics*, I suggested that causation is always vicarious, asymmetrical, and buffered. 'Vicarious' means that objects confront one another only by proxy, through sensual profiles found only on the interior of some other entity. 'Asymmetrical' means that the initial confrontation always unfolds between a real object and a sensual one. And 'buffered' means that I do not fuse into the tree, nor the tree into its sensual neighbors, since all are held at bay through unknown firewalls sustaining the privacy of each. From the asymmetrical and buffered inner life of an object, vicarious connections arise occasionally (in both senses of the term), giving birth to new objects with their own interior spaces. There is a constant meeting of asymmetrical partners on the interior of some unified object: a real one meeting the sensual vicar or deputy of another. Causation itself occurs when these obstacles are somehow broken or suspended. In seventeenth-century terms, the side-by-side proximity of real and sensual objects is merely the occasion for a connection between a real object inside the intention and another real object lying outside it. In this way, shafts or freight tunnels are constructed between objects that otherwise remain quarantined in private vacuums.

We now have five kinds of objects (real intention, real I, real tree, sensual tree, sensual noise) and five different types of relations (containment, contiguity, sincerity, connection, and none). Furthermore, we also have three adjectives for what unfolds inside an object (vicarious, asymmetrical, buffered) and three different kinds of noise surrounding a sensual object (qualities, accidents, relations). While this may not be an exhaustive census of reality, and may eventually need polishing or expansion, it offers a good initial model whose very strictness will help smoke out those elements it might have overlooked. What remains to be seen is how these elements interact, how one type of relation transforms into another, how new real objects paradoxically arise from the interaction between real objects and sensual ones, and even how sensual objects manage to couple and uncouple like spectral rail cars. These sorts of problems are the subject matter of object-oriented philosophy: the inevitable mutant offspring of Husserl's intentional objects and Heidegger's real ones. In turn, these are only the present-day heirs of Hume's contiguous impressions and ideas (Husserl) and the disconnected objects of Malebranche and his Ash'arite predecessors (Heidegger).

The problem of philosophy now resembles a jigsaw puzzle. We have detected the pieces as carefully as possible, and none seem to be blatantly missing. We also have a picture of what the ultimate solution should look like: the world as we know it, with its various objects and interactions. Unlike jigsaw puzzles, this one unfolds in at least three dimensions, ceaselessly changing from moment to moment. But like such puzzles, instead of mimicking the original image, it is riddled with fissures and strategic overlaps that place everything in a new light. Like five-year-olds faced with a massive thousand-piece puzzle, our greatest danger lies in becoming discouraged. But whereas frustrated children angrily throw their pieces to the floor and change activities, we remain trapped in our puzzle from the start, since it is the very enigma of our world. Philosophers can escape it only through insanity, or with the aid of rope or a revolver.

3. ONTOLOGY AND METAPHYSICS

Beginners in philosophy often ask the exact difference between ontology and metaphysics. In fact there is no consistent distinction, since each philosopher redefines these terms to suit individual purposes. For Heidegger, ontology is the account of how being is revealed to

humans, while metaphysics remains a term of insult for philosophies that explain all beings in terms of some privileged entity. For Levinas, ontology belongs to the global war between beings, while metaphysics speaks of the infinite otherness that lies beyond such conflict. For my own part, I have generally used these terms interchangeably for a realist position opposed to all human-centered philosophies; at times such flexibility remains useful, as in the opening section of this article. Yet I would also like to propose a more exact difference between them, one not unrelated to their classical distinction. Henceforth, let 'ontology' refer to a description of the basic structural features shared by all objects, and let 'metaphysics' signify the discussion of the fundamental traits of specific types of entities. In this sense, the aforementioned puzzle-pieces belong solely to ontology, since no object is exempt from their rule. These include the basic opposition between real and sensual objects, the five types of relation between them, and the bondage of sensual objects to their various qualities, accidents, and relations. Time and space also belong to ontology, since even eternal and non-spatial objects elude only the narrowly physical spatio-temporal realm, and by no means escape time and space in a broader sense. The question of universals also seems to be a global theme belonging to ontology as a whole, and there may be others. As for metaphysics, which walls off and analyzes the internal organs of any specific kind of entity, the most obvious possible topics include human being, language, artworks, and even God. Any type of object distinct from others, however hazy the boundaries may be, can become the subject of a metaphysics. There could be a metaphysics of artworks, the psyche, and language, and even of restaurants, mammals, planets, teahouses, and sports leagues. Insofar as philosophy clearly differs from activities such as singing and gambling, there could also be a metaphysics of philosophy itself, unlocking the crucial features of this discipline, whatever its numerous variations and degenerate sophistical forms.

The distinction between ontology and metaphysics is proposed here for a specific reason. Along with real objects, we have also described sensual objects, which exist only on the interior of some intentional whole. Yet intentionality is regarded by almost everyone as a narrowly human feature. If this depiction were correct, sensual objects would be confined to a metaphysics of human perception, with no place in an ontology designed to address plastic and sand dunes no less than humans. This confinement of sensuality to the human kingdom must be refused. Intentionality is not a special human property at all, but an ontological feature of objects in general. For our purposes, intentionality means sincerity. My life is absorbed at any moment with a limited range of thoughts and perceptions. While it is tempting to confuse such absorption with 'conscious awareness,' we need to focus on the most rudimentary meaning of sincerity: contact between a real object and a sensual one. For instance, I may be sincerely absorbed in contemplating glass marbles arranged on the surface of a table. This is my sincerity at the moment, since I forego other possibilities of greater and lesser import to witness this austere, Zen-like spectacle. But note that the glass marbles themselves are sincerely absorbed in sitting on the table, rather than melting in a furnace or hurtling through a mineshaft. (Though they may not be ‘marbles’ for anyone but humans or playful kittens, we need a nickname for the united object that we draw into our games.) The question for us is not the panpsychist query of whether these marbles have some sort of rudimentary thinking and feeling capacities, but whether they as real objects encounter the table-surface as a sensual one.

The answer is yes. We must ignore the usual connotations of sensuality and fix our gaze on a more primitive layer of the cosmos. It is clear that the marbles must stand somewhere in reality, in contact with certain other entities that stabilize them briefly in one state or another. The entities they confront cannot be real objects, since these withdraw from contact. Nor can the marbles run up against free-floating sensual qualities, for in the sensual realm qualities are always attached to objects. Only one alternative remains: the marbles are sincerely absorbed with sensual objects. This indirect argument becomes more persuasive if we examine the landscape inhabited by the marbles, which turns out to share the basic structural features of human intentionality. First, notice that these marbles are perfectly capable of distinguishing between the table and the contiguous relational environment, even if not in the panpsychist sense of a primitive judging ability. At present the marbles sit on the table, but are otherwise surrounded by air; hence, this air is contiguous with the tabletop in the life of each marble. But if we now carefully frame the marbles with bookends or melted wax, the table itself remains the same intentional object, unaffected by our eccentric manipulations. Second, the marble confronts the tabletop quite apart from its accidental coldness and slickness, though it probably registers these features in some way as well. If we heat the tabletop, or render its surface sticky or granulated by pouring different materials nearby, the table as an intentional object still remains the same. The final question is whether the marbles can make a distinction between the table and its more essential qualities, such as its hardness, levelness, solidity, and lack of perforation. Even humans can only make this distinction between objects and their qualities in very special cases; since I will soon describe these cases under the heading of 'allure', we should wait to ask whether glass marbles are able to follow suit. What is already evident is that all real objects inhabit a landscape of sensual ones, a playground whose fluctuations enable new real connections to arise. Some of these fluctuations are a mere domestic drama, while others provoke new relations with the outside. But whatever is special about human cognition belongs at a more complicated level of philosophy than these sensual objects, though it must be expressible in terms of them.

Elsewhere I have used the phrase 'every relation is itself an object', and still regard this statement as true. But since this article has redefined relations to include containment, sincerity, and contiguity, the slogan must be reworded as follows: 'every connection is itself an object.' The intentional act's containment of me does not make the two of us into a new object, and neither (for the most part) do two or three nearby perceptions of cars make a unified object. But two vicariously linked real objects do form a new object, since they generate a new internal space. When two objects give rise to a new one through vicarious connection, they create a new unified whole that is not only inexhaustible from the outside, but also filled on the inside with a real object sincerely absorbed with sensual ones. And just as every connection is an object, every object is the result of a connection. The history of this connection remains inscribed in its heart, where its components are locked in a sort of kaleidoscopic duel. But connections occur only between two real objects, not any other combination. This entails that my relation to the sensual pine tree is not itself an object, but simply a face-off between two objects of utterly different kinds. Hence, although intentionality seems to be a relation between me and the sensual pine tree, this is merely its interior. The intention itself results only from the unexplained vicarious fusion of me with the real pine tree, or with whatever engenders my deluded belief that I perceive one.

To repeat, my relation with the sensual pine tree is not a full-blown connection, but only a sincerity. This sincerity can indeed be converted into an object, as happens in the analysis of our own intentions or someone else's. When I analyze my relation to the sensual tree, I have converted that relation into an object for the first time. It has become a real object insofar as its exact nature recedes from view, inexhaustible no matter how many analyses I perform. We now face a merely sensual apparition of the original sincere relation, which withdraws from analysis just as hammers withdraw from handling. A second, more tedious observer might now decide to perform an analysis of my analysis, thereby converting it into an object whose nature can never be grasped, and so on to infinity. But note that this is not an infinite regress: all of these objects are not contained infinitely in the situation from the outset, but are sequentially produced *ad nauseum* by an increasingly twisted and pedantic series of analysts. Back in stage one, even my relation to the sensual pine tree is not a real object, but simply a sincere relation of two distinct elements inside a larger one. Unified objects can be molded at will from that clay-like interior. This already shows a way for sincere relations to be converted into real connections. Whether it is the only such way, and whether this method belongs to humans alone, is still unclear.

Another point is in order before passing to the final section. To say that every object is located on the sensual molten core of another object undermines some of the key assumptions of Heidegger. For him, human being partially transcends other beings, rising to glimpse them against a background of nothingness. But the interior of an object leaves no room for transcendence or even distance: a horse seen in a valley several miles away still touches me directly insofar as I witness it. Distance lies not in the sphere of perception, where everything brushes me directly with greater or lesser intensity, but only between the mutually exclusive real objects that lie beyond perception. We do not step beyond anything, but are more like moles tunneling through wind, water, and ideas no less than through speech-acts, texts, anxiety, wonder, and dirt. We do not transcend the world, but only descend or burrow towards its numberless underground cavities – each a sort of kaleidoscope where sensual objects spread their colours and their wings. There is neither finitude nor negativity in the heart of objects. And each case of human mortality is just one tragic event among trillions of others, including the deaths of house pets, insects, stars, civilizations, and poorly managed shops or universities. The Heidegger-Blanchot death cult must be expelled from ontology, and perhaps even from metaphysics.

4. ALLURE AND CAUSATION

Some may find it disturbing to think of the world as made up of vacuum-sealed objects, each with a sparkling phenomenal interior invaded only now and then by neighboring objects. A more likely problem, however, is indifference. There seems to be no need for such a weird vision of reality, since it is easy enough to think of the world as made of brute pieces of inescapable solid matter: 'primary qualities' supporting a series of more dashing, volatile human projections. In my view, however, Heidegger has rendered this picture of the world obsolete. Though his tool-analysis aims to describe only the withdrawal of objects behind explicit human awareness, practical activity is equally unable to exhaust the depth of objects, and even causal relations fail to let them encounter one another in full.[4] Finally, even sheer physical presence in space is a concept shaken to the core by the tool-analysis: after all, to occupy a spatial position is to take up relations, and however objects might occupy space, their reality is something deeper. The world is neither a grey matrix of objective elements, nor raw material for a sexy human drama projected onto gravel and sludge. Instead, it is filled with points of reality woven together only loosely: an archipelago of oracles or bombs that explode from concealment only to generate new sequestered temples. The language here is metaphorical because it must be. While analytic philosophy takes pride in never suggesting more than it explicitly states, this procedure does no justice to a world where objects are always more than they literally state. Those who care only to generate arguments almost never generate objects. New objects, however, are the sole and sacred fruit of writers, thinkers, politicians, travellers, lovers, and inventors.

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[4] The idea that physical relations also have an intentional structure is a minority view, but by no means my own invention. See for instance George Molnar's fascinating *Powers: A Study in Metaphysics* (Oxford: Oxford University Press, 2003) 60 ff.

Along with the distinction between real and sensual objects, there were five possible kinds of relations between them: containment, contiguity, sincerity, connection, and none. Our goal is to shed some light on the origin of connection, the one relation of the five that seems most troubling for a theory of ghostly, receding objects. A connection simply exists or fails to exist; it is a purely binary question. Furthermore, connection must be vicarious, since one purely naked object always recedes from another. An object simply exists, and this existence can never fully be mirrored in the heart of another. What we seek is some fertile soil of relation from which connections surge up into existence: a type of relation able to serve as the engine of change in the cosmos. 'Connection' itself cannot provide the solution, since this is precisely what we are trying to explain; if two objects are connected, then the labour we wish to observe is already complete. The option 'no relation at all' also fails to help, since if things are unrelated then they will remain so, as long as the intermediary we seek is lacking. 'Containment' is of no assistance either. Here too we have a merely binary question: either the sensual pine tree and I are together inside a given intention, or we are not. Finally, 'contiguity' does not give us what we need: at best, the shifting play of sensual objects redistributes the boundaries between them, but cannot lead to real changes outside their molten internal homeland. The only remaining option is 'sincerity.' This must be the site of change in the world. A real object resides in the core of an intention, pressed up against numerous sensual ones. Somehow, it pierces their colored mists and connects with a real object already in the vicinity but buffered from direct contact. If light can be shed on this mechanism, the nature of the other four types of relation may be clarified as well.

It all comes down to the dynamics of sincerity, whether of a human or any other real object. Sincerity contends with sensual objects that are defined by their qualities and shrouded with peripheral accidents and relations. What we seek is the manner in which sincere relation with a sensual object is transformed into direct connection with a real one. The coupling and uncoupling of real and sensual objects is now our central theme. We know that a sensual object is detachable from its accidents and relations. The interesting question is whether it can also be detached from its qualities, which seem to belong to it more intimately. By qualities I mean the essential qualities, without which we would regard an object as no longer the same thing. Remember, there is no hand-wringing crisis of objectivity here, since we are speaking of qualities that belong not to the essence of a real object, but only to the sensual things that command our attention – a realm where we ourselves are the highest judge in the land. Now, it might be

imagined that we could liberate the qualities of the marbles by overtly discovering and listing all the crucial features that the marbles cannot do without. This was the great hope of Husserl's method of eidetic variation. But the effect of this procedure is superficial, and does not grasp the sensual marbles in their essence. Notice that even as our analysis of these objects proceeds, we continue to take them seriously as units, even if we brilliantly slice them into thousands of separate features. Even in the case of a sensual object, the essential qualities cannot be stated or analyzed without becoming something like accidents: free-floating traits artificially detached from the sensual object as a whole. Our sincerity is not really concerned with such a list of detached features, as Husserl realizes when he grants privilege to unified sensual objects over their myriad facets. The unity of such objects even indicates that there is just one quality at issue: this marble-essence, this pine-essence. The unified quality of the thing is not noise at all, but is the sensual object itself. Concerning Aristotle's question as to whether a thing is identical with its essence, the answer for sensual objects is yes. Although qualities were described as a form of noise earlier in this article, this is true only insofar as they veer off toward the status of accidents, when broken free and itemized separately. But the existence of a unified quality of things means that the sensual realm is already home to a certain 'I know not what' that makes the marble a steady focus of my attention. Unlike the followers of Locke, we do not say *je ne sais quoi* in a spirit of gentle mockery, but as a true statement about sensual objects. The sensual thing itself has a unified and basically ineffable effect on us, one that cannot be reduced to any list of traits. But if such listing of traits does not sever a thing from its quality, there may be another way for this to happen. We have also seen that vicarious causation – the enchanted unicorn we seek – requires contact with the essential qualities of a thing without contact with the thing as a whole. In this way, discovery of how the sensual object splits from its quality may be a stepping-stone toward discovering an analogous event among real objects.

The separation between a sensual object and its quality can be termed 'allure.'[5] This term pinpoints the bewitching emotional effect that often accompanies this event for humans, and also suggests the related term 'allusion,' since allure merely alludes to the object without making its inner life directly present. In the sensual realm, we encounter objects encrusted with noisy accidents and relations. We may also be explicitly aware of some of their essential qualities, though any such list merely transforms the qualities into something accident-like, and fails to give us the unified bond that makes the sensual thing a single thing. Instead, we need an experience in which the sensual object is severed from its joint unified quality, since this will point for the first time to a real object lying beneath the single quality on the surface. For humans, metaphor is one such experience. When the poet writes 'my heart is a furnace,' the sensual object known as a heart captures vaguely defined furnace-qualities and draws them haltingly into its orbit. The inability of the heart to fuse easily with furnace-traits (in contrast with literal statements such as 'my heart is the strongest muscle in my body') achieves allusion to a ghostly heart-object lying beneath the overly familiar sensual heart of everyday acquaintance. Notice that the inverse metaphor is entirely asymmetrical to the first: 'the furnace is a heart' draws cardiac traits into the orbit of a sensual furnace, which is freed from bondage to its usual features and evoked as a sort of hidden furnace-soul, one whose *animus* now powers rhythmic beating and circulation. Humour does something similar: we can follow Bergson's *On Laughter* and note the tension between a comic dupe and the traits he no longer freely adapts to changing circumstances. These qualities are now exposed as a discrete visible shell beneath which the agent haplessly fails to control them. There are countless examples of allure. In instances of beauty, an object is not the sum total of beautiful colors and proportions on its surface, but a kind of soul animating the features from within, leading to vertigo or even hypnosis in the witness. When Heidegger's hammer fails, a concealed hammer-object seems to loom from the darkness, at a distance from its previously familiar traits. In language, names call out to objects deeper than any of their features; in love, the beloved entity has a certain magic hovering beneath the contours and flaws of its accessible surface. The list of possibilities is so vast that they deserve to be categorized in some encyclopedic work of aesthetics. Until now, aesthetics has generally served as the impoverished dancing-girl of philosophy – admired for her charms, but no gentleman would marry her. Yet given the apparently overwhelming scope of allure, aesthetics may deserve a rather vast role in ontology.

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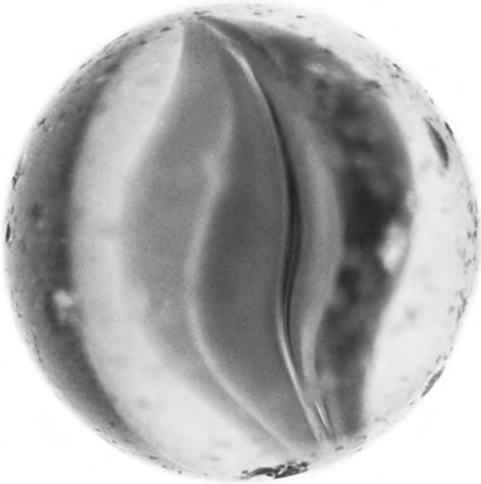
[5] See also *Guerrilla Metaphysics*, 142-4.

Different sensual objects within the same intention are described as contiguous; they do not melt together, but are treated by the intentional agent as distinct, and this agent is the final court of appeal in the sensual realm. This pertains to what has been termed the relations of sensual objects. But accidents are a different case. The surface of a sensual object does not merely lie side-by-side with it. Even though we look straight through these accidents to stay fixed on the underlying sensual thing, the accidents are not viewed as separate from that thing, but are encrusted onto it. This frosting-over with peripheral qualities comes about in an interesting way. Recall that the sensual tree as a whole is made up of just one quality (the one from which it is severed in allure). But notice that this unified tree-apparition still has parts. If we start taking away branches and leaves, there will come a point at which we no longer regard it as the same tree; the tree is dependent on its parts. Yet these parts are only unified in the tree along one specific path. It never devours them completely, but employs only a limited portion of their reality. What we know as the accidents of the sensual tree are simply the remainder of its parts, the remnant not deployed in the new object. Each of these parts is complicated because it is made up of further parts, and so on to infinity. But however far we advance toward this infinity, we continue to find objects, not raw sense data. It would be wrong to think that we confront a field of colour-pixels and then mold them into objective zones. For in the first place, it is arbitrary to think that points of green are more qualitatively basic than a unified tree-quality or branch-quality; all are capable of filling up my sincerity, and all have a specific personal style. And in the second place, even a supposed pixel of green at least takes the spatial form of a dot, and hence is a complicated object in its own right. There are always largest objects in the sensual realm: namely, those that are recognized by sincerity at any moment. But one cannot find a smallest, since there will always be a leftover remainder of parts, and parts of parts, like the endless overtones of notes struck on a piano. These accidents are the only possible source of change, since they alone are the potential bridge between one sensual object and another. For there can be no changes in the sensual object itself, which is always a recognized *fait accompli*; at most, it can be eliminated and replaced by a new one. Accidents alone have the dual status of belonging and not belonging to an object, like streamers on a maypole, or jewels on a houka. Accidents are tempting hooks protruding from the sensual object, allowing it the chance to connect with others and thereby fuse two into one.

But the relation of part and whole does not occur only in the sensual realm. A real object, too, is formed of parts whose disappearance threatens its very existence.

The difference is that the parts of a sensual object are encrusted onto its surface: or rather, certain aspects of those parts are fused to create it, while the remainder of those parts emanates from its surface as noise. By contrast, the parts of a real object are contained on the interior of that object, not plastered onto its outer crust. In both cases, however, there is a vicarious cause enabling the parts to link together. This can be clarified through the historical difference between scepticism and occasionalism, which are complementary in the same manner as encrustation and connection. Hume and Malebranche face opposite versions of the same problem. Although Hume supposedly doubts the possibility of connection, note that for him a connection has actually already occurred: he is never surprised that two billiard balls lie simultaneously in his mind, but doubts only that they have independent force capable of inflicting blows on each other. In this sense, Hume actually begins with connection inside experience and merely doubts any separation outside it. Conversely, Malebranche begins by assuming the existence of separate substances, but doubts that they can occupy a shared space in such a way as to exchange their forces – leading him to posit God's power as the ultimate joint space of all entities. Like Hume, we can regard the intentional agent as the vicarious cause of otherwise separate phenomena. The tree and its mountainous backdrop are indeed distinct, yet they are unified insofar as I am sincerely absorbed with both. But more than this: when the parts of the tree fuse to yield the tree with its single fixed tree-quality, I too am the vicarious cause for the connection of these sensual objects. Even if I merely sit passively, without unduly straining eyes or mind, it is still for me that these parts have combined. Here, a real object (I myself) serves as the vicarious cause for two or more sensual ones. In the inverted case of Malebranche, we cannot accept the pistol shot of the deity as our vicarious cause, since no explanation is given of how God as a real object could touch other real objects; fear of blasphemy is the sole protection for this incomplete doctrine. Instead, just as two sensual objects are vicariously linked by a real one, two real objects must be vicariously linked by a sensual one. I make contact with another object, not through impossible contact with its interior life, but only by brushing its surface in such a manner as to bring its inner life into play. Just as only the opposite poles of magnets make contact, and just as the opposite sexes alone are fertile, it is also the case that two objects of the same type do not directly touch one another. Contiguity between sensual objects is impossible without a real intentional agent, and connection between real ones does not occur except by means of a sensual intermediary.

This entails that all contact must be asymmetrical. However deeply I burrow into the world, I never encounter anything but sensual objects, and neither do real objects ever encounter anything but my own sensual facade. The key to vicarious causation is that two objects must somehow touch without touching. In the case of the sensual realm, this happens when I the intentional agent serve as vicarious cause for the fusion of multiple sensual objects: a fusion that remains only partial, encrusted with residual accidents. But in the case of real objects, the only way to touch a real one without touching it is through allure. Only here do we escape the deadlock of merely rolling about in the perfumes of sensual things, and encounter qualities belonging to a distant signalling thing rather than a carnally present one. The only way to bring real objects into the sensual sphere is to reconfigure sensual objects in such a way that they no longer merely fuse into a new one, as parts into a whole, but rather become animated by allusion to a deeper power lying beyond: a real object. The gravitational field of a real object must somehow invade the existing sensual field. Just as I am the vicarious link between two sensual objects, the alluring tree is the vicarious link between me and the real tree. The exact dynamics of this process deserve a lengthier treatment, but something unusual has already become evident. The separation of a thing from its quality is no longer a local phenomenon of human experience, but instead is the root of all relations between real objects, including causal relations. In other words, allure belongs to ontology as a whole, not to the special metaphysics of animal perception. Relations between all real objects, including mindless chunks of dirt, occur only by means of some form of allusion. But insofar as we have identified allure with an aesthetic effect, this means that aesthetics becomes first philosophy.



Demons Get Out!

Interview with Paul Churchland[1]

From his first significant publication in 1970[2] *to the forthcoming* Neurophilosophy at Work[3]*, Paul Churchland has established a reputation as a brilliantly iconoclastic philosopher of mind and science. Along with his wife and frequent collaborator Patricia, Churchland remains the most (in)famous proponent of 'eliminative materialism', whose canonical formulation opens a seminal paper from 1981:*

> *Eliminative materialism is the thesis that our commonsense conception of psychological phenomena constitutes a radically false theory, a theory so fundamentally defective that both the principles and the ontology of that theory will eventually be displaced, rather than smoothly reduced by, completed neuroscience.*[4]

Although this radical claim has certainly tended to provoke consternation among philosophers who have sought to integrate commonsense or 'folk' psychology into the ambit of natural science, the stakes of the eliminativist hypothesis evidently transcend the niceties of academic philosophy, with professional philosophers of mind moved to

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[1] This is an edited version of an interview conducted by Sophia Efstathiou, to appear in Greek in *Cogito* no. 6 (See http://www.nnet.gr/cogito.htm).

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depict the promised 'elimination' in apocalyptic terms ('[it] would be, beyond comparison, the greatest intellectual catastrophe in the history of the species').[5] *For Churchland proposes nothing short of a cultural revolution: the reconstruction of our phenomenological self-image in light of a new scientific discourse. In the following conversation Churchland reemphasises his commitment to eliminative materialism, exploring its broad consequences for science and philosophy, and remarking upon key research outcomes and philosophical problems which have influenced its development.*

COLLAPSE: Let's start where the totally ignorant person would start: according to the current entry on *Wikipedia*,[6] Paul Churchland is a philosopher who believes in eliminative materialism, which says that folk psychology should be replaced. Our propositional attitudes can be reduced to neuroscientific language.

PAUL CHURCHLAND: I haven't gone to *Wikipedia* and seen my own entry [!] but somebody else told me that that's the first entry and of course it's strictly true. That paper is a paper I wrote twenty-five years ago! But it's the one that most captured people's attention and as they describe it, in two or three sentences, they are correct. I really am

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2. 'The Logical Character of Action Explanations', *Philosophical Review* 79, no. 2: 214-236.

3. Cambridge University Press, 2007.

4. 'Eliminative Materialism and the Propositional Attitudes' in *Journal of Philosophy* 78, no. 2, 1981: 67-90. Reprinted in P. M. Churchland, *A Neurocomputational Perspective: The Nature of Mind and the Structure of Science* (Camb., Mass: The MIT Press, 1989), 1-22.

5. J. Fodor, *Psychosemantics*. (Camb., Mass.: The MIT Press, 1987), xii.

6. See http://en.wikipedia.org/wiki/Paul_Churchland

inclined still, after twenty-five years, to think that our conception of our own cognition will change as we learn more and more about the brain.

What I'm most suspicious of, in our common sense conception, are the so-called 'propositional attitudes' – talk about 'beliefs that *p*', and 'desires that *p*,' and 'fears that *p*' and 'hopes that *p*', and 'preferring that *p* to that *q*', where we describe our mental states in sentences in some language or other. I'm suspicious of that for a number of reasons, and one of them is that we are the only creature on the planet that uses language! And I want to ask the question: How do we account for the cognition of all the other creatures – the dogs and the cats and the mice and the lobsters and eagles and the porpoises and so forth? I doubt very much that they are all talking to themselves in some inner language in the way that we think of ourselves as doing; and because our brains are so similar to theirs, I have to be skeptical about whether our cognition has that form.

Now, of course, that is how I think of *myself*; in terms of propositional attitudes! I am as much in the grip of that conception as is anybody else – and at the moment I don't know of any systematic alternative; one has not been developed yet. But I'm sceptical that propositional attitudes describe more that 2 or 3 percent of human cognition. I would guess the other 97 to 98 percent of cognition has nothing to do with language or the forms, the structures, that you find in language. So I am as sceptical about propositional attitudes as I was twenty-five years ago.

Indeed my scepticism has only grown, because I've learnt more and more, the human race has learnt more and more, about how brains – all brains, not just human brains – how all brains represent the world. And we're learning about an alternative way of describing how brains represent the world; it has to do with population coding. We're learning something about how brains process information. And the answer seems to be that they transform one higher-dimensional vector into another. These models, which are now fifteen to twenty years old, are ever more successful at explaining how we can do interesting things such as recognize faces or recognize voices or [reaching for cup] reach for something that is in front of us.

The neurosciences are making progress, exciting progress, and they're *not* making progress because they're paying attention to 'propositional attitudes'. So, I think that in the long run science may decide that propositional attitudes are not the fundamental mode of cognition of human brains. That's why I'm inclined to think that in the long run science will eliminate them from its basic story of how brains work.

Other parts of human cognition like sensations and emotions, I don't think they'll be eliminated at all, because we are already starting to get neuronal explanations of sensations and what they are and how they work – how the brain codes for color, how the brain codes for pitch of sound, how the brain codes for tastes and smells – and also the emotions, although there it looks like biochemistry will play a larger role, rather than the activities of neurons. The different emotions look like they're connected with different kinds of neuropeptides like oxytocin or adrenalin or other chemicals like that. The brain is a chemical machine as much as it is an electrical machine. And I think those things will be successfully reduced or explained by modern science. In this sense I'm not an eliminativist at all; I'm a reductionist. But I am suspicious about the propositional attitudes still, for what I think are good reasons.

Now, I hope you will realize that the position I just outlined isn't quite as radical as the first two sentences in *Wikipedia* make it sound. I'd like to be thought a radical, but I don't want to be thought *crazy*!

C: So do you still think that folk psychology is a kind of theory?

PC: I do, and I think it will change as we learn more and more. That is the theory, the theoretical framework. The way we talk to one another will change. We already talk to one another about being adrenalized or being depressed because our dopamine levels are down. At least, some of us do. Just as we learned to look at the night sky and see it differently from how Aristotle saw it. He looked up and he saw the inside of a sphere with little jewels stuck on it that turned around us. We look up at the sky and see sort of an infinite space going off to infinity and the stars aren't moving at all, it's the earth that's turning. So this kind of major change in how we perceive or understand something has happened to the human race before, it's just that it's very close to home this time; it's going to be the way we think and talk about *ourselves* …

C: But is folk psychology similar to a physics theory, or is it more like the sort of common knowledge that we have? Let's take the example of picking up my glasses here. It might actually be that a resultant force is acting on them and describes this move. But I would just say 'I'm picking up my glasses.' Is it that kind of relationship that folk psychology might have to the more basic scientific theory? The kind that common-language claims would have to a physics theory?

PC: I think that the analogy is a good one. People talk about 'folk physics'. And the physics of Aristotle, if you go back two-thousand-some years, describe pretty much what folk physics thinks, and most people today still think in terms of folk physics. But physicists don't, and people who've learnt some physics see the world interestingly differently. And I think the same will be true of folk psychology; Anyone who learns a great deal of neuroscience – especially cognitive neuroscience, high level systems neuroscience – will understand the people around them in interestingly different ways.

And I don't think of this as being cold and machine-like, or something frightening, something from science fiction that you want to run away from! I think of it as just the reverse. If you have a much deeper understanding of how brains work, and how they function well when they do well, and how they function badly when they do badly, then we'll be able to see in other people when things are going wrong! You can *see* that someone is not being cruel, they're depressed for some reason and they're having a hard time dealing with the world; or you can *recognize* that somebody has not just gone off the deep end and is doing crazy things, but that they're bipolar; or that somebody is frontal – has a frontal deficit – they can't see the consequences of their action more than, say, twenty minutes into the future, and so they behave recklessly.

If you can see into the human mind and see what's going on then you're in a better position to act in a benign way toward that person. You can help them get out of trouble; you can help them get an antidepressant so that they can come out of their gloom; you can find new and interesting ways to pour oil upon the troubled waters; you can be a better human; a more caring human. So I'm not frightened by advances in neuronal theory; I think they will make us more humane, they will make us more caring.

C: But the point was one of replacing folk psychology altogether. It seems like you're still using those common-knowledge terms.

PC: Yes, I agree. Replacing it entirely will take a long time. And by 'a long time' I don't think it will happen in one hundred years; I think it will take a *thousand* years before it is systematically replaced. And of course I'm guessing when I say that, because most of the science lies ahead of us. We don't yet know how wrong we are in how we think about the brain. But we're learning that some of the things we thought about the brain are wrong – and there's an analogy here, from history, that I think everyone will appreciate.

Five hundred years ago we didn't know what life was, what a living thing is, what made something a living thing – and correspondingly we didn't have an idea about what it was for a life to be unhealthy. We had some idea; if you smelt bad and you rotted and fell over dead, you weren't healthy!

But our theory of what made people unhealthy ... There were theories that you were possessed by a demon, or that you had too much black bile, or too much phlegm – or any of the four humors of ancient medicine. And as we know of course, this is a *terrible* theory about health and about disease! And the sorts of things we would do based on this theory, our medical practices, were mostly *pitiful*! [laughs] If someone was possessed by a demon, you would try to drive the demon out. And you could drive a demon out in two ways: you could burn the person at the stake – well, that's not too good for the person! Or another way was you could cover them in excrement! And the demon thought this was a horrible place to be and so would fly away! Of course neither of these things worked, and maybe even medicine was uniformly ineffective.

Now, look how medicine changed our evaluation of what health is, after we came to understand what life is. We came to understand metabolism, and cell metabolism, we understood anatomy, we understood the thermodynamics of life, we understood energy flow; we came to understand that there are viruses and that there are bacteria; we came to understand what life is, including genetic defects in much greater detail than anybody had before – and with it we had a much better understanding of what the difference is between being healthy and being unhealthy.

And the difference allows us to be much more humane. We can cure people. If they have a septic infection we can give them antibiotics; we can prevent disease by giving children an inoculation against smallpox, and do all sorts of things we couldn't do before.

Okay, so that's a happy state. Let me bring you now to the case of cognition – that's the parallel to life. We don't understand very well what cognition is. The virtue of cognition is rationality: being reasonable, being moral. And we have some idea of what being rational is, what being moral is, or what being stupid and what being cruel is, but imagine how much better we will understand the virtues of cognition, when we finally understand what cognition *really* is! I think we will have a much deeper insight into mental health – cognitive health, intelligence, reasonableness, rationality – even things like scientific insight and moral insight.

So I'm not afraid of this at all, I think that it's going to set us free – it already is! We can be better now at treating certain standard kinds of mental illness than we ever could before. But we are still a long way from being perfect and, as I said, it will take a thousand years before we know everything … And probably – I take that back – we will *never* know everything! But as the centuries go by we know more and more. And I think, when we do learn more it changes the way we conceive of the world. And I don't see why our case is immune from the changes we've seen elsewhere.

We think of the heavens utterly *differently* than we did two thousand years ago – a thousand years from now, we might think of cognition utterly *differently* from how we do now. And we will simply throw away the old ways of talking and the old ways of thinking: they will survive in the history books, but even in the market and at the dinner table people will interact with one another differently from how they do now.

C: What's your opinion of Dreyfus' view of socially embedded and embodied cognition?[7]

PC: Oh, I think he's right – and it isn't just Dreyfus who's following on from Heidegger, it's other philosophers like Tim Van Gelder, John Haugeland and Andy Clarke. I think they're entirely right. And what they're discovering is something that I've discovered only belatedly – and that's how important the surrounding culture is to the kind of cognitive activity that any person engages in.

It's important because the conceptual framework you and I use wasn't generated just by us, scrambling around in the forest by ourselves. We downloaded a conceptual framework that had already been tested and tested, many times, by many prior generations. It's called the language that we speak. Languages evolved over time and books that contain wisdom evolve over time and the institutions – the police department and the hospitals and the Mayoral office and the legislature for the states and the Congress legislature, all these levels of cultural control, I'm thinking of the judiciary as well and the way the courts function –

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[7] See H. Dreyfus & S. Dreyfus, *Mind Over Machine* (NY: Free Press, 1986), H. Dreyfus *What Computers Can't Do: A Critique of Artificial Reason* (NY: Harper & Row, 1972) and H. Dreyfus, *What Computers Still Can't Do: A Critique of Artificial Intelligence* (Camb., Mass.: MIT Press, 1979).

all of these regulate our lives in ways that we're not always aware of. At bottom all this happens, I think, because humans invented language fifty thousand years ago – or a hundred thousand years ago, nobody knows. But it had the effect of making cognition communal, instead of individual. It also had the effect that the language we learn to speak could begin to accumulate wisdom over the years and the decades. And so the language we speak long outlives any person who is fleetingly born, speaks the language, perhaps modifies it a little bit, and then dies. That has allowed for cultural evolution. And once you can speak a language you can write it down, you can write books and legends and stories; use it to make laws to govern commerce, and to govern social behavior – it makes modern human civilization possible. So, I think language is very, very, very, *very* important; it's probably the single most important thing that ever happened to the human race. But I don't think language reflects the basic structure of animal cognition. We are animals in the end, and speaking a language is a trick the brain learnt along the way – a very very good trick. But it used different resources in order to learn that trick – and the other species didn't learn that trick. (Well, I'm not sure … maybe the dolphins, maybe the whales ... maybe even birds, I often wonder what they're chattering to each other about. Is that a kind of language? For all I know it is.)

C: I'm also thinking about art, and other ways of representation and communication. How important are non-propositional ways of communicating, learning, teaching?

PC: I think they're very important. And it's interesting that pictures start appearing on cave walls round about the time that we guess that language began as well. Humans were concerned to represent things that were not present. They could do it in language, they could do it in pictures, so I suspect that those two things evolved alongside each other. There are also other representational media. Music might be a way to represent emotions or a way of representing communal activities like dancing, or chanting.

Yes, I think that those things are enormously important. And when you look at society you realize that language is not the only medium of representation. Think of the enormous importance of blueprints, of diagrams for constructing skyscrapers, diagrams for constructing a coffee-maker, diagrams for constructing an automobile, diagrams for constructing an integrated circuit, drafting and architectural drawing – these things are of incredible importance.

C: A second set of questions concern the problem of qualia. Nagel has argued against excluding the phenomenal features of experience from an account of mental phenomena and thinks that these phenomenological features – qualia, or subjective experience – are excluded from materialist reduction.

PC: He thinks they're special, and physical science will never explain them; that's right. But I think he's wrong! Just straightforward wrong! I agree with him that it is *hard* to imagine how a physical theory of the brain, neurons firing and chemicals sloshing around, could explain something like the visual sensation of red or the smell of a rose the taste of garlic, or something like that. The qualitative features of experience that are present to consciousness do indeed seem to be very very different from a complex neural activity in the brain. Of course it *seems* to be something very different. I grant him that entirely. And when you first come across the problem and someone asks how you're gonna explain this in terms of that, it *isn't* obvious – it's *far* from obvious! But I am unimpressed by this – he is *very* impressed by it. I'm unimpressed and here's why: think of the wonderful phenomenon that was light. And even primitive people thought light was what God created first: [deepens voice; gestures] 'Let there be light!' And there was light. In vain, then, would we try to explain light in terms of things that God only created afterwards. Light also seems special and utterly mysterious – especially to people before 1850, or thereabouts. There were theories that light was particles or light was waves, and philosophers like Wolfgang Von Goethe and William Blake, the English poet, thought that this was just a ridiculous idea. This couldn't *possibly* explain it!

And things only got worse when somebody suggested that light might be electromagnetic waves. An electromagnetic wave is an oscillating magnetic and electric field, at right angles to one another, moving through the ether at a very great speed. And someone might say: 'Look, I know what a magnetic field is – that's what makes compass needles wobble; and I know what an electric field is, that's what happens when you rub your comb and then you pick up little pieces of paper; But what's that got to do with *light*!? Isn't there an explanatory gap there? How can you possibly explain the wondrous features of what light is, in terms of this arcane physicalist, made-up phenomenon, electromagnetic waves?'

And yet as we all know, when you look at all the properties of electromagnetism – how fast it goes, how it's reflected by mirrors, how it's refracted when it goes through a lens, how it carries energy, how it's generated in incandescent objects – it turns out it has all of the behavioural features of light and more besides. Because the theory entailed that there should be such a thing as invisible light; ultraviolet light at wavelengths shorter than blue, and infrared light, wavelengths much longer than red. And people's initial reaction was – 'invisible light?! That's a contradiction in terms! [laughs] Light is essentially visible, and makes everything else visible!'

C: I know what you're going to say next – black yellow...![8]

PC: That's right ... ! Well, actually, I wasn't gonna go there. But here's where, in the history of science, there's a parallel case, I would suggest. And people did resist the idea that light was electromagnetic waves – they thought the idea patently absurd. It took people a long time to get used to the idea that it might be true – and there wasn't any slam dunk [slams the desk] proof at any point, that they were identical. It's just that the explanatory successes of the theory of electromagnetism got bigger, and better, and wider, and after a while, the resistance just sort of – died.

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[8] See Paul Churchland, 'Chimerical Colors: Some Novel Predictions from Cognitive Neuroscience', in Brook and Akins (eds.), *Cognition and the Brain* (Camb.: Cambridge University Press, 2005).

This is starting to happen, I suggest, in the case of neuroscience and subjective qualia. And if we had time I would tell you again the story I've already told you about the chimerical colours. These are impossible colours analogous to invisible light, but they turn out to be there. But I agree this is just a little case. Neuroscience has a long way to go before it can equal the success of electromagnetic theory. And so the question is still, strictly speaking, open. Still, it's *possible* that subjective qualia are a reflection of a non-physical, spiritual domain. That possibility has not yet been definitively ruled out, but I would bet money on the other side, because I see the science developing and in some cases it's already offered us some explanations – about colour, for example. There is an important area of qualia, where we have systematic explanations from the Hurvich-Jameson neural networks story. Other cases, we're still waiting and hoping. But I don't see the argument that Nagel gives or that Chalmers gives or that Alex Levine gives are – it used to seem that they were decisive – qualia *couldn't be* states of the brain. But it used to seem decisive also, that light *couldn't* [thumps on desk] be electromagnetic waves – and, I'm sorry … it turns out that it could be and it *was*!

C: Would the appropriate answer perhaps be that the kind of reduction that Nagel hopes to obtain is not even obtained in natural science? He would like to have some sort of complete description of contextualized objects, but that subjective character of natural phenomena is not and doesn't *have to be* captured by natural science. It seems that natural science does a lot *without* capturing that.

PC: I disagree. My position is more optimistic than that. I think we *can* explain that qualitative feature – why it has the qualitative dimensions that it does. We can even predict it has new ones, and that's what we are doing – with colour for example.

If you remember, the scientist Munsell looked at the phenomenology of human colour and he saw that all possible colours – at least the ones that humans can perceive – could be located within this double cone spindle, with white at the top and black at the bottom, with all of the hues on the equator, and they would fade through pastels up to white at the top and black at the bottom and gray at the middle. This is a way of describing the range of possible subjective sensory qualia. And, one can then ask: Why do our subjective qualia organize themselves that way? Why is orange between red and yellow? Why is green between yellow and blue? Why is gray between white and black? And the new neuronal theory of color processing in the brain – this is a theory that has been established for at least twenty years, the Hurvich-Jameson theory[9] – now explains, quite adequately, why that space has the shape that it does, why the various colors that are located within it are located where they are. It gives you a systematic explanation – this was supposed to be impossible – of why the qualia are as they are, why they have the similarity relations, the dissimilarity relations, that they do.

This is real scientific explanation, by real physical stuff, of phenomenal qualia. And moreover it predicts some new things. Some things that commonsense didn't know about. And you go and you check these predictions to see whether they're true; the predictions come out …

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[9] See L.M. Hurvich & D. Jameson, 'An Opponent-Process Theory of Color Vision', *Psychol. Rev.* 64, 1957: 384-404.

So, this is a happy case, not of finding some excuse for failing to explain a qualia, but of succeeding and explaining the qualia surprisingly well, thank you very much. I agree we haven't done it for the whole range of qualia – that will take many many years, but I'm no longer filled with despair. *They* are. But I think they're just arguing from ignorance. They are taking the limits of their imagination to be the limits of what's possible.

C: What do you think are the reasons why traditional artificial intelligence failed, and what are the prospects for artificial intelligence research today?

PC: I think it failed not because the computers that we built weren't fast enough – [hushed] the computers we built were much faster than you or I – I think it failed because the way in which classical AI tried to represent information in a computer was by way of sentences – Propositions! They were sentences in a computer language rather than in English, but they were sentence-like representations. And the computer processed the information by drawing inference-like relations between them. If you like, it was an attempt to push folk psychology onto computers. And we deliberately made these machines so that they would function as folk psychology suggests the way we live – we fill with propositional attitudes the things that the computer knows. It knows that *p*, that *q*, that *r*, and so forth, and then you can let it figure out whether *t* by examining whether or not there was an inferential chain between the premises and the conclusion. Initially things worked pretty well, partly because the computers were so fast – they could do an awful lot of things very very quickly.

But it began to emerge that when you ask them to do things that humans and animals do very easily – like recognizing a face, within a third of a second, or recognizing somebody's voice as the voice of your wife or the voice of your child, or detecting the emotion in somebody's cry – is it a scream of delight, or a scream of terror? – that sort of thing is something humans and animals are very good at – and when people tried to write programs to do that, it isn't that they failed utterly. It's just that it turned out that the programs had to be *enormously* complex if they were to succeed at all. And it took the computers ten times, a hundred times as long as it took humans to do it, even though computers function a million times faster than we do – because they're conducting electricity through wires rather than conducting action potential trains down an axon. Those things ride at about the speed of a human bicycle, this is practically the speed of light. So people began to scratch their heads, thinking 'what's going on here?' And the suggestion – and here I get to the positive side – I think that's why they failed: they misrepresented what cognition is at bottom.

Other researchers started to say: 'well, let's try and take our instructions from the brain, here – how is the brain wired up?' And you have about a hundred million neurons on each retina, and they project their axons back to ten million neurons at the LGN,[10] and they project their axons to five hundred million neurons and you realize that biological brains are doing an enormous number of little computations, simple things: [hushed] … all at the same time – *all* of these synaptic connections attached to *all* of these neurons *all* doing a little something, a very *little* something, *at the same time*.

The contrast with these machines is that they're doing a little computation too – but they're doing it – *phrrrrrrrr* – as an enormously fast sequence. It's easier to do large numbers in parallel than it is to do them serially, or one after the other. So when people looked at the computing power of the brain, given the vast number of cells, and neurons in the brain, and the vast number of connections, it turned out that the human brain was doing more computations per second than the biggest and most powerful computer in the world. The computers were getting close, but again, they're using serial processing, so they're still behind us. So I think that the prospects for artificial intelligence are still very very good. Because I too am inclined strongly toward physicalism, given the success of the physical sciences, but I think success will come when we try to build an artificial intelligence that mimics the way the brain is wired up; then we will start to get interesting artificial intelligence.

C: So, what is connectionism?

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[10] Lateral geniculate nucleus: the part of the thalamus that receives visual signals from the ganglion cells of the optical nerve, and transmits processed information to the primary visual cortex.

PC: Connectionism is the view that AI should follow the lead of the brain. We should reverse engineer. We should find out how mice do it, and how cats do it, and how human brains do it, and how lobster minds do it, and how ant brains do it. And then try and do it the way they do it.

That leads to an interesting possibility by the way, which worries me a little bit. If we do build a brain, say just like yours Sophia, neuron for neuron, synaptic connections – so we produce an electronic creature, that not only thinks like you do, but has the same knowledge you do, the same emotional profile has been built, we will produce an artificial Sophia. But this Sophia will think a million times faster than the real Sophia, she would think in ten seconds, what would take you ten years.

C: [Laughs] Can you build her please?

PC: I would be afraid of a creature like that, because she would be able to think faster than any of us. Here is a case where our children may be made of metal, but we may love them as much as if they were made of flesh and blood – that is a worry I have. Artificial intelligence is possible, and if we reengineer the human brain to produce an electronic version, a parallel system that is a normal brain, it will function very much faster than normal brains do, and I would frankly be afraid of such a thing. I think we have to tiptoe very carefully here, even though I'm very optimistic about the prospects.

Now I don't think this will happen very quickly, again I think we're talking about two hundred years at least, into the future. But it's a possibility that I think we have to be aware of.

C:But we have created atomic bombs, things that are much more powerful than we are.

PC: More knowledge breeds more power. And power can always be abused, and what the human race has to do at every stage, is to grow up. When we learned to make fire! Uh! That was a dangerous advance! Suddenly you could burn a whole village, here, in half an hour. Did we give up fire? No – we just learnt to be responsible with its use. And when we made atomic bombs, it was terrifying, we could destroy an entire modern city in three seconds. But of course, I think within a hundred years most of our power will be coming from nuclear power stations – we're going back to nuclear power because oil and coal and gas have too many drawbacks. This is another case of technological advance yielding power when we must be careful that it's not abused.

C: How do you conceive of the relationship between science and the philosophy of science? You have said that you think that a philosopher of science doing epistemology is like a cognitive scientist, and so in that sense you think of yourself as a cognitive scientist. But what is at stake in the divisions philosophy of neuroscience/philosophy of science, and philosophy of science/science in general? And what is the difference between philosophy of neuroscience and of the life sciences in general, and the philosophy of, say, physics? Because it seems that the vocabulary and the artillery of neuroscience and the life sciences in general deal with things much closer to our hearts than maybe physics does. And in that sense, perhaps they are also more dangerous.

PC: I think ultimately that all of us – the philosophers and the scientists – are all doing the same thing. We're trying to understand the universe. And we're trying to understand different parts of it. And people used to think, back in the early twentieth century, and particularly in places like Oxford, that philosophy was something very different from the sciences. Sciences were doing empirical research, philosophy was doing conceptual research, or conceptual analysis, or something like that. I think *that's* a made-up story! I think philosophers are trying to explore the conceptual frontiers – but so do scientists, when they make up new theories. Philosophers are distinguished only because … [sighs] what we call a philosophical problem is a problem that's so far from scientific solution that no self-respecting scientist will touch it! And so they throw it over to philosophy and say, here, *you* worry about it! And a successful philosopher is someone who manages to bring some order or insight inside the area, sufficient order that you can then start asking empirical questions – you can start proposing experiments, and saying: 'Oh! I was wrong! You've got to modify that theory'.

It used to be, of course, that it was philosophers who did physics. The department of physics at Cambridge – that department goes back to 1200, or something like that

– is still called the Department of Natural Philosophy – philosophy of the natural world! And philosophy used to encompass astronomy, but astronomy went off on its own, back in classical Grecian times, and physics went off on its own during the Renaissance, and chemistry, which also used to be part of philosophy – remember the alchemical search for the philosopher's stone that would allow you to turn base metals into gold? They thought of that as a department of philosophy. As disciplines become more self-contained and more driven by empirical data, we don't call them philosophy any more, we call them sciences. Now, there are always some residual problems left, like the mind-body problem, or the problem of life – there's a problem that solved itself in the middle of the last century. Biology went off – it too used to be part of philosophy, just like chemistry was. All of those cases are cases of philosophical success. We finally get enough of a grip on a problem that you can start performing experiments, to test the theory and to modify it. We finally learn from experience rather than sheer speculation, mere stabbing in the dark. Philosophers are trying to do the same things that scientists are. They're just addressing some of the hardest questions, and they're engaged in stabs in the dark, and so, philosophy moves forward more slowly than the sciences do. Now, you said you had a worry. What was your worry?

C: I was thinking of cases where the language of science has been used to promote political goals. For example the use of holistic biological language by the Nazis to promote their totalitarian goals: the idea of the *Führer* as the head and the *Volk* as the body of an organism that functions in unison. Those kinds of metaphors that travel from a domain like biology – especially from life-science domains, whose vocabulary seems compelling – to the domain of politics. To what extent should philosophical work be constructive – what balance needs to be struck with a negative, critical theory?

PC: Well, yes, evil metaphors are certainly just as possible as benign metaphors. The metaphor of a master race, ruling over subjugated races, was a lousy metaphor and it was a misuse of biology. The idea that evolution was something that leads from lower to higher and that northern Europeans were the most evolved was a false conception of how evolution works. Evolution works in a radiated fashion rather than arrowing towards some goal.

I think the broad answer is that science can provide compelling metaphors for a number of things. And sometimes they are very revealing. Newton said that the moon is just like a flung stone, it moves in an elliptical arc focused on the earth – that's an illuminating scientific metaphor. And then there are other metaphors that aren't so illuminating at all, like the notion of a master race, or the notion of evolution focused on the *Führer* itself, or on blond-haired Aryans.

We have to resist the ugly metaphors. Science is as rich a source of metaphors as anything else, and we have to resist the bad ones and nurture the good ones and we have to learn how to tell the difference. And that means that we have to *test* them in systematic ways – they have to be subject to criticism. The Nazis weren't interested in having their metaphors tested in systematic ways, they were interested in using them for political purposes. Newton was interested in having his metaphor tested, and he was lucky and most of the tests turned out very well indeed thank you. So in that way we can discriminate between good metaphors and bad metaphors. Beforehand you often can't tell the difference. You have to get them in a position where you can test them.

Some of them of course will look morally ugly, even before you can test them. Maybe then you want to resist them. But I remind you of cases like the smallpox vaccine. When it was first invented, in the early 1800s, the Church thought it was a *horrible* thing, because they thought that if you were giving people vaccinations you were playing God. Whether or not you got smallpox and died was God's will, and if you were protecting your children by giving them smallpox vaccine, you were intervening in God's plans, and the Church tried to prohibit the smallpox vaccine for quite some time. But after fifteen years someone did a survey in Northern France, and the number of deaths of innocent children from smallpox fell from one hundred and forty-five thousand to four thousand in just fifteen years. Now, all of a sudden it starts to seem like: no, smallpox was not a case of being morally evil, it wasn't a case of playing God, it was a case of protecting innocent children from something that has nothing to do with them.

Now, it's never easy to see what's true and false, it's never easy to see in the long run what's right and what's wrong. One needs to keep an open mind and evaluate things as you go along.

C: Is connectionism a good source for metaphors?

PC: I think so. I think so, yes. But the research is in such an early stage, it's still at a very theoretical stage, so I can't claim any grand successes. It is a fertile metaphor because it suggests that the way, say, the visual cortex represents the world, could be more like the way your television screen represents a baseball game. If you go up at the screen and look really closely you see all those little pixels: there's two hundred thousand little pixels – some of them green, some of them red, some of them blue – and any little picture – say Dan Rather, reading the news – is a particular pattern of activation levels across all of those pixels; some of them bright, some of them dark. Well, any particular representation across the visual cortex in the brain is a particular pattern of excitation levels across one hundred million neurons – not two hundred thousand, but one hundred million! So, the resolution, if you like, of the visual cortex, is much higher than a television screen. And that's true of a monkey, that's true of a mouse – this gives you a new respect for the representational power of the brain. It may be representing – not always like a two-dimensional picture – but representing with activation levels across millions and millions of neurons. And then it transforms one representation into another – because you've got many different populations in the brain. And you can do computations over these representations.

And this is a metaphor for conceiving what's going on inside the human brain. It looks like a useful metaphor for understanding motor control, facial recognition, auditory recognition; it looks like a very promising metaphor for human research. And that's why we're pursuing it. But the proof of the pudding is in the eating. We'll see how this research programme pans out. It could very well die, just as classical AI died. After ten or fifteen years of trying, this may wither on the vine as well.

C: I guess part of keeping the metaphor tight relies on reproducing the architectural structure of the brain adequately in your model – figuring out the criterion of what's an adequate simplifying assumption, and what's just plain misrepresentation.

PC: Well, that comes out in the testing. If you can get useful idealizations, then fine. But if you end up misrepresenting what's there and the explanatory power gets feebler and feebler and the metaphor gets more and more and more strained … That's what happened with classical AI. The idea of an internal set of sentences crunching away according to logical rules – that turned out to be a poorer and poorer metaphor. We strained it and strained it and the behavior of the machines that were being programmed, the investment didn't justify the payoff. And that's why people are switching to new ways of trying to create AI, because the old ways failed. Well, these new ones may fail too! But at the moment they seem to be flourishing! So keep your fingers crossed – and come back in ten years.

C: This seems very classical-Greek: the idea of the philosopher doing the work before the scientist steps in.

PC: Yes it is very much like the classical Greeks. Aristotle was a proto-scientist, and Plato was a proto-scientist – but he was not very good [laughs]. And then if you look at Theophrastus and Strato of Alexandria who came after Aristotle at the Lyceum … Were they philosophers, were they scientists? It's a silly question! They were *both*!

C: My only worry is keeping a critical distance from the practice of science, insofar as that enables you to see the mistakes, see the confusion. So I guess both philosophy and science need to be there. And keeping the balance is the tricky thing.

PC: Yes, keeping the balance is the tricky thing. You can't have a balance until you have *both*.

Nevertheless Empire

Clémentine Duzer & Laura Gozlan

Pestilent fumes had tainted the atmosphere of the suburbs so that little by little passers-by began to steer clear. But some remained, unafraid, while the epidemic continued to spread. Such was the case with private investigator K9: his thoughts were haunted by a woman of the worst kind.

She ran a brothel.

*

'He used to run an out-of-town osteopathic clinic, took on a few drugged patients for three large ones a week.

As you know, the epidemic was swiftly killing off the hired help. Our workers were spilling all over the lino, you understand, liquified bones softening the flesh.

It was all going from bad to worse. We were hiring younger and younger recruits, but it was no good.

We were about to shut up shop, before we had the idea: the graft.

We had some failures. Yes. Automutilation with fan blades. In short, it turned against itself.

So we eventually discovered that female parts are much more co-operative than male. Accordingly, as you will understand, the very best grafts come from domesticated animals ... '

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Islamic Exotericism: Apocalypse in the Wake of Refractory Impossibility

Reza Negarestani

Unlike other strains of monotheism, Islam cannot be said to include the idea of an apocalypse in the sense in which we usually understand this word. In fact, the radically external, 'impossible' (non potest) *nature of Allah renders the judaeo-christian apocalypse structurally impossible* (impugnable). *At the same time, Islam posits an apocalypse that is neither feared, hoped for or expected, but which, in the ideal of pure submission, is inhabited by the faithful as pure impossibility. In order to comprehend what appears, in its violent irruption into western chronology, as the apocalypticism of radicalized Islam, we must understand how Allah's absolute externality has as its consequence a different conception of temporality, different mechanisms for the maintaining of faith, and an apocalypse which cannot be reduced to a chronological moment or a possibility in unification.*

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The Outside of Outsiders. The Islamic account of Genesis spirals around a non-ontological unity. Firstly, as Mollasadra (1571-1640), the Iranian philosopher, emphasizes,[1] Allah is not 'Being' (yet neither is it *nihil*); its truth can never be known, either through being or through non-being, either before or after the Apocalypse. Secondly (and in parallel with the foregoing), Man can never attain an integral unity with God – such a unity as would, in other strains of monotheism, exalt and transform Man from his former (*quondam*) state. Man can only return to Allah, not unite with him. Unity or completeness in terms of the human is only entailed by affordance,[2] a state of mutual affordability or an economical openness: the state of being open to. In Islam, however, God is constantly external to Man, and only 'unlives' through the impossible, an absolute *potestas* so ultimate that it is im-*posse*-ible for Man; Al Farabi (870-950CE) in his *chef-d'oeuvre*, *On the Principles of the Views of the Inhabitants of the Excellent State*,[3] clearly brings into conjunction the possibility of possess-ability and impossibility, to suggest an *im-possess-ability*.

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[1] Al Farabi, *On the Principles of the Views of the Inhabitants of the Excellent State,* trans. Seid Jafar Sajjadi (Tehran: Ministry of Culture and Islamic Affairs, 2000).

[2] Polish philosopher Roman Ingarden, in his works focused on ontology – written after breaking from Husserl's phenomenology through a critique of transcendental idealism – expounds on the problem of openness and affordance, suggesting that closure (or modulated/economical openness) is a priority for open systems, and analysing niches as power projection zones and inhibitors of unwanted interactions and communications. The openness of the niche protects itself from what makes it open, by opening itself to what makes it closed. Only through such an openness can the existential moments be afforded, and modes of Being are then able to emerge. For more details on affordance, see my 'Militarization of Peace' in Mackay (ed.) *Collapse* Vol. I, 72n.11.

[3] Mollasadra (Sadr al-Din al-Shirazi), *The Beginning & the End on Transcendental Philosophy (Al-Mabda wa'l- Ma'ad fi'l-Hikmat al-Muta'aliyyah)*, Vol. 2 (Tehran: Sadra Islamic Philosophy Research Institute, 2002).

Possibility must be afforded if it is to be reached, its *potenz* must be attained, possessed and sometimes even activated through a dynamic course of action in order for it to be released (X is possible for Y if and only if Y affords X *i.e.* if Y is able to reach X and authenticate its possibility; or, Y must attain the capacity to afford X as a possessable objective). But Farabi bifurcates impossibility into a 'Latent/Passive Impossibility' (an impossibility characterized by its quiescence) and an 'Active/Unfailing Impossibility', where the former is merely a symptom of a subjective capacity or temporary lack of mutual affordance. That is to say that Latent or Passive Impossibility describes a situation where, once Y achieves the desiderata necessary to capacitate itself and afford X, the Latent Impossibility will be actuated as Possibility. Latent impossibility attests to the fact that the impossible object(-ive) (X) still remains in the horizon (boundary) of the subject in relation to which we attribute its impossibility; it is necessary only that it be afforded and that it mutually afford the subject in order for it to become possible (possess-able). At the same time this makes it certain that the latently impossible object(-ive) remains bound to the logic of the boundary, of conditions and characteristics (having its own idiosyncrasies which must be afforded in order to be activated and become achievable for the subject Y). Thus it remains existentially perusable and intrinsically inert and transient (it is not permanently and fully impossible). And it is neither functionally nor spatially external to the subject Y; on the contrary, it (latent impossibility: X) exists just as the subject Y exists, waiting to afford X to turn it into a possible (possess-able).

Christian luminary Nicholas of Cusa (1401-1464AD) argues in *De Possest* (a neologism best understood by breaking it down to its pre-existing elements *posse est*) that 'God alone is what (He) is able to be.'[4] Nicolaus Cusanus expounds on a microcosmic proto-monadic system which is shaped around his term *Possest* (*Posse Est* or *Können-Ist*) which draws an intrinsic and interiorized line of alliance between Able-ness (being able to) or Actuation, and *Potentia* or Possibility. To exist is to be possible in the sense of *possest*; or more accurately, 'able-ness' and 'actuation' are immanent to potency and possibility. Possibility alone renders existence, just as potency alone renders able-ness. According to Cusanus, *possest* means that 'possibility itself exists' ('*posse est*'); then he concludes that because what exists, exists actually (existence is the actuation of possibility), the 'possibility to be' or the 'potentiality to be able' exists insofar as the 'possibility to be' is actual. Cusanus calls this *possest*. In other words, and from a different etymological and biblical perspective of the term *possest*, it means that the 'potentiality to be' exists as effectuation and able-ness (*posse/possibilis*).

The proposition 'God is *possest* (actualized-possibility and able-potency)' captures an omnipotent quality, to be opposed to created beings who can never completely fulfill their potentialities and can never fully reach their possibilities. This intrinsic and autonomous transition in *possest* between possibility and actualization, or potentiality and able-ness, can only be established in the presence of capacity or affordability; because actualization or able-ness emerges when possibility or potentiality achieves and satisfies a certain capacity (*i.e.* in the case of chemical processes, reaching a certain gradient in potency to trigger a specific action) that leads to a certain actuation and effectuation. Designated actuation is the matter of designated affordability, or the range of capacity for a potency which must be fulfilled (afforded).

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[4] See Nicholas of Cusa, *Metaphysical Speculations*, Volume 2, trans. Jasper Hopkins (Minneapolis: The Arthur J. Banning Press, 2000), *A Concise Introduction to the Philosophy of Nicholas of Cusa*, trans. Jasper Hopkins (Minneapolis: The Arthur J. Banning Press, 1986), and *Nicholas of Cusa: Selected Spiritual Writings*, trans. H. Lawrence Bond (New Jersey: Paulist Press, 1997).

The necessity of capacity as the ground on which possibility and actuality are mapped together, or in other words, capacity as what connects possibility and actualization together, can now be examined through an apagogical argument (*reductio ad impossibile*) and in conjunction with the theological context at stake here. To this purpose, we shall assume that the connection between possibility and actualization (or potentiality and able-ness) is direct and immediate, and they operate in regard to each other without an intermediary, a *capacitas* which can contain something.

In the absence of capacity and affordability as bases which underlie both possibility and actualization, every possibility could lead to any actualization and any able-ness could be ensued by a potentiality with no required gradient or degree of quality or quantity. Or in other words, no particular ability would exist, since it is the capacity and gradient of fulfillment that lead a certain potentiality towards its able-ness. Once we assume that capacity and its subsequent affordability do not exist in the transition of possibility to actualization – ergo the *possest* of God – there would not be any boundary (limit) or compass for the actualization of a possibility, or *vice versa*.

Consequently, in the absence of capacity, the possibility of being God and actualization of that possibility – being the Divine, that is – for Man would be equal to the *possest* of God itself: so to speak, Man and God would be potentially and actually at the same level; a theological conclusion that is not only invalid for monotheism but also confutes its own grounding structure. Therefore, to this extent, the relationship between possibility and actualization, both in the actualized-possibility of God (*possest*) and possibilities of Man, is subjected to the economy of capacity and ability – in the sense of tolerance (range of modulation) – which is an economy of affordability rather than openness, environmental surround rather than radical outside. Now if capacity is latently and potentially attainable at all times (can be afforded at any time) and it constitutes the grounding nexus of possibility and actualization for both God and Man, then Man can afford the Divine all the time – which is not the same thing as 'Man being God' or 'becoming the Divine instantaneously'. God can be afforded all along. This affording of God – which is delineated as the possibility of Man being actualized as God (ultimate actualized-possibility or *possest*) and is not 'to be God itself' – incessantly maintains the position of the Divine within the range (*confinium*) of Man's affordability (either incapaciousness or capaciousness: capacity), or in other words, interior and endemic to Man's *ecologia* and existence.

Following Cusanus, in God's *possest*, actuality and possibility can correspond and conform to each other symmetrically (with an equal scale) only if the capacity between them is equal to the unit distance or the unit capacity. That is to say, *ab* is posed as the unit measure (*unus*: 1) for any other variation in actuality, possibility and capacity *i.e.* a unit in the threefold of existence. Accordingly, *possest* can be diagrammed as *ab,* which is equal to the unit capacity and the symmetric fold between actuality and possibility (see Diagram 1). To put it differently, *possest* as the complete symmetry and corresponding state of possibility and actuality (God) can only come to existence if both actuality and possibility are aligned with the Absolute or the un-conditioned (x=0); since any condition, or more concretely, any variable step (*gradum*) or status, either in possibility or actuality, is formulated as a deviation (*d*) from the unit distance or the unit capacity ($d \succ 1$). To this point, beings are perpetuated as variations, and their existences are deviations from the unit capacity (*ab*), which is immutable to variation and digression. For created beings, either actuality or possibility is characterized as the ratio of this deviation to its corresponding capacity. For instance in Diagram 1, for possibility of a created being this ratio of deviation is b_1b, *i.e.* b_1 to b_1o (similar to a cosine function: b_1/b_1o). Likewise, the existence of a created being becomes tangential to the existence of God. The existence of a created being is posited as the ratio deviation of both its actualities and possibilities (a_1, b_1) to the unit capacity (*ab*) which is *possest*

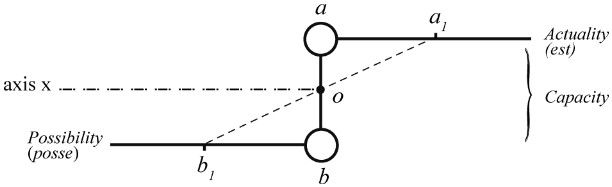

Diagram 1. The Threefold of Existence

or God itself (similar to the tangent function): $(a_1 b_1)/(ab)$.

Here the qualitative or quantitative characteristics of One and its formation as a specific *com-plexus* (or according to Cusanus, God's *complicatio*/enveloped in relation to the world's *explicatio*/developed), namely unity, should not be presented as the reductive 'indifference of the unity itself toward itself' (Hegel) by way of totalization or exclusion. Unity here serves monotheistic theology only by the virtue of its (i) positioning, (ii) the alignment it takes and (iii) the fold it plaits (as a fold-line which is itself a plait) in the threefold of existence. It is by way of these three acquired attributes (subsidiary to its unitary quality) that unity – as of God – more than being the exclusive oneness, is posited as the unit capacity, the measure (*metron*) of affordance. And affordance is the only and exclusive destination for the openness between Man and God in this territory and the ontological relevancy between possibility and actuality. Only through economical (dyslogistically economical, of course) possibilities of affordance or reciprocal affordability, can actuality be posed as the ideal realization of possibility, an end in itself, an entelechy. Unity of and through God is the fold of connection and communication made in the name of affordability and capacity (so long as one can afford). Neither unity nor its formative processes (unification) are totality or exclusion in themselves. To highlight the problematic of 'Unity as immanent totality', it can be suggested that different numeric principles can be applied to unity itself, in the same way that Kazimierz Twardowski[5] proposes that Leibniz's spiritual system is subject to two different numeric principles. Consequently, Leibniz's system only includes monism of kind but not numeric monism. Unity as a process is perpetuated by two main numeric systems – of which at least one is manifold – which are applied synchronously together from both ends in the process of unification. In Christian theology, one is the numeric multitude or the participation of people (Man) in God; and the other is the numeric monism of God, which also envelopes the monism of kind. Moreover, one can embarrass the presupposed tautology ('I be that I be' [Exodus 3:14]) that is associated with One not only by the logic of exception (which again is directly extracted from oneness as counter-generalization) but also by the singularity function of One by which One separates from its unitary predeterminations. At the same time, from another direction, infinite growing processes can encapsulate the same singularity of One and develop the same 'object conception'[6] that is applied to One. If One consolidates everything under its banner by any means possible, every anomaly, unilateral development, exception, germinal multiplicity and constant driftage – that is to say, infinite perversion ($d \succ 1$) – can also be gathered under the flag of One. This is the remobilization program (in a military sense) that is harvested from the double-dealing dynamism of heresy. If God basks in his house, let us reconstruct it according to the laws of demons.

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[5] Kazimierz Twardowski, *Selected Philosophical Writings (Wybrane Pisma Filozoficzne)*, (Warszawa: PWN, 1965), 200-4

To this end, the monotheistic theology in which the existence of beings is tangential to the unit course

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[6] Ed Dubinsky *et al*, 'Some Historical Issues and Paradoxes Regarding the Concept of Infinity: An APOS Analysis: Part 2', in *Educational Studies in Mathematics*, Vol. 60, No. 2 (The Netherlands: Springer, 2005), 253-266.

(*unbedingt*) of God makes sense; but only at the cost of postulating the existence of God as capacity, or more accurately, the unit capacity in the threefold of existence. The *possest* of God is transversally interposed between actuality and possibility, an imposition that not only establishes a monopoly of God, for which beings are mere excursions, but also economizes existence. God is the *metron* of affordance; Man's affordability tangentially folds over and contains God (see Diagram 1).

The affordability of God (*i.e.* God being afforded or God within the fold of Man's existence) perpetuates the Divine as domestic or in-the-house (cohabitant) in connection to Man. The Almighty's omnipotence is merely effectuated in the wake of its confinement, which includes and covers Man too; while the latter is a part, the former is only environment, the neighbouring, the one that is tethered to the part's capacity. If the Triune God is existentially possible, it is because this God cohabits the same space in which Man resides, which is functionally bound by the economical closure of affordance between the two (Man and God) and is rendered volumetrically limitless by the opposition between 'the becoming of Man' and 'the Being of God', which determine the ongoing perpetuation of affordance (see Diagram 2). The affordance or mutual affordability between God and Man is an economical openness through which overlap and 'radical communication' (indifferent to capacity) are not attainable. Here, communication and overlap can only take place in the presence of and within a third capacitor, which is situated as an intermediate state (*meso-philic*) by both sides and interposes a buffer between them capable of consociating and bringing the sides to one capacity, coordinating a domain of communication for God and Man. This capacitor is partially shared by both sides and does not preexist for them individually; it is conceived and formed by the movements of Man and God to each other (see Diagram 2). Coexisting contemporaneously and dynamically, these diametric movements whose course of action is affording, participate – in the sense of orchestration – in the coordination of a communal capacity, a *hospitium*. The hospitality of axes, here, cannot be exalted into an act of conjoining, unless through the act of lodging each party on the basis of their regulations, ineptitudes and failures toward each other and in themselves – the hospitality associated with the foundation of lazar-houses or the erection of hostels as loathsome places of dejection and parsimony. If God and Man are incapable of fusing with each other outside of their affordability, and for that reason their oneness is eternalized through a shared vessel (*vehiculum*) which renders both subordinate to each other, they never fully overlap each other; though at the same time they do overlap on a bounding level. In other words, the affordance or mutual affordability between God and Man can only lead to unity (continuity in and of One, *un-us*) when the boundary of Man is afforded (economically affirmed) by God. In the wake of Franz Brentano[7] and later, more concretely, Roderick Chisholm's theories of coincidence, which propose 'if something continuous exists as a boundary, it must be in connection with other boundaries and it must pertain to a continuum of higher dimension',[8] the continuity of God and Man in a 'shared capacity' determines and marks out not only the boundary of Man, but also of God. Unity cartographically outlines the shared and coinciding boundaries of Man and God, the afforded boundary. In unification as culminating affordance, all possibilities – including the possibility of unity and the possibility of Man's deification – are molded by the capacity and boundary of Man which necessitate a boundary for God as the continuity of Man's boundary in unity. The possibility of unity entails the possibility of a coincidence of boundaries in the congenial company of

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[7] Franz Brentano, *Philosophical Investigations on Space, Time and the Continuum*, trans. Barry Smith (Sydney: Croom Helm, 1988).

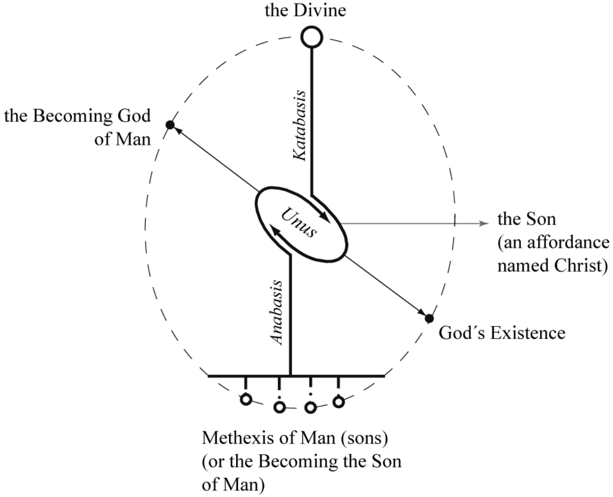
the Divine
the Becoming God of Man
Katabasis
Unus
the Son (an affordance named Christ)
Anabasis
God´s Existence
Methexis of Man (sons) (or the Becoming the Son of Man)

Diagram 2. Monad Mechanics

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[8] R. Chisholm, *On Metaphysics* (Minneapolis: U. of Minnesota Press, 1989), 83-90.

Man and God.

Having ratiocinated the threefold of possibility, actualization and – *en passant* – meso-philic capacity, the investigation of Possibility and Impossibility for Man and God can be pursued by, and in conjunction with, Farabi's Islamic question of Active/Unfailing Impossibility.

For Farabi, Being and being united with God demarcate a passage that is trodden through the intersection of Latent/Passive Impossibility and Possibility (symbolised as A∩B), and whose boundaries are outlined by the 'symmetric' difference of Latent/Passive Impossibility and Possibility which is the union of both minus their intersection and can be symbolized as (A∪B)–(A∩B). Farabi refutes any manifestation of 'possibility of Being' in the existence of God, because possibility of Being is – with the same scale or *sun-metron* – symmetrically determined by the relative complements of A and B (symbolised as A–B and B–A) which maintain existence by exclusion and debarment of other parts (simultaneously full A and full B) (see Diagram 3).

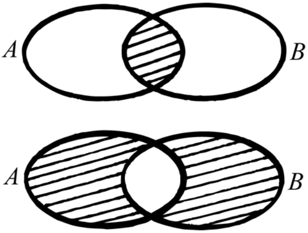

Diagram 3. Union and Symmetry in *Possest*
(After Nicolaus Cusanus' *De Possest*)

The Christian doctrine of Apocalypse and Return to God adheres to the model of Latent/Passive Impossibility; it is maintained that the Unity with God which is now impossible will eventually be afforded, and, as possible, will ensue. Affordance, or 'the openness to possess', is the *causa causans* of 'possibility (*posse*) to be able and actualized'. In the presence of affordance, possibility is assumed as the capacity (amplitude) or the containing possibility to do something. Possibility as affordability – in its economical receptivity and investment – exists prior to possibility as ontological potency. Parallel to, but entirely dissociated from, Latent Impossibility, it is the other impossibility (im-possess-ability) delineated by Farabi that designates the plane on which Allah pervades everything in Islam; it is Active or Unfailing Impossibility, which cannot be afforded under any circumstance. Hence it perpetuates and postulates itself outside of possibility and possess-ability – that is to say, potentiality for Being and being united. Farabi's Active Impossibility, which suggests itself as consistent and radical, equals radical externality. Allah's externality renders it im-possess-able; its active impossibility originates and reinforces its un-existence or im-possess-ability for all modes of existence. But at the same time this un-existence is not that of the *nihil*, since it is immanent to existence and all modes of being. Allah does not afford, but is the total openness which must be afforded, regulated, grounded and moderated in order to be transformed into modes of existence, into survival; otherwise, its active im-possess-ability would be the resolute terminus of all beings.

According to Islam, then, existence is the consequence of the prevailing impossibility of Allah, and Allah's absolute openness can only be afforded (that is, submitted to economical communication or the affordable passage from passive impossibility to possibility) but not radically communicated. Ontological modes of openness or ‘openness bound to existence’ cannot be absolute, since they would thereby transgress their existential necessity (first and foremost, they must survive and their openness is bound to their logic of survival). They merely afford this active impossibility and maintain their survival through its im-possess-ability, since possessing it in its entirety would be the undoing of affordance, and consequently of the survival that affordance makes possible and maintains. Absolute openness cannot be communicated, it can merely be afforded; and existence emerges out of this very lack of radical communication with the Absolute Openness (or in Islam, the impossibility or im-possess-ability of Allah) and its pathological symptom, affordability.

The revelational conclusion or the unitary apotheosis with God is defined as coming to union with God by participation, or participation in God through the Son. In this revelatory process, the aperture of man's epistemological focus in relation to the Divine must surpass his ontological isolation by means of a third capacity outside his own capacitance or the state of his capacity: an *extenta* whose boundary (or boundedness) ontologically shares and overlaps that of Man, and whose epistemic expanse (of unboundedness) intersects with the Divine. The mechanism of ‘coming to Union’ or unificatory disclosure of the Apocalypse (Revelation), while it is subjected to variations of either ontological or epistemological directions, constantly partakes of a fundamental revelatory process in a monadic or unitary sense: participation by the necessity of incompatible entities or parts and their ordained unity, *i.e.* difference, and adding a quality or amount (a content) to the difference to satisfy and fill it. This attributable content which takes form as *contentum* (the conjoiner) and *contentus* (the satisfier) cannot be anything. Precisely speaking, it should be – by the virtue of its satisfying function – determined and individuated by exclusion, or the logic of negativity, to locally fill and neutralize the effect but not the cause of the difference – that is to say, to be 'something specific' at last. This 'specific something' must share the contents of both the Divine and Man without transgressing their capacities or boundaries outlined by affordance, which actuates the coincidence of boundaries (*viz.* necessitating both the existence and coincidence of boundaries) between God and Man; it can be the groundwork of participation and affordance if and only if it is perpetuated by the sum exclusion of both sides – neither outside of X nor outside of Y. To this extent, this certain content reinvents the autonomy of participation in ostracism and repels the ephemerality of its existence by double-satisfaction. The Son is the ultimate *contentus* of Revelation and Unification, the double-satisfier of Platonic participation. If according to Hans Urs von Balthasar, transcendence to Christ manifests the apocalyptic consummation of History and Christ gives the world (the *exteriora* of the created world, the *interiora* of human essence and the *superiora* of heavenly order) its *Gestalt*, then both the configuration and consummation of the world (essence itself) exist only in affordance and economical participation through capacity.

We shall become Sons by participation (methexis)
(Cyril of Alexandria)
Totus Christus, Caput et Corpus

Four factors are involved in neo-Platonic and later Augustinian doctrines of *methexis* (participation): **(i)** The divine source of experience or the horizon (*horismos*: whose formation is characterized by an inner hegemonic boundary – *perata* – and an external boundlessness) of participation, which affects the spiritual senses of the human beings. Apart from this horizon there is no motivation for participation, since *methexis* presupposes the lack of an autonomy between participants, *i.e.* participants undergo *methexis* through their lack of autonomy and the hegemonic autonomy of the Divine. **(ii)** The *telos* of experience or the intention of the source, the purpose and goal for human being, which is unity with the Divine. *Methexis* presupposes myriad levels of being necessarily emanating from the Divine to unify later with the Divine as the ultimate One. **(iii)** The transformation brought about through experience which is based on the capacity/affordability between participants (*participans*) with each other, on the one hand, and the participant with the Whole or the *contentus* of participation (*participatum*), on the other. The persistent interference of capacity and affordance in participation, and in the reciprocal relation between participation and participants, imparts a self-correcting or gravitational quality to the collectivizing process of participation towards a satisfactory collectivity – thereby constraining in its collectivization dynamics – for the participants and the content of participation. This state of participation undertakes the together-ness of relationship as long as the capacity of nexus can be fulfilled; therefore, it operates as 'coming together (*com*) under a bound or an obligation (*munis*)'. This is an Obligation that can only exist as One (*unus*) because it is directed and achieved by and through capacity and affordance between entities in participation, or to be exact, by the collective affordance or the 'shared' capacity, the capacity shared by all as the sum affordability that can be fulfilled by all. For such an obligation, which can only survive and influence as a shared capacity, the plane of movement is necessarily one of convergence and concentration. Here, the participation dynamic inexorably describes a transition from *munis* (collective obligation) to *unus* (being one) in the wake of a collectivity (*com*) which perpetuates itself through affordance (see Diagram 4). This is why, in the New Testament, discussions and references to participation are mostly expressed in terms of *koinonia* (in its Platonic sense) which signifies sharing, and suggests an obsession with economic fixation, rather than *Methexis* (participation). **(iv)** The affective states that accompany the experience of participation are already modulated by the affordance between participants and the Whole, and the hegemonic autonomy of the Divine, which imposes unity with itself upon all modes of participation – *methexis*.

The Christian apotheosis promises a final unity with the God through a transcendental participation or *methexis* (or what Theodore Runyon calls Orthopathy)[9] – with the Son (as an indispensable intermediary or channel-regime of this exchangeability, the double-binding chain of the Atonement, the double-satisfier) and the other sons (men)

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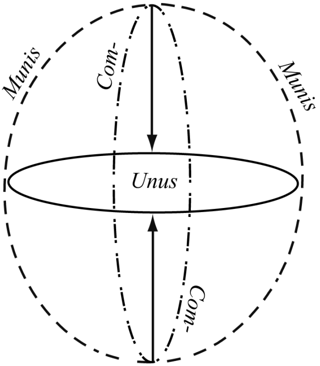
[9] Theodore Runyon, 'The Importance of Experience for Faith', in *Aldersgate Reconsidered* (Nashville: Abingdon Press, 1990), 93-108.



Com-: Coming together-ness of parties from both ends

Diagram 4. Monad's Communication Dynamics

taking part in a process of concrescence (the theological becoming grounded upon economic participation or *methexis*) oriented towards unification with God. But Islam openly rejects such a theologically relieving covenant. Man can never be unified with Allah and Allah will never be revealed to Man; the knowledge of Allah can be obtained neither through the affirmative desire of *cataphasis* nor the logic of negativity and emphatic negation of *apophasis*. In more precise terms, in Islam, unity with the Divine is eventuated neither on the ontological nor on the epistemological level. The son can never return to the father since there is no son and no father; there is only Allah, external to all beings and their surrounding outside *i.e.* the possibilities of their transgression. Because transgression is conveyed on the plane of affordance and the dynamics of 'being open to', a tactical line of openness constrained by the plane of logistics rather than the subjective line of command. This radical outsideness, however, is not prompted by the jealous impulsions of God, passed on to the victim(-ized) body of Man (a parasitic creed stubbornly energized and exploited by the exchangeability between *lex talionis* and victimology, their double-binding system carved on to the monopoly of God), but rather that immensity that is the undoing of Man, of all potential sons and the Father alike.

> While God was the exclusive source of the revelation to Muhammad, God himself is not the content of the revelation. Revelation in Islamic theology does not mean God disclosing himself. It is revelation from God, not revelation of God. God is remote. He is inscrutable and utterly inaccessible to human knowledge [...] Even though we are his creatures whose every breath is dependent upon him, it is not in interpersonal relationship with him that we receive guidance from him.[10]

Islamic Apocalypticism is not a contemplating process, a river (a flowing transcendence or a process of concrescence [A.N. Whitehead])[11] tending towards unification with God, as the complete state of its refinement. It is a process which seeks to ultimately and fundamentally

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[10] Edmund Perry, *The Gospel in Dispute: The Relation of the Christian Faith to other Missionary Religions* (New York: Doubleday, 1958), 155.

[11] *Concrescence* emphasizes an economical participation through the theological doctrine of *Diaconate* which assembles a regulating all together; the itinerary of this process is continuously guaranteed by the responsibility of each entity to serve and survive for the other, becoming a passive negotiator-field to save the continuity of the self-refining flux. In such a participation (*methexis*), one cannot escape and still survive; the entities which cannot bear this dynamic but fully economical participation are automatically forced to leave the dynamic network of pseudo-flux (forced to be dumped out of the dynamic course of the flow).

'surrender' to the impossible which remains external to being (absolute surrender or pure *Islam*). Submission occurs according to the imperceptible Will (*Hoda*) of the im-*posse*-ible (Allah). Everything is preserved and maintained by a pure externality, not because of the power – ontological or epistemological sovereignty – it imposes upon being, but for the sake of externality itself – the radical outsideness that simultaneously provides the possibility of being, affordance and survival. The process of surrendering and submitting (or *Islam*) which leads Man towards God is suddenly disrupted by *Qiyamah* (*Ghiamat*) which is wrongly translated as Apocalypse. *Ghiamat* is a vast desert where Man finds that he can never reach (possess or afford) the Absolute or the Unconditioned (*unbedingt*). Here Man is totally disillusioned (one of the functions of *Ghiamat* is an awakening, in the sense, not of resurrection, but of disillusionment, *entebaah*) of everything he 'believes' himself to possess, and of existence as ontological corollary of affordance. Islamic Apocalypse occurs where (not when) Man grasps the utter externality of God to himself (an externality based on the radical outside-ness of function and an unaffordable openness of communication – rather than on a distance, which in the Islamic account of the divine is regarded as the utter glory and generosity of God to Man). Deleuze and Guattari[12] diagram the Absolute in terms of a movement qualitatively different to relative movements but necessarily associated to them. In Islamic Apocalypse all movements which give rise to the Absolute (and flow 'through' and 'as' Islam) abruptly cease to process (they cannot install Man as multiple or even One); the process of rendering a Unity by exception or subtraction fails before it is initiated. Before such an impossibility, the Deleuzian escapism to the Outside is an aesthetic movement based either on the idealism of reaching/possessing the Impossible (the active im-possess-able) or on becoming open to an absolute openness which can only be economically afforded and explored by the survivalist policy of 'being open to' and its escapist lines. This radical openness is so unrestricted that it turns all modes of openness ('being open to' in particular) and lines of escapism into a romantic struggle to tolerate it. However, every instance of toleration of this immense openness (even in the form of economical openness, escapism or 'being open to') results in a suffering which affordance and all economic regulations carry with themselves as the consequence of their restrictions and survivalist moderations. Economical openness (or escapism, which employs its dynamism on the plane of 'being open to' *i.e.* economical openness) as an instrument for moving towards Absolute Openness, operates in the form of an economic reformation of affordance and suffering. For such an economical openness relies on a movement or escape according to a subjective capacity – bound to the capacity of the Whole – which can crack at anytime, leading to a crisis of survival and toleration at different levels. This crisis or symptomatic side-effect associated with economical openness is both the result of the lack/capacity it must include in order to survive (regulation of communication) and of the radical openness which affordance cannot fully regulate and which, therefore, will eventually cut it (the subject of economical openness) open. Is escapism on the plane of 'being open' therefore a reformation of Atonement, its reinvention in another territory?

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[12] Gilles Deleuze, Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia,* trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 509.

Escapism presupposes that openness all happens on the plane of 'being open to' (it excludes the radical side of openness or openness from the Outside *i.e.* 'being opened by'). The propulsive body of 'the line of flight' (Deleuze and Guattari) runs on this plane of openness to explore the Outside, or in other words, to be open to the Outside. Consequently escapism is involuntarily prone to unlimited appropriating functions and restrictions of capacity, since these maintain the openness for both the subject that escapes and the environment that affords and supports this escape – the capacity or affordance of the Whole. As the escape reaches critical levels in opposing the gravitational forces (territory, the State, organic life, *etc.*), its capacity for 'being open to' becomes a burden of tolerance and confinement (the limits of capacity) rather than a propulsive engine. To this extent, the over-tolerance for escaping becomes equal to suffering (*thlipsis megale*) for salvation. When it comes to the exigency of capacity, a scintilla of openness on the plane of 'being open to' – which is always oriented in opposition to the function of gravity but is aligned with affordance – can be likened to a tribulation whose conclusion (salvation) is not liberation from capacity but arriving at, shifting to, a reformed capacity.

In Islam, Man does not reach the Absolute, nor does the Apocalypse manifest the Absolute. Unlike other apocalyptic revelations, Islamic Apocalypse is a disruption for a transcendental process towards an Absolute which is impossible; a cessation, manifesting neither a succession nor an interlude but an utter terminus for transcendental Absolutism. Islamic Apocalypse is a momentary process for dismantling all manifestations of Absolutism, only highlighting the absolute externality of God as the Imperceptible or irreducible exteriority – 'The secret of God is eternally ungraspable by Man'; the Quran does not speak about the concealment of a secret but of the utter inaccessibility of the radical externality of God. This latter always remains secret, not in the sense of a mystery [*muein*] whose accessibility varies between the initiated and the uninitiated and according to the epistemological tools at ones disposal, but in the sense of 'being ungraspable and unthinkable forever' for everyone. According to Islamic scholars, it is the limitless generosity of this externality that, despite its radicality, makes 'being' possible for Man by posing itself as refractory impossibility. Theology in general, particularly Christian theology, is vigorously involved with the act of giving or the biblical *didômi*, and the measure of this act is determined by the emphatic limit of the act of giving in the sense of the Divine which is Revelation, or the epistemological Gift. The Gift of Revelation – by the necessity of the aforementioned affordable structure of Revelation – abstains from excess and ceases to be radical in itself and in the act of donation. The principle of gift-economy consolidates around its compensability. When a gift is afforded by the receiver of the gift, it can also – potentially and by virtue of the capacity of the receiver who has already met the expense or level of the gift – be paid back or re-gifted at least with a gift of equal or lesser value. When the gift is Revelation or the ultimate giving and Man is the receiver, the potential re-gift is proportionally equal to the possibility and the existence of God (*Esse*) itself in Revelation. The radicality of the gift originates from its exorbitance (it is outside the cycle of exchangeability), the absence of any opportunity to counterbalance or compensate it, and its externality to satisfaction, hence reducibility to a content. In Islamic theology and according to explicit Quranic verses, the ultimate gift from Allah averts satisfaction and does not satisfy Man in terms of providing what the human deems enough (*satis*). Nor can it be exchanged or compensated. Allah's gift attests to the immensity of the ultimate act of giving: the ultimate gift is essentially external to possession and possessability. If Allah's gift were to satisfy, or position itself as exchangeable, it would bring human being to extinction, an epistemological inferno and an ontological eradication; the gift then would contradict the act of giving and its giftness by becoming the act of absolute seizure or abolishment in the name of confiscation. The gift is merely the disclosure (in terms of unfolding) of Allah's externality on a radical and all-encompassing level, the affirmation of refractory impossibility and the repudiation of the possibility of an *apocalyptio* (unveiling) of a content, whether of God or of Man, which again should be differentiated from the content of the Divine in the usual understanding of Apocalypse. Disillusionment is the function and realization of such a gift. Islamic *Ghiamat* manifests enlightenment under the holocaustic luminosity of radical outside, and presents human possibility, of both ontological and epistemological potentialities, in the wake of refractory impossibility.

To this extent the monotheistic belief – *hena theon*, *unum deum* – does not describe a rewarding destiny in Islam; it submits the *cogito* to an externality for which belief is at the same time a plethora of uselessness and a minimally organized line necessary for attaching to the eradication of itself as it blindly pursues the eternal Unrevealable. Islamic Apocalypse is an anti-absolute politics. God is the only Unconditioned; it is neither grasped nor unveiled and thus cannot 'come into being' transcendentally; it is eternally external to Man, it is the Absolute as the desert of un-restriction (*ab-solvere*) for which Man or ontological potency is a restriction, a *modus* and a deterrent. Upon such an unfathomable externality, Man is left deserted; yet he is not abandoned, for this externality is mapped as an extra-proximity, utter and ungraspable closeness ('We are closer to him than his jugular vein' – thus the Quran). This is a panorama similar to the Survival Economy (*libban*, of Germanic origin) or what is commonly called life but is the territory of living (afforded Life or the process of affording life) and (un)Life, or life in its externality to affordability. Life is external to survival yet survival is allowed to live by means of the very 'possibility of containing' – or capacity – that Life makes accessible for it (either for the eradication of survival or in order to lure it elsewhere). What is given to Man is precisely what unlives for him. According to Islam, Man is liberated in *Ghiamat* not by joining the divine but through a disillusionment from his own being, a disillusionment made possible by the externality of God not the quiddity of this externality (*i.e.* the *Wesen* of God). *Behold the Outside, you shall not explore it*! For such an openness comes forth as a reactionary extinction by and through being, an inevitable self-destructive repercussion triggered by the affordance of capacity. But its unfathomability can be grasped; this indeed is the way that 'Return to God' is depicted in Islam. According to Islamic commentators, *Ghiamat* (the Insurgency) – which, again, is wrongly translated as Apocalypse (the moment of uncovering or revelation, *apocalyptio*) since even in *Ghiamat*, Allah is ungraspable and unrevealed to Man – promises a simultaneously brutal and glorious encounter of Man with what is radically external yet closest to him; awakening this externality for Man and awakening Man to grasp the radicality of this externality – the Unrevealable, the irreducible, full-fledged horror.

Revelation is extruded from the dynamic vector of a 'loving to know the unknown' as Augustine suggests, but not a loving of the unknown itself. In Islam, however, the Unknown itself is venerated in its full externality to the *cogito* and to love. Reverence then is influenced by an *outsiding* glory (radicality of outsideness) as an affect passing and emerging through existence, not in the sense of an advent or arrival from an outside which affords a tendency, that is to say, a constraining extension, but as a perpetual foreigner. Advent can only be registered as an event when it is fulfilled or reaches its tendency, a status where its foreignness ends (arrives at an orientation). Anything that has the quality and movement of an advent is bounded by a condition and a destination corresponding to that condition; its outside-ness is only provisional. To approach an unattainable without anticipation of reaching it and in the absence of a destination as a position to be possessed, the movement and its affect must be inherently upheld in relation to *xenos*, as a resident but ceaseless outsider (*xeno*) – insistent alien.

When the Unknown is unknown because of its radical externality, not because it is superior to human knowledge[13] – a position which can be afforded if not communicated or fully identified in itself – epistemological disciplines, in the same vein, unfold as alien tools. For such an unknown imbued with refractory impossibility, mysticism or contemplative theology proves itself to be not only otiose but a romantic project, a symptom of the loss of hope in a rigorous encounter with radical externality. If mysticism culminates in the form of an epistemological salvation or deliverance through initiation, its principles are constantly refuted by refractory impossibility, as simultaneously pusillanimous and irrelevant exploitations of ignorance on behalf of a redeeming unknown.

> 'Apocalypse' is a genre of revelatory literature with a narrative framework, in which a revelation is mediated by an otherworldly being to a human recipient, disclosing a transcendent reality which is both temporal, insofar as it envisages eschatological salvation and spatial insofar as it involves another, supernatural world.[14]

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[13] The latter is exemplified by the theologies of Augustine or Aquinas. ('*In finem nostrae cognitionis Deum tamquam ignotum cognoscimus*' [Thomas Aquinas, *Boetium de Trinitate*]). Following Aquinas who did not pursue the heretical trail of his remark and did not travel to the outer limits of his theology, one comes to this conclusion about the Divine as the *superiora* of knowledge: that 'God exists as ignorance'. This does not denote that God is ignorant or is ignorance in itself but that God existentially registers itself in human knowledge as Supreme Ignorance. Therefore, the true existence of God as the ultimate knowledge (immutable wisdom and knowledge in its full presence) is dependent on human knowledge or real ignorance as something capable of being transcended, if the God's true face is to be unveiled (namely, 'God as ignorance' realized as 'impeccable knowledge').

[14] John J. Collins, 'Introduction: Towards the Morphology of a Genre,' in *Apocalypse: The Morphology of a Genre*, ed. John J. Collins (*Semeia* 14, 1979), 9.

Schelling's obsession with Revelation (*Philosophy of Mythology*, *Philosophy of Revelation*) which re-presents the Judaeo-Christian account of Revelation and is a pivotal *quodlibet* in non-Islamic monotheistic religions, is rendered completely obsolete in the Islamic account of Apocalypse (*Ghiamat*) and is regarded as heresy. It is described by Schelling as 'that which exists [...] only in order to see if I can get from it to the divinity'. Such a statement is based on the primal prophetic promise of Revelation, the promise that the divinity must be eventually revealed or exposed to Man through transcendence and its anabatic movements. The true glory of the lord is exposed to Man when it is revealed ['God can be known'(John 1:18; 14:7; 17:3,6)]. In Islamic Apocalypticism, such a promise is absent and is regarded as *Kufr* (apostasy). Motahari, the Iranian Islamic scholar, once suggested that the glory of Allah bursts forth at the exact moment when Man realizes that nothing of Allah can be revealed to him. According to Islam, in such a moment one encounters the utter mercifulness of God, for if God reveals itself, all modes of survival and being would be rendered impossible. If God were to reveal itself, everything would be overkilled. According to Islam, the most merciful moment (supreme glory) is the moment when Allah shows Man that despite its utter externality to all beings, they exist precisely by virtue of this externality. Allah's radical supremacy is delineated more according to its degree and radicalness of externality and openness than to its authority over being (According to Islamic literature, Allah does not need to enforce authority; authority is the consequence of this externality which maintains the survival of all beings for if Allah reveals itself, the undoing of Man will be inevitable).

On the topic of external sovereignty, Islamic scholars pose the question: if God is external and sovereign, then how can beings exist? This question is answered by recourse to an ungraspable generosity (not forgiveness) and Glory (both of which are purged of any quality) which surge up through beings as the only reason for their existence. Even the purpose of this Mercy and Glory will remain unknown, Outside: nothing of God itself will be revealed. With the consequence that applying the term Revelation (*apokalypto*) to the Islamic account of Apocalypse is highly problematic. Even on a technical level, Apocalypse, constitutive as it is of monotheism, is not designed for or capable of the particular functions that it presents in other monotheistic threads in the Last Day. *Ghiamat* (or *Qiyamah*), whilst it includes the diametric discourse of the Judgment Day and its monopoly on inevitability, as Al Faruqi points out, also adds a new and radical twist to the Apocalyptic politics common to all strands of monotheism; *Ghiamat* does not mean *apokalupsis* (involving the process of lifting the veil). Rather, it heralds *Ghiam* or rebellion, which is connected to *Sura Al-Takvir* (overthrowing). The Quran depicts *Ghiamat* – Ultimate Insurgency – as being governed not by a climax-oriented narrative, based on the consumption or depletion of the number of its possibilities, but on a series of participations, a chain of minor insurgencies (*ghiams*) which bring with them possibilities external to the capacity of the narrative.

Al Faruqi and Alameh Tabatabai both suggest that the Quran wholly withdraws from the diametric concealing/disclosing revelation of other monotheistic

Books, from the opening verse through to the end. It declares itself as an active cipher; it even shows a radical cynicism (or even hatred) for the facsimile by twisting the very foundations of monotheism as expressed in the Bible or Torah, progressively making itself unidentifiable, connecting what has already been told to anonymous (both in the sense of *an-onoma* and *a-nomos*) lines which make its contents accessible through an ulterior structure. This deviation from the familiar path culminates in the nomenclatural system usually associated with the Last Day; *Ghiamat* (Ultimate rebellion, Insurgency, Standing to respect, Awakening in the sense of disillusionment) becomes the substitute for all other names in Apocalyptic literatures which frequently suggest revelation (with *velum* at the center), resurrection or strict judgment (functioning through the dynamic scaling and measuring processes of *metron*).[15] The unity of the Advent Hope is frequently expressed by such phrases as 'the last days' and 'the end of the age'(Heb 9:26). Apocalyptic thought apparently arose within Judaism following the sixth century Babylonian exile of the Jewish people. Although the book of Daniel is the only complete example of an apocalypse in the Hebrew Bible, other passages contain ideas that are either apocalyptic or similar to apocalyptic thought – Examples would include Zechariah 9-14, Ezekiel 38-39, and Isaiah 24-27.

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[15] *Metron* (Greek origin), to be found etymologically encrypted in English words such as Dimension (from *dimetiri*: measure out), meter, etc. Keeping well in mind the famous doctrine of Protagoras, 'Man is the metron of everything' (*pantôn chrematôn metron anthrôpos*), *metron* can be translated as Scale, Measure, Standard, and Value. According to Sextus Empiricus *metron* expresses *criterium* (scale, measure) but Heraclitus and Sophocles saw it as certifying dominance, a domination over something. Therefore, *metron* indicates that both measure and dimension interconnect with Power, Justifying and Reasoning. The critique of *metron*, then, diagrams how dimensions (namely *metron*) bring Power into effect, mobilizing and propagating it.

In Islam, and particularly in Sunni accounts of Islamic theology, examples of revelatory apocalypse and even seeing Allah in *Ghiamat* can be found (Abu Hurairah, Al Bukhari, Al Hajjaj, *et al*). However, most of these apocalyptic attributes originated from Hadiths – and hence had been subject to alteration, hadiths having being collected in different times and by different narrators. Their authenticity being thus questionable, they could not maintain a lasting presence in Islamic theology and Islamic accounts of *Ghiamat*. Not only because of their disputable origin (as in the case of Abu Hurairah for example), but also because of their contradiction of the emphatic statements in the Quran regarding *Ghiamat* and absence of revelation, in Islam apocalyptic theology (in the sense of revelation and epistemological or ontological unity with God) did not succeed in extending its influence beyond classical and early Islamic theology. In Islam, explicit reference (*nas-e sarih*) to the Quran is prior to everything and must not be transgressed. Cultivated by the Al-Azhar School's rigor and animated by such figures like Mahmood Shaltoot who inveighed against the classic theologians who advocated apocalyptic eschatology of Judeo-Christianity and worked mainly outside sectarian doctrine, the revelational doctrines were denigrated in Islamic theology.

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16. *Apokrisis* or *ekkrisis*, the Anaximanderian universal pro-creationist process of separation which is a prerequisite for unification and ultimate union. The process of *Apokrisis* stratifies the universe into properly arranged layers (unlimited appropriation and regulation by lamination and stratification) which make unification as a dynamic process possible. This process of separation is prerequisite for the cosmic union/separation machinery of the ultimate unification, or in other words, the final union which functionally presupposes a series of separations and unifications leading

The externality of Allah cannot be oversimplified into a mere process of separation (*ekkrisis*).[16] Aristotelian philosophy shows us that separation always presupposes a unity through a cyclic transcendence of separations (of *chorismos*) and unions (of *to hen*) which rotates – or in more technical terms, refines itself – towards a distilled Quiteness or Unity with the Divine, a unity which is not present in Islam. Moreover, unlike other modes of monotheism, for Islam this externality is not the result of a primal moral collapse or original sin (the Revelation system of Christian redemptive history influenced primarily by Tertullian [ca.155-220]); it is intrinsic to the existence of being. Neither does this externality have anything to do with sinfulness or the concupiscent nature of Man – who in Judaeo-Christianity must be cleansed, introduced to *katharos* – since in Islam the present condition of Man is not sinful but normal; in the Islamic account, sin emerges only as a consequence of the mis-perception of this externality, as a result of latching on to the quiddity of this externality, Allah.

Islam does not construct itself on redemption and/or revelation. Redemption (the wayfarer becomes totally at one with God's way of redemption) is inseparable from its consequent hope and boredom or redeeming despair, and modes of development which are steered by the conjunctive bonds between these two. The promise of

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to a purely distilled Unity (corresponding to the classic distilling mechanism). Anaximenes, however, developed the process of *ekkrisis* into the two processes of rarefaction (corresponding to separation) and condensation (corresponding to unification); we can follow these processes in the unificatory and distilling mechanism of Kerotakis (reflux condenser) which was invented and designed according to the cosmogonic traditions of alchemy and Aristotelian philosophy. On *Apokrisis*, see Theophrastus commentaries on Anaximander; also, Hippolytus' *Refutation.*

Revelation presupposes a reward for a vigorous transcendentalism through the loss of sin and the accomplishment of unity with God – or more precisely, the reformation of affordance, and the capacity of Man to turn the (latent) impossibility of the Unity with God into a possessable possibility. In Islam there is no such reward, no such promise; there is only the inexhaustible activeness of refractory impossibility or Absolute Openness, crushing affordance and the economic regulations of capacity, disillusioning Man from his repressive openness *qua* economical self- and environment-protecting communication. Externality is diagrammed by a simultaneous formidable closeness and externality of function, a concretization of 'closer to you than your jugular vein' (what a vampiristic horror!)

IN ISLAM, CHRONOLOGICS IS A HERESY.

> The individual's encounter through faith and grace with a personal God then salvation is contained precisely in the human surrender to God (*Islam* [Submission]) and that divine guidance (*huda*) which according to the Koran remains or should remain forever unaltered by time and history. Accordingly, there is no reason to conceive of revelation as something temporal or historical.[17]

Norman Brown is right to suggest that Islam is thoroughly apocalyptic but without a sense of 'Time' that could be grounded as the ordinance and understructure of the spectacles of Grand History (whether *Heilsgeschichte* or

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[17] Abdoldjavad Falaturi, 'Experience of Time and History in Islam,' in Annemarie Schimmel & Abdoldjavad Falaturi (eds.) *We Believe in One God* (London: Burns and Oates, 1979), 65.

Weltgeschichte). 'Only the moment is real,' Brown notes,[18] but goes no further. The moment is transient, its function is traced by its escapability, momentary variation and particle frequency, by its *gradus sine vestigio*; the moment in its entirety is an *uncogito* with a pulsatory intermittent existence, ungraspable by Man and inaccessible by mapped courses of action. All that is graspable are the moment's trajectories, its tails which complicate and diagram time according to their spatial multiplicity, rather than the chronologics of Time. Too many traces left by the ever-escaping moment result in the loss of time, 'untraceability of all narrative lines and temporal relations'[19] (= The Islamic Apocalypse, *Ghiamat*), the fall of the Kingdom – the emergence of a sinister imminence constructed not upon temporal relations or modes, but upon the loss of them. Such a constant imminence surpasses necrocratic terror: when Omega is always imminent and one cannot look backwards and ask what happened, the necrocratic fear of death – powered by anticipation of the future as well as the questioning of the distance to the Outside – is but a neutralized repression.

Time is absent in the Quran; the absence of any occurrence of the word *Zamaan* (Time: *chronos*) is one of its most noted enigmas. Instead of using the word *Zamaan*, the Quran frequently addresses events through the word *vaght*, conveying them through *vaght* and not *zamaan* towards *Ghiamat*. *Vaght* is concerned with 'Whereness' whilst also obscuring the quiddity of this whereness as spatial but unlocalizable ubiquity; it can only suggest an unchronological Now (neither permanence nor discontinuity; all entities are regarded as events through a denuded space with no chronologic dominance), a 'timeless where' through which beings are suspended but not stopped. But 'Where is Now?' The Quran never answers. 'Now' always remains anonymous; its ever-expanding Where which is essentially based on its whereness (the quality of its spatial continuity), is ceaselessly contagious. For whereness engineers terrains to remain ubiquitous and be actively divergent, a multiplicity which is a manifest epidemicity. Where is intrinsically and autonomously contagious. All manifestations of history (or even histories) are regarded as an infidelity towards this spatial and contagious Now (*vaght*) which is the most functional plane for utter submission (*Islam*) to the eternal externality of Allah, the pervading or epidemic impossibility. *Now* is the only plane on which Being can be saved from complete extinction by its illusions, which foam around its grand obsession with unity. Abdoldjawad Falaturi is possibly the first Islamic commentator who has rigorously worked on *vaght* in the Quran and on the Islamic sense of time (See his *Experience of Time and History in Islam*, and other essays).

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[18] N. O. Brown, *Apocalypse And/or Metamorphosis* (Berkeley: University of California Press, 1992).

[19] Norman Brown writes, 'the Quran breaks decisively with that alliance between the prophetic tradition and materialistic historicism – "what actually happened" – which set in with the materialistically historical triumph of Christianity.' (*Ibid.*)

In the sense of *Ghiamat*, is it too early or too late? Only by your 'participation' with this spatial Now (*vaght*), can you find out. We are always in a premature *Ghiamat*.

Islamic imminence escapes the doctrine of the Advent and the Christian Imminence. 'The great day of the Lord is near and hastening fast'(Zephaniah 1:14); 'O Sovereign

Lord, holy and true, how long before thou wilt judge and avenge our blood?'(Rev 6:10): such Nearness or Distance is at the heart of the Christian imminence, architectonically constructed on Waiting and Patience ('Be patient' [James 5:8-9], James admonishes believers). The affordable *esse* of the Christian God posits the Outside in terms of distance or opening-between (an openness that is situated in-between is affordance rather than openness). Distance and affordance realize movement only in the anticipation of reaching a destination, even if the destination is not accessible and only exists as an affordable event or entity. In terms of economical openness, what is afforded has already been achieved with the same scale of possibility and actuality. If distance potentiates destination, and destination actualizes distance, a movement that either travels according to the distance or according to and towards the destination would remain passive in its dynamism, because it would have already been presupposed by affordance. Such a movement, one whose course has already been afforded, does not undertake the risks of venture, instead it accepts the consequences of anticipation (immanent to distance and the afforded movement). Here opens a horizon of passivity as the inexorable glorification of patience and chronological toleration organized by the promise of Revelation, as a moral urgency of the Advent and Revelational Hope. Or, to be exact, this nearness of the Christian Imminence is articulated by the passivity of waiting and patience as the consequences of anticipation, whose endemic affliction is expectation, which in turn provokes hope and negative despair and gives rise to crises of faith (as for the first century Christians who expected the grand return of Christ: '"My master is delayed," the unfaithful servant complains'[Matt 24:48]). And it is through this prolonging of hope and persistence as to the affordability of openness (of both Man and God to each other), that faith is manipulatively maintained. To this extent, the distance (wait, patience, nearness, expectation) of Christian imminence can be *metron*ed (measured) either by Empirical or Existential Time. But Islamic imminence, spread over the epidemic Now, has no such bond to expectation, patience or waiting, and it cannot be measured since it is entirely based on furious participations (voluntary and involuntary, triggered by total openness fueled by a refractory impossibility that cracks affordance *ab intera, ab extra*) moved by the loss of the promise of the Revelation and the eternal externality of Allah.

If Islam's process of submission affirms the radical externality of Allah as a refractory impossibility, and if Islamic Apocalypse supposes the loss of time, then for Christianity, Islam expands and inflames along the same chronopolitical dimension in which the Apocalypse deploys its cremating and concluding machinery, incinerating the western sense of time, cleaving the bonds between modes of historicity and western chronologics; a plane along which chronologics shrinks to momentary particles taking viral and swarming forms to spread through this spatial Now (or irrevocable imminence). Islamic *Ghiamat* is the vertigo of moments. For Christian chronologics, Islamic chronopolitics is that 'radical disruption in the spatio-temporal relevancy of events' which is generally called the Apocalypse. If War on Terror, on its western front, is haunted not by *fin de siècle* scenarios but also by the political manifestations of the Apocalypse and emphatic finality, it is because western chronologics has engaged an opponent which only exists as a desert levelled of all idols or transcendental abominations to Allah. It is the desert that hosts, and looms as, the Apocalypse. It is a desert lurking in the disruption of chronologics, the corrosion of history and the collapse of the spatio-temporal continuity to the outside, because it is effectuated by refractory impossibility, not the other way around. This is not a question of a clash between civilizations but a radical Time-war, between chronologics and chronopolitics or what – by virtue of its dynamism, that is affected by the Outside and Impossibility – operates as Apocalypse or time-disruptive politics within other systems. Each Western tactical line in War on Terror must inevitably configure its program with reference to Islamic chronopolitics if it seeks to engage and afford the 'conflict principles' (correspondence with other war machines in space and time) which every war machine both upsets and affirms. If, on the Islamic front, the *Ghiamat*-apocalypse is always already-there and the entities of the *pax islamica* are already desert-nomads of this contagious Now, for the most part (but not entirely) it is the Western entities of War on Terror which are subjected to apocalyptic commotions and disruptions in time. While the Western chronosphere harbours a chronological cataclysm for the Islamic front, Islam's chronopolitics betrays time and the Western chronosphere altogether.

Elysian Space in the Middle East

Kristen Alvanson

ONTORIUM. *The Western graveyard is a place of consummation for the ontotheological horizon which dominates Western engagement with time and space. The site of the graveyard bridges the ontological contents of the living and the* post-mortem *protrusion of these contents, thus marking the transition from ontology to theatrical ontology. Or, in other words, here ontology is staged both as it is – or as it functions – and as the result of its own accomplishment (effect). Thus, all ontological projections of architecture flourish in the graveyard. Taking into account Heidegger's notion of 'settling'* (regelung) *which, from both objective and subjective perspectives, describes the connectedness of building, being and thinking, the graveyard, then, is a rich resource for reasoning back to the experience of the ontological encounter with space and time and the uniqueness of this experience within each culture or ontotheological formulation of Elysian Space.*

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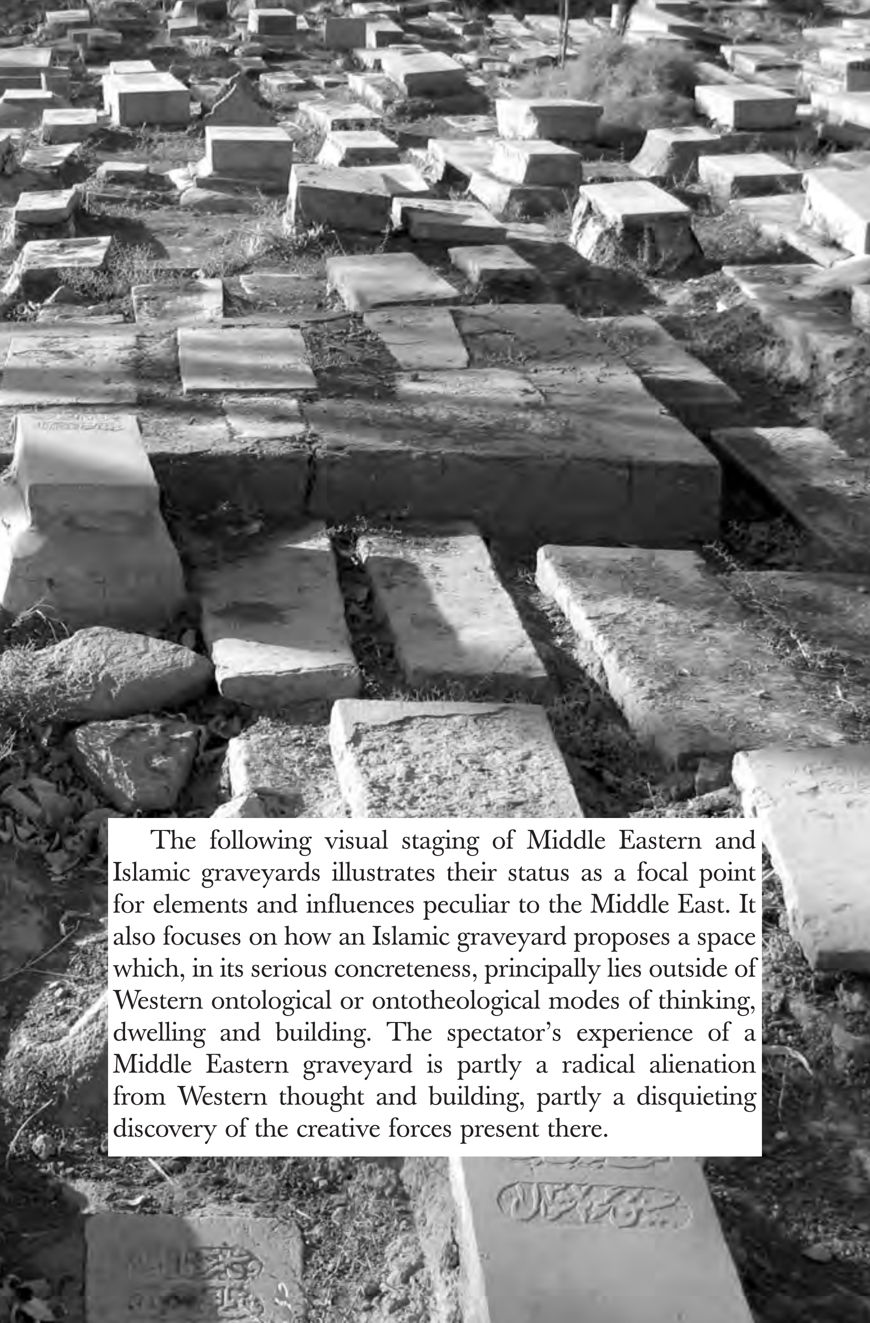
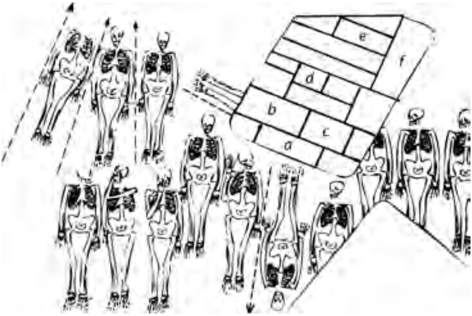


The following visual staging of Middle Eastern and Islamic graveyards illustrates their status as a focal point for elements and influences peculiar to the Middle East. It also focuses on how an Islamic graveyard proposes a space which, in its serious concreteness, principally lies outside of Western ontological or ontotheological modes of thinking, dwelling and building. The spectator's experience of a Middle Eastern graveyard is partly a radical alienation from Western thought and building, partly a disquieting discovery of the creative forces present there.

MORE THAN A VOLUME, LESS THAN A SPACE. The Western ontology of dwelling has it that *residing* (remaining) alone in a space which both separates its dweller from, and connects them to, their surrounding environment, is not in itself enough to define dwelling. Therefore, residing or occupying cannot be appropriately integrated with building and being – and for that reason, with the human. Dwelling is the inhabiting and populating of a space by an entity. This definition requires an axial factor which is sustained by an entity and its dwelling place; a factor that can be defined as ‘the minimum space required for the inhabiting and populating activities of a given entity in a given place’. The basis of these activities is movement. The dwelling-place, or room, is a space in terms of its capacity to accommodate contents or allow actions. What is required for such a definition is, firstly, a volumetric instance of building that can support both an entity and its actions, or

more specifically, its movements within the space. The consequence of dwelling, then, is more than mere inhabiting; it also includes different actions provided by this ‘enough’ space or room which fundamentally takes shape and is built upon the minimum, that is, the minimum space. According to this ontology of dwelling, then, the human as a dweller builds its action on a limit which is that of the minimum, and which is maintained in every ontological context related to (the) *room.* Western graveyards push this ontology of dwelling to its extreme. Such an ontological orientation only makes sense when an onto-theological disposition of dwelling in its fully-fledged sense is involved; for otherwise, the application of the dwelling ontology of the living to the dead would merely signal the reduction of ontology to law. Sarcophagus and coffin as above-ground and underground volumetric spaces of room are examples of this ontology of dwelling that is manifested in Western graveyards and entombment. Similarly, the required limit for dwelling or room as 'enough' space entails not only an adequate space within each grave but also between graves, determining an orderly arrangement in the graveyard.

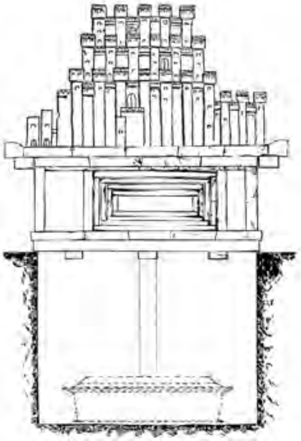
Proximity, Privacy and Neighborhood. In Middle Eastern graveyards, graves randomly infringe or interfere with each other's affairs and private space. The openness of graves is only superficially restricted by the size of the horizontal grave slabs and their boundaries. The slabs are commonly used as markers, as opposed to vertical tombstones. Neighboring grave slabs or horizontal markers form a relatively uniform surface, a solid flatness as opposed to a volume. If the Middle Eastern graveyard exhibits a single ambition, it is that of partaking of and sharing flatness. Socializing with the dead in Middle Eastern graveyards is partly inspired by the elimination of 'room' or sufficient space of dwelling. In order to reach loved ones, a visitor has to walk over neighboring graves. Greco-Roman graveyards maintain a type of dwelling or



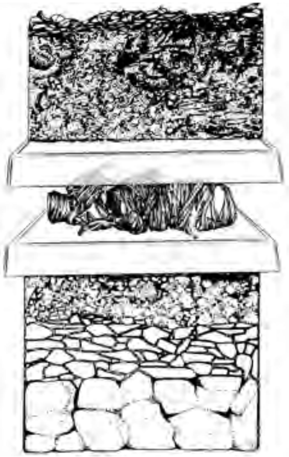
adequate space for the living and extend the dwelling space of the living to the dead via a law-abiding transition of ontology to the ontotheology of the living. The reason for Western culture's preoccupation with the roaming or walking dead can be found in the establishment of the graveyard as a residential complex, a settlement which the dead should have no reason to abandon. In Western graveyards, the space of graves can be given as a metric value, each person being allotted relatively equal space for their grave and its surrounding. In Islamic graveyards this space varies: some graves are inches away from each other, others slightly further; many are buried on top of each other, as new cemeteries are carpeted exactly atop older ones. Sometimes five layers of new cemeteries – as in the case of Iran's *Dar-o-Salam* graveyard – bear each other's tombstones, graves and their contents; only the most recent graveyard is visible, while the rest form the bedrock of the new cemetery until rain or soil change force a small part of the older graveyards to surface in an unexpected place, sometimes beneath a recent tombstone. Thus the

hadith that 'no one can build any palace or even a house other than on top of someone else's home' is exemplified in a typical Middle Eastern graveyard. The *hadith* aims at the nihilism of economy or its impending fate, because this is understood to lead to a tranquilized economy. If layers and layers of graves over each other – in addition to the literal contact of graves and their horizontal slabs – have one ontotheological message, it is the intimacy of the living with the graveyard, the dead and their own demise.

Elysian or Emphatic Horizontality. Western coffins or burying spaces are by their nature sarcophagi. They are governed by the fate of volume: providing room. Western graves bespeak dwelling space on two levels: one is the coffin or casket which provides its contents with room; and the other is the surface tombstone or perpendicular marker that represents a volume. The difference between Western and Middle Eastern – or specifically, Islamic – graveyards in their approach to building originates from their difference in grasping or working with the solid as a building or architectural component. If, for the Western graveyard, dwelling is supported by solid volume, or the solid that brings space to volumetric enclosure, for the Islamic graveyard the solid subtracts dwelling from the volume. In Islamic graveyards, solidity is the privileged state of matter; unlike its role in the Western graveyard, where it creates volumes, it is replete, and has only one role: to remove room or adequate space for dwelling from the grave. The body in an Islamic burial is not placed in a coffin; coffins are used only by family and friends when carrying the deceased to the grave site. The body is placed atop a solid stone slab deep in the ground, tightly wrapped within a *kafan* or shroud sheet. Another slab of the same size is put over the body to fully press its weight on the deceased, crushing the chest and eliminating any space or air around the body. Then dirt or soil is dumped on the slab, swallowing the body into an Elysian horizontality which is that of a filled solid without room. Finally, another slab is placed on the surface to conclude this Elysian horizontality for the living.



In general, then, graves in Islamic graveyards have no 'dwelling' potential. Heidegger ties building and dwelling to the twofold of thinking and being. Thinking is entailed by *raum* (room) or dwelling space. In the wake of the Western graveyard and its ontological dwelling-space, continuing as it does either on the ground or under the surface as in the coffin, the Western aspiration for thinking is carried on even beyond death, in the grave. The act of removing the dwelling-space in Islamic burial leaves no space for thinking. The Elysian space of Islam creates spaces which, by virtue of their resistance against the ontology of dwelling, subtract the creative force of building and being from the Western exigency of thinking.



Unlike the comforting Western spaces, the slabs of the Islamic burial exert pressure. Their emphatic horizontality rises from bottom to top, diminishing *post-mortem* relief. The two slabs under and over the body transmit the hardness and the weight of deeds in life. These weights create a crushing force which makes use of tolerance and turns it into pressure; because sin (pressure) reaps its potentiality from tolerance. When tolerance reduces, or one becomes less tolerant by various means, such as temptation or loss of hope, sin ensues by virtue of this lack of tolerance. Yet the dead have no

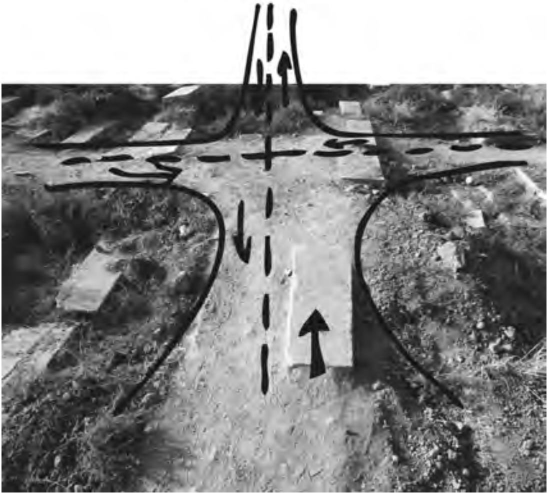
tolerance. If theology nourishes faith by being well-grounded and valid to the very End, the Islamic graveyard deals with a theology thatmaintains faith by purposely stopping making sense.

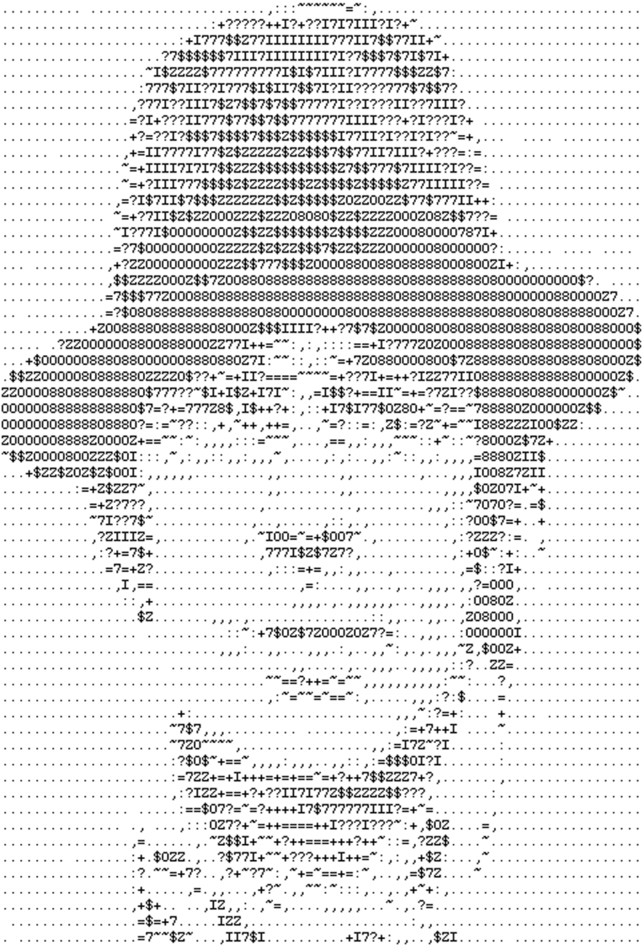
Over one's dead body. An Islamic graveyard encourages an uncommon socialization with the dead. The dynamics of this socialization are for the most part inspired by the building forces of the graveyard. If the dignity of the dead is nothing but the indulgence of the living, then the living too ought to be liberated from the legal codes that bind the graveyard to dwelling and traffic taboos. Firstly, everyone, regardless of religion or orientation, can be buried in an Islamic graveyard – as long as one can endure the place. In the Middle East, the graveyard is fully connected to the social body; it is located in the vicinity of social activities. The Islamic graveyard is a place of casual socialization. Fruits and snacks are brought to the graveyard to be distributed among the poor. The poor come to the graveyard to eat and return to the communal structure of society. The graveyard levels the dead as well

as the living; privatization of the space around graves rarely happens. When it does, it is to construct a shade over the horizontal slab to protect the marker from the sun. If in the West, graves represent private spaces even when they have no walls built around them, in a Middle Eastern graveyard this private space is casually broken by people walking over graves. Tens of footprints on each grave mark the evidence of this passage from restricted dwelling to collective wayfaring.

Lastly, the graveyard is trans-gender. In the Islamic graveyard, the faces of deceased women are often rubbed off from the photos which are placed on their graves.

Given the fact that historically in Islam, the face of God and holy figures must not be depicted, and vermin are faceless people, removing the faces of women amounts to verminizing the Divine, or making God and woman equal.





Computer Deleuze

Editorial Introduction

Robin Mackay

Welcome to our third volume, the greater part of which is devoted to the work of Gilles Deleuze.[1] Alongside a number of searching examinations of his work, it also features two previously untranslated texts by Deleuze himself. Although assembled under the working title 'Unknown Deleuze', the volume announces no scandalous revelation, no radical reinterpretation; rather, this title simply indicates a humble acknowledgement of the fact that, *philosophically speaking*, Deleuze remains something of an enigma.

It is not without trepidation that we devote almost an entire volume to one particular philosopher; even more so given the ever-accelerating trend of secondary commentary and the rash of titles claiming to apply Deleuze's thought to

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[1] In the second part of the volume we present a record of the conference 'Speculative Realism', which elaborates certain themes taken up in COLLAPSE Volume II. Since these themes were already introduced in that volume, we will remark here only that one should not anticipate a discursive statement of fully-formed philosophical positions, but rather a continuation – in the absence of the extended interviews featured in previous volumes – of COLLAPSE's commitment to the publication of 'live philosophy'. 'Speculative Realism' is a conversation between four philosophers who think outside partisan affiliations to particular thinkers or schools, and thus is genuinely exploratory. Its 'unfinished' aspect reflects its status as a document of contemporary philosophy in the making, in which new conceptual approaches are proposed, the borders between science and philosophy probed, and the history of thought mined for fresh insights.

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areas as diverse as dance, feminism and geography. These latter might be taken as proof enough of the continuing fecundity of Deleuze's philosophy, but they belie the fact that it is still difficult to situate his work philosophically. Interdisciplinary appropriations too often compound this, turning 'Deleuzianism' into a game of recognition and thus merely succumbing to a new image of thought (*everyone knows* what a rhizome is …) Although doubtless such works can and do succeed in producing worthwhile and productive syntheses, it is difficult to assess their claim to represent Deleuze's thought without a renewed, properly philosophical effort to examine the latter. But should this even matter, given that Deleuze himself told us simply to use concepts 'like a toolbox'? Such a riposte typifies the most deleterious aspect of the 'success' currently enjoyed by Deleuze; for any precision tool must be mastered before it is 'put to work', and for this one must understand, in turn, its own workings and its interaction with the rest of the conceptual 'equipment' in hand.

The first of our texts by **Gilles Deleuze** himself, a short interview from 1981, offers a review of the enduring concerns of his ambitious philosophical project. Despite its brevity, the exchange merits translation because it sees Deleuze, despite his antipathy to being asked 'general questions',[2] speaking on a general level about his philosophical work, even going so far as to make a distinction – heretical by the lights of *Capitalism and Schizophrenia* – between his own concerns and those of Félix Guattari in that work. In this exchange Deleuze recapitulates and reaffirms the major themes of his thought – a renewed philosophy of nature; the problem of the image of thought; the construction of a science of the problem, and of a new metaphysics; the battle against neurosis and the typology of multiplicities. The other contributors to our volume take up, in various ways, the question of the interconnection of these themes – how do they come to be integrated into *a* philosophy?

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[2] *Dialogues II,* 1.

With a style that combines the resources of the conceptual, the poetic, the mythical and the etymological, **Arnaud Villani** has constantly aspired in his work to do justice to the richness of Deleuze's thought, just as this thought itself, he argues, aims above all to do justice to the 'burl' of the real.[3] Gerard Manley Hopkins, who Villani cites here, is indeed an intriguing reference-point for Deleuze, with his language of 'inscapes' and 'instress', 'oftening' or repetition, and 'cleaves or folds' in the 'burl of being'; but it is Villani's aim, without annulling this poetic affinity, to distance Deleuze from any model that would have us rely on God's grace (Hopkins) – and equally, on the grace of the universal (Badiou)[4] – to take us from one 'cleave of being' to another.

For, as critics who attribute to Deleuze a politically suspect 'aestheticism' point out, it is in the practical sphere that an affirmation of 'life, in all its frightening complexity'[5] is not enough: this complexity must be negotiated, reduced, decided upon. Against charges that Deleuze falls short of this exigency, Villani emphasizes the importance of the moral and political in his work, arguing that the central problem of a Deleuzian metaphysics is that of 'isolating the conditions of possibility for a complex act'.[6] Indeed, Villani suggests that philosophy itself begins precisely when we try to think experience without sublimating its infinite riches by investing them in back-worlds. Succeeding in this would mean that action, no longer having a special status to whose strictures the poetic and noetic would have to be submitted, would multiply their infinite riches: like the sensible and thought, it would remain true to the 'burl of being' rather than fearfully ceding to a vicarious relation to it. Ethical action would not betray the infinitude of experience but would affirm it in its every work.

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[3] A. Villani, present volume, 52.

[4] See E. Alliez, 'Badiou: The grace of the universal', *Polygraph*, vol. 17, 2005:267-73.

[5] G. Deleuze, 'Questions', present volume, 42.

Such complexity would not at all preclude action from being 'pointed', punctual;[7] only it would be a matter of an intense, implicated concentration rather than a decisive rupture: singular in the sense of the haecceity, the non-substitutable moment, rather than levelling all moments with a dis-qualified void. Here Villani pinpoints the most troubling consequence of the demand – increasingly made in respect of Deleuze's (and Guattari's) work – that a philosophy should prove its political mettle before even being considered as philosophy. This is a question of beginnings: in beginning with the infinitude of lived experience, Deleuze wished to see the 'drastical' rise to it; whereas in beginning with the demand for 'decision', we decide in advance against a truly philosophical – metaphysical – thought, thus impoverishing action and making political 'truth' the locus for an effect closer to the positive feedback of *hype*, drastically disengaged from the real, than to a 'labyrinth of creation'[8] with a 'thread' always connecting it to the outside, keeping it open.[9]

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[6] Villani, present volume, 56.

[7] *Ibid.*, 58.

Why would a 'pure metaphysician' see a theory of artistic creation as an essential component of his project? Precisely because 'complex action' finds at least one of its models in the artist's attempt to endow the work – through a series of selections or decisions 'concerning for example the relation of two neighbouring colours'[10] – with the infinite complexity of his experience. This is the process that **Éric Alliez & Jean-Claude Bonne** detail in *Matisse-Thought*,[11] where they advance a radical new thesis with regard to Matisse's development – namely, that the 'Fauve period' was not a wild anomaly but a period of rigorous experimentation which laid a methodological groundwork for everything that would follow. In the process, they demonstrate the pertinence of a Deleuzian 'metaphysics', in the rich sense explored by Villani, to an alternative conception of modern art and, indeed, modernity.

Rethinking Matisse's painting as a practice of the 'all-over', in which the force of local actions is always determined in relation to neighbouring forces within a virtual 'whole', Alliez and Bonne recall the importance for Matisse of 'a complete vision' of this 'whole'[12] – not a formal blueprint to be 'transferred' to the canvas but 'an idea which one does not truly know except in so far as it develops with the growth of the painting'.[13] Their thesis is that the importance of Fauvism, for Matisse, lay in a 'strict quantitative ordering' by which it governed this processual development.

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[8] *Ibid.*, 56.

[9] T. Duzer, present volume, 254.

[10] Villani, present volume, 56.

[11] E. Alliez & J-C. Bonne, *La Pensée-Matisse: portrait de l'artiste en hyperfauve* (Paris: Le Passage, 2005).

[12] Cited in Alliez & Bonne, *Pensée-Matisse*, 75.

As 'the empirical exercise of sensibility [...] can grasp intensity only in the order of quality and extensity',[14] so the indissociability of quality and quantity indicates their mutual origin in intensity. The pursuit of the Idea in the processual unfolding of the work is not a quest for a particular contrast between 'a certain red and a certain green',[15] since these qualities mean nothing apart from their quantity; it seeks, rather, an actualisation (one of many cases of solution) in which the 'proportions of tones' (quantities of qualities) will act like a kind of lens, converging sensations in order to repeat or rehearse an Idea (*focus imaginarius*) in itself imperceptible since intensive.[16] The Idea of the whole does indeed come first, but its *expression* is assured only through a painstaking process of experimental *construction*.[17]

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[13] Alliez & Bonne, present volume, 209.

[14] *Difference and Repetition*, 240.

[15] Alliez & Bonne, present volume, 217-8.

[16] *Ibid.*, 217; on the Idea as 'ideal focus' see *Difference and Repetition*, 169.

[17] In a recent book, film-maker David Lynch adumbrates the characteristics of this constructivist-expressionist conception of the Idea as infinite heterogeneous multiplicity, and its actualization as intensive unfolding of differences: (1)*All at Once*: The Idea as event or encounter, as a singular moment or haecceity (the Idea is neither foundational or generic, but is always encountered within lived series). Why does touching the roof of a car heated by the sun 'cause' the appearance of 'the Red Room […] the backwards thing […] and then some of the dialogue'? (2) *Fragments:* The encountered Idea is already partially unfolded into a set of sensible fragments, only ever encountered in a state of 'degradation', but this degradation is in its very nature in so far as it appears. (3) *Expression:* The 'adventurous character of Ideas' implies a dialogue, a continuing conspiracy ('The Idea tells you to build this Red Room. So you think about it. Wait a minute, you say, the walls are red, but they're

An early experience during Matisse's apprenticeship with Moreau shows how this problematic had exercised Matisse, from the very first attempt to copy a painting in the Louvre, Chardin's *The Pipe*: he was 'baffled' by 'an elusive blue […] a blue that could look pink one day, green the next.' In a strange, inverted prefiguration of his mature method, Matisse 'even cut up his own preparatory oil sketch and stuck bits on to Chardin's canvas, where each separate section was a perfect match, but when he put them together, there was no longer any correspondence at all. "It is a truly magical painting," he said, adding that this was

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not hard walls. Then you think some more […] they're curtains. And they're not opaque, they're translucent. Then you put these curtains there, but the floor […] it needs something […]'). This pregnancy of the Idea, in the process of its expression-construction, suggests a new understanding of *anamnesis*: The retention of the singularity and the unpacking of its intensive differences 'incarnates' the Ideal event, so the work becomes the ground for repetition, rehearsal or recollection of what was inactual but was somehow encountered ('[…] you go back to the idea, and there was something on the floor, it was all there. So you do this thing on the floor, and you start to remember the idea more […]') The successive posing of questions operates an 'enframing' of the Being-Idea-Problem constraining it to bring forth 'cases of solution' (*b*eings) to which the former remains irreducible but without which it would remain the object of a sterile and mute contemplation (whether phenomenological or 'Platonic'). In this sense, and *contra* Heidegger, science, when it experiments, is no different from art, their estrangement merely responding to a conventional partition of Problems-Ideas on the basis of the apparent duality of quality and quantity, itself testifying to an 'image of thought' that capitulates to the covering-over of intensity or difference-in-itself. (The theme of *mathesis universalis*) (4) *The whole must be made:* This estrangement is dissolved in a 'superior empiricism': Ideas as experienced intensive states, in pure memory, employed in the assessment of an attempted repetition ('when you veer off, you *know* it […] this isn't like the idea said it was'), in ensuring a fidelity to the event through its mediate reconstruction (or retro-struction) through the manipulation of quantity and quality in an 'all-over' organisation ('The idea is the whole thing – if you stay true to the idea, it tells you everything you need to know […] You try some things and you make mistakes, and you rearrange, add other stuff, and then it feels the way the idea felt.') (D. Lynch, *Catching the Big Fish: Meditation, Consciousness, and Creativity* (London: Tarcher/Penguin, 2007).

the only copy he had in the end to abandon.'[18] Matisse was to pursue the reverse-engineering of this 'magic', the life of the painting, throughout his career – and this, as Alliez and Bonne show, through a meticulous and rigorous thinking of the dynamic relations between the intensive and extensive, quality and quantity.

That Alliez and Bonne see this new conception of painting as implicitly prefiguring a new political formation only makes more urgent the completion of Villani's 'typology of complex action': for does politics, can politics, really proceed in such a fashion (even if 'the factors of decision and prediction are limited'): 'by experimentation, groping in the dark, injection, withdrawal, advances, retreats […]'?[19] In any case, their analyses, like Villani's, are invaluable in uncovering the connection between what we might have understood as Deleuze's metaphysics *stricto sensu* (the typology of multiplicities, the necessity of the virtual, difference), his ethics (denunciation of the priestly type, active and reactive forces), and his aesthetics (the notion of *intensity* as infinitely expressive force). Rendering back over to every instant of life what properly belongs to it, rather than sequestering it in an inaccessible site from which it will subject us, requires all of these resources.

As the coruscating conclusion to **QUENTIN MEILLASSOUX**'s contribution reminds us, it is not a question of 'full communication', which on the contrary represents a kind of extinction instinctively repugnant to the philosopher, personified in the conceptual incontinence of the

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[18] H. Spurling, *The Unknown Matisse*: *A Life of Henry Matisse*, (London: Hamish Hamilton, 1998; 2 Vols.) Vol.1, 85-6.

[19] *A Thousand Plateaus*, 461.

'ideas men'.[20] Against all 'anarcho-delirious' worship of flux, Meillassoux reads Deleuze as a Bergsonian philosopher of *subtraction*.

The symphonic sweep of Meillassoux's text – from the *scherzo* of the opening conceit, which introduces an 'unknown Deleuze' in the guise of an obscure pre-Socratic, to the thunderous challenge with which it closes – is an index of the mercurial tenor of Deleuze's own work. Meillassoux's methodological proposal that we approach Deleuze through a mere fragment in order to 'reconstruct' his thought is not at all facetious: Better a modest, even reductive, model culled from a Deleuzian fragment, but understood 'from the inside' – through (re)construction rather than exegesis,[21] than an opaque interpretative quagmire where partially-understood terms become precious tokens too profound to be understood – much less rationally reconstructed – by the profane. But in fact, Meillassoux meticulously demonstrates how the quest for immanence, the theme of 'selection', the refusal of the reactive, and the logic of matter, are all comprised, concentrated, in the tiny fragment, a prismatic shard in which is revealed a distinct-obscure image of the whole of Deleuze's thought.

Pursuing Deleuzian immanence through Bergson's critique of Kant and his theory of pure perception, we meet again with Villani and Alliez and Bonne's analyses, in so far as the thing-in-itself is also a 'telephone to the beyond': a true metaphysics opposes Kantian critique with an affirmation that everything is before us just as it appears, owing nothing to a synthesizing subject. But this immanence raises new problems: why is the 'burl of being' differentiated at all, what kind of interruption of matter is a living being? As Meillassoux demonstrates, pure immanence and individuation can only be reconciled by thinking the body as the locus of a drastic subtraction from the infinitude of matter, a primary selection that provides the terms for the selection of will. This double selection is a key notion in Meillassoux's thought, and here as elsewhere it informs a logic of the event as non-probabilisable and non-deterministic hazard. Events are the movements of 'atoms of void' across lines of flux, but, in line with Deleuze's upholding of Leibnizian continuism, rather than a cut in the fabric of being, here the void is revealed as a stitch in time, a virtual loop drawn out from the weft of the actual.

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[20] Meillassoux, present volume, 105; See *What is Philosophy?,* 10.

[21] See Meillassoux's own justification of the methodological approach, present volume 69-70.

Haswell & Hecker's performances of work created using composer Iannis Xenakis's digital UPIC system operate a molecular re-engineering of the body through sound, inducing synaesthaesia and an attunement to the microsonic. In their contribution to our volume they present some of the graphisms which are the basis of these transformational events, and their album of UPIC recordings *Blackest Ever Black*. In creating this new work for the UPIC, a computerised system that directly 'translates' drawings[22] into sound, Haswell and Hecker invite a renewal of Xenakis's musical thinking. As discussed in our accompanying text, within Xenakis's own *oeuvre* the UPIC allowed the application to the microphonic texturology of his *concrète* works the same analytical resources his orchestral works had brought to bear on macrocompositional problems. But the invention of the UPIC was also inspired by a will to induct a new generation into abstract spaces of sound which went beyond the confines of musical tradition.

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[22] Among the drawings used is one representing the microscopic structure of a new material developed by scientists as an optimally non-reflective black surface – hence the title *Blackest Ever Black*. (See http://www.newscientist.com/article/dn3356.html).

Haswell and Hecker's work demonstrates that it would be wrong to reduce Xenakis's marshalling of synaesthesia to a wish to get 'through' the music, to step 'outside-time'. Although he will often seem to view the human ear as a lamentable constraint, a symptom of being a '"Two-faced" mortal',[23] Xenakis, like Deleuze, is ultimately a chronicler of our amphibious condition: the 'outside-time' structures he seeks are always subject to the vagaries of perception, and although our unconscious may be roamed by packs of molecular sound, sonic events are unavoidably always the product of an integration.[24] As in Deleuze, virtual and actual are not the object of a value-laden dualism, but are the inextricable conditions for the emergence of a real: without both of them, no music.

As well as clear Leibnizian-Deleuzian themes (sustained and stable tones as exceptional cases of glissandi; *petites-perceptions*;[25] infinities within infinities[26]), thinking through Xenakis also returns us to a theme that recurs throughout this volume: that of the 'contraction' of quantitative material phenomena into qualities. For Bergson, in liminal phenomena (*e.g.* the lower notes of the scale)[27] a 'detension'[28] comes into operation whereby we begin to break through the operation of contraction-memory and perceive matter itself, perceive the quantifiable series of intensities that science describes. Xenakis investigated this in the form of 'acoustic beats', where the interference patterns of waveforms create rhythmic pulses.[29] These phenomena reveal a continuum between tone and rhythm, a continuum suppressed by the stave's perpendicular separation of infrasonic statistical aggregates (notes) and macrotemporal arrangements (rhythmic placement). In rendering this same stratification transparent,[30] the UPIC engineers a 'transcendental encounter' with the selection we make from matter.[31] The time of music is a biological artefact, a two-dimensional sandbox made by 'folding' the vibratory continuum along a seam constituted by the limits of our auditory system ('Our brain does a kind of statistical analysis', 'Our ear is nothing but a periodicity-counter');[32] a crease in our relation to the physical vibratory continuum. In mimicking these foldings the UPIC gives us the means to probe them, to 'take the reverse path'[33] and to reinsert ourselves into the concrete continuum of sound, outside the traditional strictures of music, with its double-selection of preconstituted 'notes' and metric combinatorial space.

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[23] (Parmenides) – Xenakis, *Formalized Music: Thought and Mathematics in Music*, trans. S. Kanach (NY: Pendragon, 1992), 203.

[24] See Xenakis, *Formalized Music*, 8

[25] Haswell & Hecker, present volume, 111-2.

[26] Xenakis in B. A. Varga, *Conversations with Iannis Xenakis* (London: Faber, 1996), 205-6.

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[27] See Meillassoux, present volume, 79-80.

[28] *Ibid.*, 80.

[29] Xenakis in Varga, *Conversations,* 64.

[30] See Haswell & Hecker, present volume, 119.

[31] *Ibid.*, 86.

[32] Xenakis in Varga, *Conversations,* 78, 91.

[33] Meillassoux, present volume, 82.

Contraction is thereby revealed as a property, not of a synthesizing subject, but of the folds of matter – revealing to us the 'concrete scale of temporalities'[34] along with our own temporality or rhythm.

We do not truly know how the twenty-one year old student **Gilles Deleuze** came to write the introduction to a republication, by a private press specializing in esoteric works, of Johann Malfatti de Montereggio's nineteenth-century esoteric work *Mathesis: Or Studies on the Anarchy and Hierarchy of Knowledge*.[35] During his early years (1944-8) at the Sorbonne, Deleuze participated in monthly salons organised by the wealthy banker Marcel Moré, a friend of Bataille's. In the leftist Catholic context of the soirées at Moré's apartment and the so-called *sessions de la Fortelle* hosted in mediaevalist Marie Madeleine Davy's grand *château* as 'cover' for Resistance activities, discussions of esoteric topics undoubtedly played a part in what must have been a heady atmosphere, mingling extra-academic intellectual exploration with furtive, morally-charged acts of resistance. Young lights of the Parisian intellectual scene including Deleuze and his close friend Michel Tournier were also, no doubt, respectful of mystically-inclined hostess Davy,[36] whose work suggested that the truth of mediaeval philosophy was to be discovered in a closely-guarded, esoteric, monastic thought that had remained faithful to the mystery of divine revelation.

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[34] *Ibid.*, 80.

[35] We are endebted to Knox Peden, Thomas Duzer, David Reggio and Christian Kerslake for valuable information and discussion on Deleuze's text which has informed the following notes.

[36] See F. Dosse *Gilles Deleuze et Félix Guattari: Biographie croisée* (Paris: La Découverte, 2007), 116; and J. Moncelon, *Marie Madeleine Davy ou le désert intérieur* (Paris: Les Cahiers d'Orient et d'Occident, 2006). Deleuze prefaces another of the early essays, 'From Christ to the Bourgeoisie' with a dedication to Davy, who also edited a series of books for Griffon d'Or, the publisher of *Mathesis* (see C. Kerslake, 'The Hermaphrodite and the Somnambulist: Deleuze and Jean Malfatti de Montereggio and

But if it was through the patronage of Moré and Davy that Deleuze came to write the piece, this reveals little about his motivation in doing so, nor why he later requested its excision from his official bibliography. In any case, within this essay Deleuze is already operating a characteristic philosophical ventriloquism: To a large extent his reading of Malfatti is an opportunity to articulate his own preoccupations, themes which traverse all of his works of the 1940s. The real question is what Deleuze found in Malfatti that could be affined to his own project.[37] It seems that ultimately Deleuze sees in mathesis a kind of ethical

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Occultism' in Culture Machine (2007), at http://culturemachine.tees.ac.uk/Cmach/Backissues/j008/InterZone/kerslake.htm, n. 2).

[37] This is not to deny that Deleuze was interested in Malfatti's book, for certain key images present in Malfatti recur throughout later works – see Christian Kerslake's work ('The Hermaphrodite and the Somnambulist – *op.cit.* – and *Deleuze and the Unconscious*, London: Continuum, 2007, particularly Chapter 4), which suggests deeper connections between Deleuze and 'occult' thought, constructing a kind of counter-history to the official account of Deleuze's work by indicating a porous boundary between the canon and 'discredited' occult works. The methodological key to Kerslake's approach might be found in his argument that insisting on the 'obnoxious term "occultism"' itself represents a kind of implacable resistance to the all forms of priestly tradition – even esoteric tradition – in favour of an anti-establishment dedication to all that is obscure and repressed (Kerslake, 'The Hermaphrodite', n. 27). In that case, if it seems immoderate to us to undertake a wholesale reinterpretation of Deleuze's work on this basis, this apparent immoderacy itself answers to the performative exigency of an 'occultist' revolutionary stratagem. Kerslake's renewal of the link between the problem of resistance and the mysteries of the occult is pursued within an irreproachable scholarly framework, which perhaps only augments its seditious potential, even if in the short term it courts the risk of encouraging an interpretation of Deleuze as 'mystic'. What must ultimately be sought is a key to Deleuze's integration of these 'occult' elements, along with the 'official' history and practice of modern European philosophy, into one singular mode of thought. Kerslake's work is invaluable and pioneering in its painstaking recovery of long-forgotten resources that may be necessary for this task, and demonstrates, once again, just how many 'Unknown Deleuzes' there are.

imperative indexed to the refusal of transcendence, and a monism elaborated on the basis of lived experience. As always, then, in the background, it is Spinoza who silently presides over the work in progress.

Deleuze's philosophical voice emerges during a period where the rallying-cry of a philosophy which was to sweep away the severity of interwar *epistemologie* was that of a 'return to the concrete'.[38] The moral disquiet aroused by the dark years of Occupation seemed to demand an unmediated examination of the moral and philosophical stakes of lived experience. For Sartre and his contemporaries an appropriation of Heidegger's work offered a powerful and convenient way to recuse the already-palling academic Brunschvicgian credo that the only way to rigorous philosophical questioning was through an apprenticeship in scientific thought: Instead, it opened up a much-needed *immediate* philosophical access to the politically-dramatic problem of freedom.

Nevertheless, Deleuze does not appear to have taken the easy path of simply neglecting or dismissing science on account of the monstrous engines of death it had recently produced. He does identify the need for the return to 'concrete life' as being an exigency posed at root by 'the principle of an anarchy',[39] that of the apparent irreconcilability of science and philosophy. But, far from seeking to collapse the entire field onto either of these mutually incomprehending discourses, Deleuze describes both as being based upon an uninterrogated ground: that of objectivity (science) and that of the representations of a cognizing subject (philosophy). This dualism, of course, is 'essentially the Cartesian opposition between extended substance and thinking substance'. However, in his aspiration to a *mathesis universalis*, Descartes himself envisions 'a third order, irreducible to the other two […] the unity, the hierarchy beyond all anarchic duality'.[40] Similarly, runs Deleuze's argument, Malfatti's book set out to rediscover this *mathesis universalis* in which (in ancient Indian civilisation) mathematics and metaphysics had enjoyed an original unity, and so to restore us to this unified plane.[41]

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[38] David Reggio explores this aspect of Deleuze's work in 'Jean Malfatti de Montereggio: A Brief Introduction', at http://www.goldsmiths.ac.uk/history/news-events/malfatti.php; and 'The Deleuzian Legacy', *History of the Human Sciences* 20:1 (2007), 145-60.

[39] Deleuze, 'Mathesis', present volume, 142.

This notion that the knowledge handed down by our intellectual forefathers was subtended by a mysterious lore was indeed widespread into the nineteenth century, frequently paired with that of a unified science or *mathesis universalis*. In the 1946 edition of *Mathesis*, Ostrowski mentions fellow nineteenth-century thinkers Oken and Ampère as seeking the same 'universal synthesis' as Malfatti, and repeats Malfatti's own claims that this mathesis is descended from Plato and Proclus. Descartes, in outlining (in the *Regulae* and the *Géometrie*) his model for a universal science of discovery, similarly confides that he seeks only to *re*discover a hidden science which, going beyond the purely formal and deductive methods available to mathematics in his own day, would explain how the ancients were able to achieve such prodigious feats of discovery.[42]

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[40] Deleuze, 'Mathesis', present volume, 143.

[41] 'Incognitum' (present volume 156-75) examines the first, numerological or arithmosophical study; For an account of the content of Malfatti's *Mathesis* in its anatomical, embryological and medicinal aspects, see C. Kerslake, 'The Hermaphrodite'.

Deleuze superposes Malfatti's vision of *mathesis universalis* onto that of Descartes; but he also 'twists' Descartes himself. For Deleuze's understanding of mathesis as a third type of knowledge misunderstood by both science and philosophy owes less to Descartes's vision of an *ars inveniendi* that to the 'three kinds of primitive notions' invoked in the correspondence with Elizabeth,[43] where Descartes's response, when pressed on the nature of the union of mind and body, is that although following the thread of philosophical meditation leads us ineluctably to conclude the truth of dualism, in our pre-philosophical state, and in the greater part of our lives where philosophical meditation is pushed aside by everyday life, the reality of this union is quite present *to the senses*,[44] so that the common man perceives no dualism, but a perfect unity. The truth of dualism and the fact of union cannot be present together – we come to appreciate both points of view, suggests Descartes, only in alternating between long periods of unreflective life where union is known experientially 'by means of ordinary life and conversation',[45] and short bursts of meditation. In his 1972 edition of Descartes's *Oeuvres philosophiques*, Alquié will explicitly link Descartes's third mode of knowledge to 'what we call the pre-reflexive',[46] rendering pithily Descartes's contention thus: 'to be conceived of, the union must be lived' [*'pour concevoir l'union, il faut le vivre*'].[47] From the point of view of a philosophy of the mind and a science of pure extension, the union is contingent. And yet it is 'proved' by experience, before philosophical reflection even begins, and again when it ends.[48]

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[42] See M. Otte & M. Panza. *Analysis and Synthesis in Mathematics: History and Philosophy*, *Boston Studies in the Philosophy of Science* 196 (Boston: Kluwer, 1997). For an account of the importance of *mathesis universalis* in Descartes' mathematical thought, including a history of the notion itself, see C. Sasaki, *Descartes's Mathematical Thought*, *Boston Studies in the Philosophy of Science* 237. (Dordrecht: Kluwer, 2003). Importantly, according to Descartes a part of this *mathesis universalis* lies in the determination of the conditions of a problem (See *Regulae* Book II 'Concerning Problems') – and here, indeed, for Deleuze too one rediscovers the unity of science and philosophy: 'It is in this manner, it seems to me, that philosophy might be considered a science: the science of determining the conditions of a problem' (Deleuze, *Responses*, present volume, 41). However, as Deleuze remarks, Descartes's achievements here belong to the mathematical *stricto sensu*; he failed to apply his discoveries about the constitution of problems to the philosophical sphere ('Descartes the geometer goes further than Descartes the philosopher' – *Difference and Repetition* 323n. 21). Of course, it would be Bergson who would remedy this failure; but all too *philosophically*, so that Deleuze would need to re-inject a differential mathematics into the Bergsonian account of problems, via Riemann, Lautman *et al*…

[43] In particular, Descartes's letter of 28 June 1643: R. Descartes *Oeuvres Philosophiques*, ed. F. Alquié (Paris: Garnier, 1973, 3 Vols) Vol III. 43-4 (R. Descartes *Philosophical Writings*, trans., ed. E. Anscombe & P.T.Geach, London: Thomas Nelson, 1970, 279).

This torsion exerted on Descartes allows Deleuze – at the price of the relation to Malfatti's text becoming somewhat strained – to connect the problematic of *mathesis universalis* to the existentialist 'return to the concrete'. Attaining mathesis will not be a question of lost lore and mystical initiation, but of a transformative thinking of one's own individual existence and its relation to one's fellows, and to the universal.

Sartre was the foremost contemporary influence on Deleuze's philosophical thought. But if Deleuze's contemporaries whispered of him as a 'new Sartre'[49] it was more for his startling creative freedom of thought than for his fidelity to the *maître*'s word. In his early works, Deleuze takes up certain Sartrean themes only to critique and transform them, always on the basis of the argument inherited from *The Transcendence of the Ego* – one of Deleuze's earliest and most abiding philosophical influences – for a field of immanence pre-existing the subject.

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[44] *Ibid.*, 44 (279).

[45] Descartes, *Oeuvres*, 45 (*Writings*, 280).

[46] *Ibid.,* 45n2.

[47] *Ibid.,* 45n1.

[48] *Ibid.,* 47n1.

In 'Mathesis' Deleuze takes up Sartre's critique, in *Being and Nothingness*, of Heidegger's notion of the 'crew' [*Mannschaft*] as model for thinking others [*l'autrui*].[50] For Heidegger, the other is no object; rather *Mitsein* is part of the very structure of *Dasein*, as a sort of primary 'ontological solidarity'. Sartre complains that Heidegger has only *described* the problem of others rather than *solving* it, and that his common existence, the primacy of the 'us', tends to level all distinctions, making of each individual a mere case of a generality. But Deleuze in turn felt that Sartre's model of a 'reciprocity of consciousnesses', each using their intentions and desires to paper over the crack in the world which is the other, also evaded the real problem of others: it imagines pure consciousnesses stealing the world from each other, undermining each others' centralisation, with the world being merely the empty field across which their combat rages. Sartre's progress over Heidegger lies in the fact that he recognizes the relational aspects of the subject to the other; but his error is to make the other its own *I*, an inverted image of myself.[51]

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[49] Dosse, 116.

[50] J.-P. Sartre, *Being and Nothingness*, trans. H. E. Barnes (London: Methuen, 1986), 246-52.

[51] See A. Beaulieu, *Gilles Deleuze et la phenomenology* (Paris: Sils Maria, 2004), 61-3.

In another 1946 paper, 'Description of a Woman', Deleuze condemns Sartre's conception of love, which, he argues, seems to be predicated upon a sexless and neutral world of 'pure souls', so that sexuality is conferred upon the beloved only by the lover. In moving toward the definition of an immanent, *a priori* structure of the other – and therefore a conception of desire without lack – Deleuze announces the 'great principle'[52] of his early work: 'Things haven't been hanging around waiting for me in order to exist'.[53] For 'I do not attach my little significations to things. The object does not *have* a signification, it *is* its signification.'[54] The world is already a world of *concepts*, of things bonded with significations, before the subject even appears.[55] In concrete, pre-reflexive experience, it is not that 'I am tired', but that there is a 'tired world' in which the road, the sun, are all tired.[56] Equally, there is not an objective cube and the space which we impose upon it as form of appearance, nor even a fullness hollowed-out 'behind' our adumbrations of it, but the cube as concept.[57] Into this immanent world comes the other, as possibility of *another* world, and at once I become I, that is, I decompose these concepts, making part of them 'mine' and part the objective world's. Where before there was a world of concepts 'in the flesh', or 'phosphorescent objects',[58] now there is 'my world', a world that immediately appears 'mediocre'.[59] Expelled by the 'intimate phosphorescence' of pure immanence, each individual qua individual must face the other-as-possible-world in 'mediocrity', without any common measure, each taking on the problem of life on their own account: how is the universality of life to be thought, regained?[60]

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[52] G. Deleuze, 'Description of a Woman', trans. K. W. Faulkner, *Angelaki* 7:3 (2002: 17.

[53] Deleuze, 'Mathesis', present volume, 148. *Cf.* 'Description of a Woman', 17, 20; Not only is Deleuze, therefore, no phenomenologist, he is also no 'correlationist'!

[54] G. Deleuze, 'Statements and Profiles', trans. K. W. Faulkner, *Angelaki* 8:3 (2003): 17.

[55] Hence 'concepts are the things themselves, but things in their free and wild state, beyond "anthropological predicates".' (*Difference and Repetition* xx-xxi, translation modified).

[56] Deleuze, 'Description of a Woman', 17-8.

[57] Deleuze, 'Mathesis', present volume, 148-9.

The immediate political stakes of 'Mathesis', where this convoluted philosophical argumentation rejoins the urgent contemporary affirmation of the concrete, are made plain in Deleuze's citation of Ostrowski's preface.[61] The 'human problem', a practical problem which mathesis aims to solve, is that of the betrayal or affirmation of 'complicity'. Where Nazism, 'a unity founded on a cult of force', assembled its crew on the basis of a subjection to general principles and a biopolitical substitutability, we must found a conscious complicity on the basis of an initiatory experience of the universality of life, guided by the principles of mathesis. The 'human problem'[62] lies not in creating a crew whose members would be 'equal' and interchangeable, but in 'passing from a state of latent ignorant complicity to an affirmative complicity', affirming that 'the universality of life as an outside' is attested to in each apparently isolated individual, and indeed genetically conditions and constitutes him.[63] Far from mathesis being a transcendent mysticism, then, for Deleuze it describes a discourse on the condition of *a life*, relating it to the infinity of Life; a logic of 'the multiplicity of living beings which knows itself as such' and 'refers back to unity' through 'complicity'.

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[58] All of this is developed most beautifully in Michel Tournier's novel *Friday* (trans. N. Denny, NY: Pantheon, 1985), a book that is absolutely crucial for understanding of the early Deleuze – It is clear that in the Sorbonne years, in advance of the 'rhizome Deleuze-Guattari', there was a 'rhizome Deleuze-Tournier'. In Tournier's novel, Robinson is disabused of the conception of the subject in the world as a 'spotlight' passing over various indifferent objects with its attention and intentions, realising that it is modelled upon the thought of *another* as a secondary structure of selection within a world that *must already be constituted* in order for that selection to take place. This first world, one of 'objects phosphorescent in themselves', is ruptured by some singular anomaly or inconsistency, and 'excretes' the subject. In 'Tournier and the World Without Others' (*Logic of Sense*, 341-59), Deleuze will explicitly name this a structuralist theory of the other (the other is a structure which particular others can come to occupy); but the importance of *Friday* lies in its demonstration that the 'structure' is neither ontological nor eternal – in certain circumstances it is liable to decompose, returning the world to its phosphorescent state through a series of intermediate disintegrations – from Robinson on the isle of Speranza to Robinson-Speranza. Tournier-Deleuze participate at once in the structuralist destitution of existentialism and in a virtual flattening of structure into a field of immanence – however knotted, the thread that binds us can always be unravelled and followed back to this virtual field.

[59] See Deleuze, 'Statements and Profiles', 86-7: in this 1946 essay the 'crew' represents the possibility of reconciliation with the otherwise threatening and hostile 'alternative possible world' of the other: I 'team up with the other' to realize a world beyond what has now become 'my world' and thus mediocre. Although the threat of rivalry still subsists within 'the spirit of the crew', 'The Crew is the only way to escape from mediocrity'. *i.e.* from the contingency that appears as soon as one 'owns' the world as a subject. Meanwhile the task of philosophy is that of 'remov[ing] any pejorative sense from the word mediocrity'.

[60] Deleuze, 'Mathesis', present volume, 144.

1953's *Empiricism and Subjectivity* seems a valuable 'missing link' between 'Mathesis' and *Difference and Repetition*, in that it marks the first appearance of a quasi-mathematical concept of integration in precisely the same context – the creation of the social in a model that refuses forced sociality in favour of the *positive realisation of complicity* ('The question is no longer about transcendence, but rather about integration';

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[61] *Ibid.*, 145-6.

[62] *Ibid.*

[63] *Ibid.*

'The problem of society […] is not a problem of limitation, but rather a problem of integration […] to integrate sympathies' writes Deleuze, building on the thesis of the positivity of institutions outlined in 'Instincts and Institutions').[64] This in turn may point the way towards Deleuze's ultimate model of *mathesis universalis* in *Difference and Repetition*, that based upon differential calculus. If that work turns to mathematics *simpliciter*, this would seemingly tip the balance of the 'anarchy' in favour of science; but equally there seems to be a reciprocal movement whereby Deleuze 'esotericises' that very mathematics, by approaching it through routes he calls 'barbaric' and even explicitly 'esoteric'.[65]

In the 1946 essay, mathesis is neither mathematical nor mystical. Like Bergson's intuition, it relates to the individual's solitary path, once displaced from 'a world' to 'my world', towards a rediscovery of the immanence of the concrete and immediate – a way to recover from a 'fundamental lapse of memory' on the part of Being itself[66] through an understanding of the meaning of individuation (the 'natal'[67] rather than being-towards-death). Mathesis treats of the nature of life anterior to philosophical reflection and scientific objectivity, that is to say before the cleavage between the subject and object of thought: it returns us to 'things-in-themselves in their wild state', the world of *concepts fauves*.

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[64] In *Desert Islands*,19-21.

[65] *Difference and Repetition*, 170. Deleuze's other 'occult' influence, the Polish messianist Hoëne Wronski, was also a mathematician, and defined a quite properly mathematical 'supreme law' which, unifying all mathematical functions and thus all scientific knowledge, was to provide the only possible opening to a true *mathesis universalis*. For a general account see P. d'Arcy, Hoëné-Wronski, une philosophie de la création (Paris, 1970); For a mathematical exposition see C. Phili, 'La loi supréme de Hoëné Wronski: La rencontre de la philosophie et des mathématiques', in E. Ausejo, & M. Hormigón (eds) *Paradigms and Mathematics* (Madrid: Siglo XXI de España Editores, 1996). More important to Deleuze, however, is Wronski's defence of a true (non-finitistic) mathematics of the infinitesimal (See A. Guerraggio & M.Panza, 'Le Réflexions di Carnot e le Contre-Réflexions di Wronski sul calculo infinitesimale' in *Epistemologia* 8:1, 1985:3-32). For it is on this point that Deleuze will take his stand against the divergence of mathematics from philosophy, in advocating a return to 'barbaric' or 'esoteric' interpretations of the calculus.

[66] 'Bergson, 1859-1941', in *Desert Islands and Other Texts*, 23.

In *Le désir de l'éternité*,[68] Alquié had founded human experience on an essential loss and nostalgia attendant upon our finitude, allowing as true philosophers only those who had the courage *not* to claim vainly to reestablish links with the infinite and the immortal (Spinoza, therefore, the ultimate enemy). Why, then, does Deleuze aver that he learnt the specificity of philosophy from Alquié?[69] Perhaps because he affirms Alquié's conception of philosophy as being linked with a fundamental encounter, whilst refusing the proposition that in this initiatory moment we meet the *inadequacy* of our finite thought: for Deleuze, to authentically encounter our 'mediocrity' or 'enfoldedness' is at the same time to discover the thread that can guide us back to infinite immanence: When we truly encounter that which can only be experienced from the point of view of our individuation, we also encounter a phosphorescent outside that no longer receives its status from elsewhere, and that is our true 'common measure'.[70] This, finally, is the meaning of

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[67] Deleuze, 'Mathesis', present volume, 152.

[68] Paris: PUF, 1943.

[69] 'The Method of Dramatization', in *Desert Islands*, 107.

[70] Since Deleuze's Malfatti not only reverses the cogito – ('sum, ergo cogito') but also introducing sexuation and reproduction into it ('sum, ergo genero') – this text evidently belongs to the period when 'there was still a specifiable relation between sexuality and metaphysics' (Deleuze, 'Questions', present volume, 40). The notion of the sexual act as the highest point of pre-reflexive existence, when the individual,

mathesis for Deleuze; all that is 'mystical' about it is that each must live it on their own account – in Alquié's words, *pour concevoir l'union, il faut le vivre*. We must initiate ourselves into the immanence of conscious complicity[71] – not, like Descartes, 'by means of ordinary life and conversation', but perhaps like Bergson, through a concentrated effort to reach 'the immediate data', guided by symbols-concepts.

It is a paradox that a philosopher who spoke out in the strongest terms against the history of philosophy as an oppressive institution[72] should demand, for a full understanding of their work, a formidable labour, precisely, in the history of philosophy – and not even just in philosophy, since from the start Deleuze drew upon eclectic resources. A difficulty facing the would-be student of Deleuze's works is that, considering this breadth along with the complicated conceptual modulations to which he subjects his sources, Deleuze seems simultaneously to demand and to repel close scholarly scrutiny. **John Sellars**, however, has had the courage to begin this work, specifically in exploring Deleuze's (and Deleuze/Guattari's) use of ancient

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the species, and nature itself are affirmed at once, is obliquely taken up in 1953's 'Instincts and Institutions' where the question of reflex, 'at the intersection of a double causality' leads to the question 'Useful for whom'? – See 'Instincts and Institutions', in *Desert Islands*, 20-1.

[71] Marie Madeleine Davy dedicated much study to the concept of 'initiation' (Moncelon, 5). Other echoes of Davy's doctrine of a 'pure experience of the presence of the divine which cannot be transmitted' (Moncelon, 3) can be found in Deleuze's work. For Davy, 'The liberatory awakening is achieved in the desert, *i.e.* in the country of thirst, of the reading of signs and of the encounter. The true encounter takes place within, and becomes experience. An inexpressible experience whose essence is unknowable' (*Ibid.*, 2). For a less apophatic but undoubtedly related understanding of the 'inner desert' as initiation in Deleuze, see 'The Shame and the Glory: T.E.Lawrence' in *Essays Critical and Clinical*, 115-25.

[72] See *Dialogues II*, 13.

sources. In thus calling Deleuze's bluff, he makes possible an intriguing glance behind the scenes, of a type that no amount of enthusiastic intra-Deleuzianism could yield.

In order to determine what transformations Deleuze exerts upon the supposedly Stoic theory of time advocated in *Logic of Sense*, Sellars compares Deleuze's exposition against that of the Stoic thinkers themselves. Now, Deleuze certainly never concealed the fact that he approached other philosophers, not with a view to representing them faithfully, but with a view to producing new 'monsters'. Accordingly, whatever cautions it may suggest to us regarding our reading of Deleuze, Sellars's article should not be read as a debunking 'exposé'. Rather, like Meillassoux's demonstration of the 'grafting' of Bergsonian onto Nietzschean selection, it exemplifies a 'stratigraphic' superposition in the 'ideal space' which, according to Deleuze, is characteristic of philosophy.[73] Explicitly-held doctrines are traced back into the problematics that spawned them, introducing a depth of field into the linear view of the history of philosophy. If, in the process, positions become attached to the 'wrong' names, it might well be said that this reveals the real, effective, process of doing philosophy: creative moments only arise out of such slippages and misalignments. That said, as a case study in Deleuze's 'ventriloquism' in the history of philosophy, Sellars's is certainly a cautionary tale: in the absence of research such as this, mere recitals or applications of theories such as 'the stoic theory of *Aiôn* and *Chronos*' will conspire against any possible estimation of the extent and nature of Deleuze's philosophical inventiveness.

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[73] *Dialogues II*, 16.

If Meillassoux proposed that we make the text 'not the *object*, but the *instrument* of the elucidation' of Deleuze's work,[74] **Mehrdad Iravanian**'s is an even more radical methodological proposal. Perhaps, in addition to drawing on his architectural practice, recalling the Islamic tradition according to which any 'text' that can be systematically extracted from the Koran belongs equally to the word of God,[75] Iravanian offers a development of Deleuze's thought in *The Fold* that owes absolutely nothing to external interpretative resources, but seeks an 'unknown Deleuze' through an approach at once graphic and truly 'literal', dealing with 'unread characters'.[76] This explication of Deleuze's book employs the text both as methodological programme and raw material for a transversal experiment in architectural ontology and impersonal memory.

Thomas Duzer's text 'In Memoriam' of Deleuze offers a concentrated survey passing through the major themes of our volume, and indeed of Deleuze's *oeuvre*, working backwards from the philosopher's dramatic exit from our world, over a decade ago now. In particular, Duzer sets out vigorously to defend Deleuze against Badiou's *post-mortem* critique, quite correctly refusing to cede to the conception of Deleuze as 'virtuoso phenomenologist'.

We have already mentioned the diversity of sources Deleuze drew upon in assembling his singular philosophy. In particular, the eclectic table of references in *Difference and Repetition* has only just begun to be mined for insights into the development of his thought. **J.-H. ROSNY**'s enchantingly weird SF tale 'Another World' sheds some light on one of the now-obscure authors cited therein.

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[74] Meillassoux, present volume, 65

[75] For instance, using the numerological system of ABJAD: See 'Incognitum's contribution to **Collapse** Vol I (Sept. 2006), 189-210

[76] Iravanian, present volume, 232.

Rosny discovers two necessary tendencies at work in life and in thought, corresponding to the 'two deaths' unveiled by Meillassoux,[77] or to *Anti-Oedipus*'s two poles of paranoia ('a growing simplification […] more and more abstract negative concepts […] pseudo-void')[78] and schizophrenia ('the mind is lost in the infinity of forms and actions').[79] We might draw a parallel also between Rosny's faith in scientific thought and the instinct for beauty, and Xenakis's affirmation that universality is achieved 'not through emotions or tradition, but through the sciences,' guided by the artist's intuition.[80] Duzer characterizes the Deleuzian break from truth-as-master-category as consisting precisely in such *experimentation*,[81] and Rosny, as will be seen in this tale, was the champion, above all, of experimentation.

In trying to identify the philosophical specificity of Deleuze, one name arises most often. It seems as if, in order to give Deleuze the proper philosophical status he deserves, the same must be done for Bergson, who – at least in the Anglo-American philosophical community – languishes on the sidelines, still apparently harbouring 'something that cannot be assimilated' to 'an image of thought called philosophy.'[82] Along with Deleuze's attempts, already in his early works, to recreate a true ('phosphorescent') Bergsonianism *against* the contemporary heralding of phenomenology as the arrival of a true (that is, corrected) Bergsonianism, we should mark Meillassoux's identification of a *differential* between Bergson and Deleuze: What is important in the relation Bergson-Deleuze is their *divergence*, what Deleuze *selects* from Bergson. And the extent to which, in making his selection, he sets out to become 'more Bergsonian than Bergson'. One could say this also of the other philosophers Deleuze encounters – is he not also 'more Kantian than Kant' in his pursuit of a transcendental philosophy and an immanent critique beyond the inherited philosophical categories which Kant desperately tried to re-erect within them? 'More Sartrean than Sartre' in selecting the pre-reflexive immanence of *The Transcendence of the Ego* as the master's singular moment, and setting out to preserve and prolong it? A supreme 'Leibnizian' in preserving the monadological *mathesis* but affirming the primacy of divergent series …? Every philosopher is the site of warring endeavours; Deleuze extracts what he considers the most powerful, the most revolutionary lines, and extends them as far as they will go (for example, in his 'selective reading' of *chronos* and *aiôn*). We certainly need, for example, a *critical* examination of Bergson, with an eye to what is irretrievably obsolete in his thought – but, as Meillassoux shows, Deleuze himself already carries out this operation: and in fact the shaping of Deleuze's philosophical assemblage often occurs when lines of argument selected from one influence limit those from another.[83]

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[77] Meillassoux, present volume, 102.

[78] Rosny, *Les sciences et le pluralisme* (Paris: Alcan, 1922), 4.

[79] *Ibid.*, 4

[80] Xenakis in Varga, *Conversations,* 47.

[81] Duzer, present volume, 249.

[82] *Dialogues II*, 15, 13.

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[83] We have seen above that the rethinking of *l'autrui* was a founding moment in Deleuze's formation, as the 'possible worlds' of Leibnizian perspectivism cut across Sartre's oppositional model. We would also indicate the important critique

Of course, we should not be afraid to do the same with Deleuze himself; to read him selectively would indeed be an apt task for a post-Deleuzian era. But in order to get to the stage where we can do so, we have to understand – or even better, reconstruct – the various dimensions of Deleuze's philosophical thought, paying attention to their interrelations and interdependencies. Another 'differential' appears to be key to this task: Thomas Duzer's article confirms that an examination of Deleuze's work would today be unthinkable without reference to Alain Badiou's *The Clamor of Being*. And the service Badiou's remarkable and provocative book has done to Deleuze consists in making it impossible for 'Deleuzianism' to remain a comfortable orthodoxy sheltered from all criticism and unprepared to define and defend its key concepts rigorously. There can be no doubt that the controversy – at once ontological, political and aesthetic – between Badiou's still-evolving work and the legacy of Deleuze's, will be an enduring one. But what counts is to ensure that it serves to deepen our appreciation of the complexity of the work of both thinkers, rather than betraying it through mutual caricature and partisanship. This means preserving the chances, not of a reconciliation, but of a fruitful confrontation.[84]

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of Bergson's critique of intensity (*Difference and Repetition* 239), on the basis of the Nietzschean requisites for a theory of force (See *Nietzsche and Philosophy*, 27 – Bergson's mistake was precisely to have 'invoked the rights of quality', confusing quality with the intensive and attributing to the former what belongs properly to the latter). The relevance to Alliez and Bonne's reading of Matisse should be obvious.

[84] Note that both Villani – a key protagonist in the initial, hostile reaction to Badiou's book in French Deleuzian circles – and Meillassoux – a former pupil of Badiou's (although by no means a 'disciple', since he has clearly defined an original philosophical project of his own) both end up, along with Badiou (but in very different ways) defining Deleuze's primary philosophical orientation as *ascetic*, whether (for Meillassoux) 'subtractive', or (for Villani) 'drastical'.

So what indeed, for instance, 'made [Deleuze] choose the word "life" as Being's main theme'? This is, as Badiou says, 'a real question'.[85] But here as elsewhere, the *bons mots* that have entered into circulation as convenient slogans for 'summing up' Deleuze have served his philosophy badly. '[N]ever write a single sentence which is not immediately a vitalist affirmation' – rather than abusing this as a confirmation for whatever tendency we have decided in advance to advocate or denigrate in Deleuze, it must be subjected to the kind of close scrutiny exemplified by the contributions to this volume.

We wager that as this is done, it will become evident that Deleuze's vitalism, rather than being a simple 'given', constitutes a central *problem* in his work. As Duzer hints, even in his death Deleuze morally distanced himself from a vitalism that would uphold the sanctity of life at all costs. The 'life' Deleuze speaks of is expressed in stranger, more hidden varieties: it has as much, if not more, in common with the 'life of music'[86] whose forms Xenakis dissected; the life of colour as explored in Matisse-thought[87] (or, indeed, the 'exemplary life of the soil' of Dubuffet's *texturologies*, or 'one of Pollock's lines');[88] the life of knowledge as evoked in Malfatti's *Mathesis*,[89] or the vitalism-structuralism of Rosny's structures of beauty or his evocation of the 'life of science'[90] – and even (affording a glimpse of one of those common inherited problems of Badiou and Deleuze) the 'life of mathematics' spoken of by Cavaillès and Lautman,[91] than with a vulgarised Bergsonian *élan vital.* Only once we understand the common thread that runs through these 'forms of life' will it be opportune to ask (but perhaps then the question will not seem so simple) whether this 'vitalism' can be salvaged from a philosophically fatal analogy with the biological animal. In short, if Deleuze's thought is a 'Fauvism' then it is one which, like Matisse's, owes nothing to a Romantic conception of expression valorising spontaneity and anarchical liberation.

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[85] A. Badiou, *Briefings on Existence: A Short Treatise on Transitory Ontology*, trans. N. Madarasz, NY: SUNY Press, 2006, 64.

[86] Haswell & Hecker, present volume, 114.

[87] Alliez, present volume, 212.

[88] *Dialogues II* (Preface to English Edition), viii.

[89] *Scientia vitae in vita scientiae* appears on the title page of the Malfatti volume – see present volume, 140, 143.

The contributors to this volume instead describe a life as the outcome of meticulous selections, a barricade against the infinitude of matter which nevertheless maintains a thread back to that infinitude. And a subject which – far from preceding and governing what is perceived, 'belongs wholly to matter'.[92] Given the equal importance for Deleuze of the problems of the withdrawal from flux, of actualization, and of construction, his metaphysics cannot be reduced to a quasi-religious valorization of the virtual. The virtual, the 'dream',[93] will always lack reality, which belongs to the 'inclusive disjunction of the actual and the virtual'[94] and their mutual interplay.[95]

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[90] 'Just as the syntheses, the orientations, the repetitions of the organism, have not resulted in uniformity (the living being is more and more differentiated), so the syntheses, the orientations, the repetitions of science do not have homogeneity as their outcome.' *Les sciences et le pluralisme*, 7.

[91] It is surprising to see such a phrase in the work of such a reputedly 'severe' philosopher. For Cavaillès, it seems, this mathematical life was nurtured through a series of 'gestures' which transformed previous thoughts into the objects of a new thought, gestures which he set out to describe and classify. (See the 1939 discussion between Lautman and Cavaillès in 'La pensée mathématique', *Bulletin de la Société française de philosophie*, 40 (1939), 1-39; reprinted in Jean Cavaillès *Oeuvres Complètes de Philosophie des Sciences* (Paris:Hermann, 1994), 593-630.

Along with Brunschvicg's 'Mathematical Philosophy', French *epistémologie* was also animated, albeit unavowedly, by the Bergsonian theme of the primacy of the problematic (see E. During '"A History of Problems": Bergson and the French Epistemological Tradition', *Journal of the British Society for Phenomenology*, vol. 35 no. 1, January 2005). More fruitful, therefore, than betraying it by making it the object of an exclusive dialectical choice between philosophers of 'life' and those of 'the concept' (See Badiou, 'The Adventure of French Philosophy', *New Left Review* 35, Sept.-Oct. 2005), would be to explore as a singular formation this vigorous philosophical movement founded on the practice of interrogating science in its becoming rather than as stockpile of knowledge (for such an approach, see Frédéric Worms 'Between Critique and Metaphysics' in *Angelaki* 10:2 (Aug. 2005):39-57).

Yes, Deleuze's thought unfolds within the element of philosophy, it is *a philosophy*[96] in the grandest and most speculative sense: a genetic structuralism, a transcendental empiricism, an abstract vitalism, an ethics as 'knowledge of life and life of knowledge';[97] but above all it develops the logic of multiplicities[98] required to describe – within a pure immanence, infinitely implicated, shaped by problem-ideas or nested series of differences – the constructive-expressive actualisation of a singularity through partial, local cut-outs integrated to make a whole, a new, singular and dynamic point of view, a life.

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[92] Meillassoux, present volume, 75.

[93] Villani, present volume, 50.

[94] *Ibid.*, 51.

[95] It seems equally mistaken to think the relation as one of irreversible emanation from virtual to actual, or of spiritual ascent from actual to virtual: Deleuze speaks of 'virtuals' and 'the actual particles by which they are *both emitted and absorbed*' ('The Actual and the Virtual', *Dialogues II*, 112; italics ours; *Cf.* the important concept of 'miraculation' in *Anti-Oedipus*, 12-3.

[96] See Duzer, present volume, 250-1.

[97] Deleuze, 'Mathesis', present volume, 147.

[98] Whilst Badiou tells us simply that 'Deleuze despised logic' (A. Badiou, *Briefings on Existence: A Short Treatise on Transitory Ontology*, trans. N. Madarasz, NY: SUNY Press, 2006, 122). Deleuze displaces it into an empiricist *mathesis universalis*: 'logic does not interest us, either everything is logical or nothing is' ('Capitalism and Schizophrenia' in *Desert Islands*, 2004 *XX*) yet 'empiricism is fundamentally linked to a logic of multiplicities' (*Dialogues II*, 'Preface to English Edition', viii).

We do not claim to have presented in this volume a definitive and complete account, but instead a series of cut-outs, a kind of collage, or a transversal selection of elements, towards an 'all-over' portrait of Gilles Deleuze. As the contributors demonstrate – something that is often missed when theorists seek to make use of one or another of Deleuze's concepts – Deleuze is a philosopher whose thought is at its most powerful when concentrated, grasped as a whole, even if at those rare moments when we manage to do so – when 'all parts have found their definitive relations'[99] – we are all too aware that it will once again escape us. This, after all, is the measure of the complex action of a philosopher's thought, which must therefore be 'creatively limited'[100] in order to be prolonged. We intended to make possible some such moments of concentration, some such creative selections.

We would like to end by expressing our sincere gratitude to all of our contributors, who have given freely of their work and of their time, in what has once again been a truly collaborative process. The assembly of this volume has proved the most challenging yet, but, as we hope to have indicated in this brief survey, in the making it has become far more than the sum of its parts.

Robin Mackay

Falmouth, October 2007.

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[99] Alliez & Bonne, present volume, 218

[100] *A Thousand Plateaus* 344-5; See present volume, 116.

In Memoriam: Gilles Deleuze (1925-1995)

Thomas Duzer

> Between the intensive and thought, it is always by means of an intensity that thought comes to us.
> (Deleuze, *Difference and Repetition*)

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> Young man, do not incriminate the gods!
> (Sartre, *The Flies*)

On 4th November 1995, Gilles Deleuze committed suicide by throwing himself from the window of his Paris apartment. He was 70 years old. In 1969, after having completed his major thesis (later published as *Difference and Repetition*), he was rushed to hospital, and diagnosed with tuberculosis; emergency pulmonary surgery immediately followed. With the passing years his health slowly deteriorated, and by the end of his life, he was dependent upon a machine: an artificial respirator.

Obviously, the question of Gilles Deleuze's suicide remains a problem which can quite properly be considered as a part of his philosophy. Indeed, by overstepping

Spinoza's prohibition, he would choose to withdraw from the scene at his own chosen moment. Ultimately it was stoicism that the vitalist philosopher chose, faced with the compounded forces which had appropriated the extensive parts subsumed under his modal essence. But perhaps these are not the best terms in which to pose the question of the ultimate meaning of his philosophy. Didn't Deleuze's thesis director, Maurice de Gandillac, emphasise his student's visceral Nietzscheanism and keen interest in Diogenes Laertius's doxographies? From the moment he began his studies at the Sorbonne, behind each philosophical system Deleuze sought the philosopher as individual: Which body? Which thought? Every philosophy is a vital and affective evaluation, an animal perspective, and a theoretical bringing-into-engagement. Every philosophy is the theory of a practice, or the systematization of an immanent way of living, of *a singularity*: For Deleuze, *every ethics is the correlative of an ontology*. In this, he is absolutely Spinozist.

This is the secret centre of the long and patient years he dedicated to the history of philosophy. In his early monographs, Deleuze does not interrogate a philosophy so much as a philosopher – which explains the strange character of these works. For in reading them, one becomes aware that, although there is no doubt that the Deleuzian commentary concerns the same author treated in classical erudite tradition, a sort of rupture is always in evidence, a sort of *Unheimlichkeit* and a problematisation that is difficult to situate. But this is so only in so far as one attempts to locate the Deleuzian reading within the perspective of a classical history of philosophy, whose logic of exposition is that of a chronological procession of concepts and systems.

For his part, Deleuze preferred to refer to a time that he called 'stratigraphic.'[1] It is certainly important that philosophies succeed one another in time. Nevertheless, these philosophies are *virtually* coexistent. Every philosophy is *virtually* contemporary with every other, even if certain logics creep into those that preceded them, and certain concepts are reclaimed in their original form. Thus, *in the present*, every system of ethics rivals every other, since, *in reality*, all logics are in non-dialectical conflict with each other. More precisely, according to Deleuze, any philosopher worthy of the name – that is to say, any philosopher-creator – traces out a plane within chaos. For concepts are born of thought's confrontation with chaos. Or, in other words: concepts must be *created*. They are dated and signed, even if later philosophers must divert them from their original function, hijacking their components and their flows. This means that every new plane, if it is to inaugurate a truly new philosophy, even if it should have originated from an anterior plane, must distinguish itself from and find its own autonomy from the latter. But how? Most fundamentally, it is through assuming his own problematics – even if these problematics are not explicitly thematized – that the philosopher has a chance of tracing such a plane. And, on this plane, a new consistency may be given to chaos, by means of the singular creation of the arsenal of connected concepts that populate it. For Deleuze, the style *is* the philosopher.

And it is from somewhere close to this *active centre* of Deleuze's philosophy that Badiou's attack seeks to draw its force. With an incisive gesture, Badiou takes Deleuze's *continuous variation*, a major element in his philosophy and his style alike, and annexes it to one of his enemy constellations: *phenomenology*.[2] This judgement may seem reasonable at first, but on further consideration becomes absurd. For Deleuze declares, as a Spinozist, his hostility towards all philosophies of the *Cogito*. Clearly, for him, there is no subject.[3] Every philosophy that concedes any legitimacy to the Ego is anathematised. Even the non-thetic[4] *Cogito* of

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[1] See *What is Philosophy?* and also the distinction between *Aiôn* and *Chronos* in *Logic of Sense*.

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[2] A. Badiou, *Deleuze: The Clamor of Being*, trans. L. Burchill. Minneapolis: Minnesota University Press, 1999.

[3] The critique of the Subject has been a *topos* in post-Cartesian philosophy ever since the *Objections to the Metaphysical Meditations*. However, after the Humean episode, it was generalized following Mach and Nietzsche, who, as a matter of fact, later spawned two divergent philosophical tendencies. Similarly, psychoanalysis profoundly modified the notion of the subject through the notion of the unconscious; Heidegger, having broken away from Husserlian phenomenology founded on Kant's inherited and enhanced *Cogito*, replaced the classical and transcendental subject with *Dasein*. The list of subjectivity's detractors in the twentieth century is certainly a long one. Nevertheless, the notion, although drastically modified at times, was never abandoned. But Deleuze affirms in a 1988 interview entitled *Signs and Events* that there is 'no subject [...] there are only processes, sometimes unifying, subjectifying, rationalising, but just processes all the same.' (*Negotiations*, 145). Undeniably, from *Empiricism and Subjectivity* onward, Deleuze asked, through the works of Hume, whether or not subjectivity is constituted within the given, within the 'flux of the sensible'. It seems, in fact, that the critique of subjectivity comprises a guiding thread in Deleuze's *oeuvre*. As a question it certainly intersects with his major problems and concepts, and turns out to be one their conditions of possibility: desire, multiplicity, BwO, 'to be done with judgement,' plane of immanence, and domain of transcendence ... But this critique cannot be reduced to a simple questioning of the subject. Deleuze promotes another type of individuation, a 'non-personal individuation', *haecceities* and singularities. The construction of these concepts intersects and enriches the problematics of other philosophers such as Foucault, Klossowski, Blanchot, or Artaud amongst others. With the help of Guattari, moreover, this construction opposes psychoanalysis in order to substitute a machinic unconscious for a theatrical unconscious. In short: 'there is no longer a subject, but only individuating affective states of an anonymous force.' ('Spinoza and Us,' in *Spinoza: Practical Philosophy*, 128).

[4] For Sartre, consciousness, being spontaneous, is effected within a 'prereflexive *cogito*,' unlike a cognition that implicates the object-subject couple; *conscientia* is not

Sartre, Deleuze's admired *maître*,[5] is rejected. What does this mean? All philosophy that claims to found itself on the central positing of an *Ego* plainly privileges substance over process. Why reject this? Because it is the triumph of reactivity. It is apparent that what makes a rhizome of the postwar Nietzscheans is ultimately a reading of Kant's Copernican revolution as *reactionary* – making the object turn around the subject changes the order, but *not the places*.[6] If the Ego, the World, and God are transcendental illusions of theoretical reason, they remain regulative ideals and, as noumena (objects of thought and not of knowledge), lose none of their force and pertinence in Kant's philosophy, at the heart of practical reason. Whereas, on the contrary, the Nietzschean revolution leads thought into an *a*subjective becoming: a comet-thought, the wandering star whose variations in speed and whose creativity constitute its coherence.

Thus, Badiou describes Deleuze's conceptual creations as virtuoso *phenomenological* apparati. His philosophy, especially when 'machined' with that of Guattari, will be ultimately monotone and repetitive. But this reading of Deleuze *fails*, in the sense that one might say of an encounter that it failed. For as we well know, one must refrain from suggesting some sort of general falsification of Deleuze

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cum scientia. Such a prereflexive *Cogito* therefore insists on a presence-to-self that is immanent and anterior to the 'return to self' engendered by reflection. Consciousness is 'to be for oneself' and refuses to settle as object: it is non-thetic.

[5] 'He Was my Teacher', in *Desert Islands and Other Texts*, 77-81.

[6] This is a strictly structuralist discovery: the symbolic – implying that in a structure, the position, the place, is primary with regard to that which occupies it. See 'How Do We Recognise Structuralism?' in *Desert Islands*, 170-92.

on Badiou's part.[7] Indeed – and the sly Badiou certainly knows how to remind orthodox Deleuzians of this – for a Nietzschean, the distinction between the true and the false never makes for a strong argument. In fact, Deleuze always favored the problematic of stupidity over that of error – that is to say, that of sense over that of truth. This is a corollary of the destitution of substance in favour of process. One of its consequences is the absolute rejection of a foundational subject or, as we have already seen, of any *Cogito*, whether it be Cartesian or Kantian, or indeed any analytic of *Dasein*. Deleuze's principal weapon against stupidity naturally turns out not to be a Heideggerian anti-humanism – which continues to concede rather too much to its opposite, even if only in order to situate itself, in Hegelian manner – but rather a strict *inhumanism*. At this point, Artaud is convoked as schizophrenic, *i.e.,* practitioner of the theory. For this is exactly what interests Deleuze so deeply about schizophrenia: that intensities are consumed *directly*. Thought articulates itself upon the body as its obverse and reverse. Within this intensive machinism, the 'Theatre of Cruelty' reveals the factories of the unconscious. Presentation is presented in its purity, without the mediation of representation: *incarnation* replaces identification and recognition.[8]

Truth and error, both structures of recognition, are merely the result of the correspondence or non-correspondence of a given case with a rule. On this point it is essential to note that to consider, as Deleuze did, that truth[9] is not an 'interesting' category doesn't indicate that it is refused wholesale, but rather that it is ratified but *not made sacred*.[10] To deny or to affirm a proposition implies that this is done according to truth, and thus according to eternity. Nevertheless, in the 'power of the false', as endorsed by Nietzsche, for example, there is something more than a simple negation of truth. *Anti-dialectically* speaking, affirmation cannot result from the negation of a negation. And this is why the problem of stupidity and consequently, that of the remarkable, the interesting, the singular, and the novel, are *transcendental*. For, following Bergson, it is a question of applying the test of truth and falsity to the problems themselves. Here, not only are the rule itself and its legitimacy interrogated, they are *experimented* with – it becomes necessary to ask not just 'what the principles are, but what they do'.[11] Thus, morality, together with the substantialisms of the Same, is abandoned in order to constitute an ethics, as experimental and processual science. In the wake of William James and American pragmatism, Deleuze proposes a *transcendental empiricism*, which can be expanded into a cartography of intensities conceived as *patchwork*, *computation*, and non-diplomatic immunity.[12] Consequently, if, as Littré says, truth is 'the quality by which things appear as they are,' then we can affirm that a transcendental empiricism is the activity through which beings *become* what they are.[13] It has been possible to paint Deleuze, as does Mattéi,[14] as contemptuous toward the *archê*, the Father, or the Master, but it is the One he adamantly challenges, in favour of a pluralist philosophy (the power of the indefinite article – *an* archê, *a* Father, *a* Master ...) Following Nietzsche's example, then, it is Platonism, but Platonism *qua* inherited philosophy, that he seeks to invert: To reject, not Plato as creator, but Plato as leader of a school, father of the *Diadochi*; to challenge the principle of succession which Plato made possible by positing the created concept as increate Idea. Thus it is not at all a question of indifferentiation, or a nihilist principle of abolition, as Mattéi maintains. Indeed, as Badiou himself recalls, 'contrary to all egalitarian or "communitarian" norms, Deleuze's conception of thought is profoundly aristocratic.'[15] Thus, Deleuze chooses the 'Platonism of encounters'[16] over that of the 'Good beyond Being'.

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[7] See, for example, the diverse receptions of Badiou's *Deleuze* in the review *Multitudes* (*formerly Futur Antérieur*).

[8] Schizoanalysis does not make 'points,' but 'lines' ('On *A Thousand Plateaus*', in *Negotiations*, 33); it is closer to Bacon's pictorial experiments and therefore closer to 'meat' than to the 'flesh' invoked by phenomenology.

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[9] For Deleuze, the distinction Badiou makes between truth (*vérité*) and the veridical (*véridicité*) does not exist. For truths are confined to the domain of knowledge (*savoir*) and do not harbour an evental dimension as they do in Badiou's philosophy.

[10] 'There are imbecile thoughts, imbecile discourses, that are made up entirely of truths [...]' *Nietzsche and Philosophy*, 105.

[11] *Dialogues II*.

[12] See T. Duzer, 'On the Mathematics of Intensity: A Logic of Self-Belonging', in *Collapse* Volume 1, 245-60.

The statement is clear: *the given is constructed.* No 'innate opinion', no phenomenological *Urdoxa. The Deleuzian philosophy is neither a sophistics,*[17] *nor a phenomenology; it is a*

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[13] Knowing that, as Badiou said, interpreting Pindar, 'we are only that which we become' (A. Badiou, *Briefings on Existence: A Short Treatise on Transitory Ontology*, trans. N. Madarasz, NY: SUNY Press, 2006, 68).

[14] J.-F. Mattéi, *L'étranger et le simulacre: essai sur la fondation de l'ontologie platonicienne*. Paris: PUF, 1983.

[15] A. Badiou, *Deleuze*, *op.cit.,* 11.

[16] I owe this expression to Guillaume Destivère. Further, he adds: 'from this point of view, [Deleuze] has preempted Badiou, "the intermediary of encounters with truths", on all fronts. And Badiou knows it.' (personal correspondence).

[17] Indeed, we should note that if the sophists insist on the question of nature, convention, and the concrete, it is Parmenides himself that reminds the young

philosophy. The Badiousian stratagem backfires, for Deleuze is truly Spinozist. Philosopher *sans Cogito*, he is also a philosopher of the concept, which is to say a para-*doxa*-cal philosopher. In this, he is a philosopher of complete freedom, meaning absolute necessity and power. On this point, the Stoic and the Spinozist, quite coherently and logically, are as one – *as ethicists*. So that Deleuze, this considerable contemporary, himself finds a place in the subterranean and volcanic line of rare philosophers who are irreducible to the official history of philosophy. *A life* – 'It is at this mobile and precise point, where all events gather together in one that transmutation happens: this is the point at which death turns against death; where dying is the negation of death, and the impersonality of dying no longer indicates only the moment when I disappear outside of myself, but rather the moment when death loses itself in itself, and also the figure which the most singular life takes on in order to substitute itself for me.'[18]

This is why there is nothing but the nomad.[19] That which 'deterritorializes,' crosses boundaries, goes beyond limits in order to go to the end of its powers, which distributes and is distributed in a smooth space. It is that which, because it is a pure multiple, *consists* and thus cannot be

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Socrates of the rights of hair, dirt, and mud to benefit from an appropriate Idea.

[18] *Logic of Sense*, 173-4.

[19] The nomad, who, although quite capable of austerity, is *desiring*, and thus certainly does not pursue the ascetic ideal stigmatised by Nietzsche.

subdivided.[20] We could call 'nomad's checkmate'[21] the move that Bergson's Riemannian disciple intuitively pulled off against Badiou,[22] the ex-Maoist turned Platonist. From *Theory of the Subject* to *Being and Event* to *Logics of Worlds,* Badiou refuses to abandon a non-phenomenological concept of the subject, inspired by Lacan, but brought together with post-Cantorian mathematical set theory as well as category theory. We must distinguish between conceptual personae here: the preeminence of the nomothete[23] over the judge is the preeminence of the one who constitutes over the one who is constituted. In passing from the former to the latter, something is lost. The distinction is neither dialectical nor logical; it is *ethical.* For joy differs, absolutely, from sadness, power from helplessness. He who gives the rule is free, while he who judges *according* to the rule is free only through the mediation of the rule which constitutes him, and through servitude to the rule he institutes. Such is the meaning of this heterological representative operation: For the hot cruelty of the theatre lauded by Artaud, and for crowned anarchy, is substituted the internal coldness of the world of Masoch, who, *aparallel* and heterogeneous to sadism, establishes a suspension of the law of the institution, by means of the contract. Which can be summed up thus: pleasure is the benchmark of *a desire that lacks nothing* since, according to the classic axiom and the Parmenidean (which is to say pre-anti-Platonic) legacy, *nothingness has no properties.*

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[20] Here, the psychoanalytic *Ichspaltung* and Lacan's divided subject are to be contrasted with Artaud's BwO, the Deleuzian planomenon, or the intensive multiplicity posited by Bergson, which differs from extensive multiplicity (divisible *partes extra partes*); being 'defined by the number of dimensions it has […] it cannot lose or gain a dimension *without changing its nature*. Since its variations and dimensions are immanent to it, *it amounts to the same thing to say that each multiplicity is already composed of heterogeneous terms in symbiosis, and that a multiplicity is continually transforming itself into a string of other multiplicities* […]" (*A Thousand Plateaus*, 249).

[21] 'Nomad's mate' (*mat du nomade*) alludes to – and contrasts with – the 'Shepherd's mate' (*mat du berger*), a chess move known in English as the 'Scholar's mate'.

[22] Indeed, for Bergson, it is within intuition that the absolute is given. If it is not a question of *intellectual* intuition, which Kant refused Plato, neither is it a question of sensible intuition. It is more a matter of *metaphysical* intuition, which is not an intuition of immutable essences or simple phenomena. Instead, it is the intuition of pure duration conceived as indivisible time and considered as *in-itself*, given that 'reality is mobility itself.'

[23] 'The philosopher […] is legislator.' 'Nietzsche', in Deleuze, *Pure Immanence*, 66.

In conclusion, if effects of transcendence do indeed occur, it is only qua denaturing of pure immanence, a denaturing whose frequency gives the exact measure of the rarity Badiou attributes to the event. For it is a commonplace that the conflict between Deleuze and Badiou's philosophies lies essentially in their respective articulation of the concepts of the whole [*tout*] and of the set; at least, this is the ambiguous *postmortem* angle of attack taken up by Badiou, holed up in the citadel of set theory.[24] If Kant makes of totality a category of understanding (under the rubric of quantity) and presents it as a synthesis of unity and plurality, for him it will consequently be a question of a principle of closure. For such a synthesis forecloses plurality, that is to say it makes it a whole through the mediation of unity. Deleuze, on the contrary, defines the 'whole […] through relation' specifying further that relation is 'not a property of objects.' The relation is 'exterior to its terms',[25] and belongs to the 'whole' on condition that the whole is thought in an exceptional way, *i.e.* not as quantity, but as *continuum*, as an indivisible continuity[26] like a 'thread' that connects sets and keeps them open. Thus it is a question of a *nomadological autonomisation of the relation*,[27] a process which consitutes the originality of Deleuzian ontology,[28] and not a mere devaluation of the 'closed,' as Badiou would have it. The latter asks: Which infinity? Which multiplicity?[29] Deleuze, however, has already responded: not with the One-All, as the master mathematician of the rue d'Ulm affirms, but with *a* multiplicity, the whole as 'paradoxical link',[30] the event as 'lightning'.[31]

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[24] However, the brief note dedicated to *Being and Event* in *What is Philosophy?* (151-2) seems almost to justify such an attack.

[25] *Cinema 1: The Movement-Image*, 10.

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[26] 'The real whole might well be, we conceive, an indivisible continuity' (H. Bergson, *Creative Evolution*, trans. A. Mitchell, NY: Dover, 1998).

[27] A relation that, as we have seen, is external to the terms that effectuate it (and which thus *become* through the relation's intervention). Therefore, the relation is not a correlation, but rather constitutes the properly Deleuzian absolute; the relation not as being or necessary essence, but as event, or in Nietzschean terms, as '*Himmel Zufall*.' In particular, it is of course not easily assimilated to the 'count-as-one' of set-theoretical belonging.

[28] More so, in fact, than the primacy Deleuze grants to Life, or even to Difference (which he declares, during the period of *Difference and Repetition*, is 'in the air of the times'), particularly through the notion of the structuralist-inspired 'differential relation'.

[29] A. Badiou, 'One, Multiple, Multiplicities' in R. Brassier and A. Toscano (eds., trans.) *Theoretical Writings* (London: Continuum, 2006), 67-80.

[30] *Cinema 1: The Movement-Image*, 11.

[31] See for example: L'*Abécédaire de Gilles Deleuze* (Éditions Montparnasse DVD, 1996), 'Z comme Zigzag' [see C. Stivale's summary at http://www.langlab.wayne.edu/CStivale/D-G/ABC3.html], or the theory of the 'dispars' in *Difference and Repetition*.

Responses to a Series of Questions[1]

Gilles Deleuze

Arnaud Villani: Are you a 'monster'?

Gilles Deleuze: To be a monster is first of all to be composite. And it's true that I have written on apparently diverse subjects. But 'monster' has another meaning: something or someone whose extreme determinacy allows the indeterminate wholly to subsist (for example a monster à la Goya). In this sense, thought itself is a monster.

AV: *Physis* seems to play an important role in your work.

GD: You're right, I believe that I turn around a certain idea of Nature, but I have not yet arrived at considering this notion directly.

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[1] This exchange between Arnaud Villani and Gilles Deleuze took place in November 1981, and appeared in A. Villani, *La guêpe et l'orchidée* (Paris: Belin, 1999), 129-31.

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AV: Can we call you a 'sophist' in a positive sense – has the *antilogos* returned, despite Plato's attack on the Sophists?

GD: No. For me the *antilogos* is connected less with the tricks of the Sophist than with Proust's 'involuntary'.

AV: Thought is 'spermatic' in your work. Is there a clear relation, in this sense, with sexuality?

GD: That was the case up until *Logic of Sense*, where there was still a specifiable relation between sexuality and metaphysics. Afterwards sexuality seemed to me rather to be a badly-founded abstraction.

AV: Could we trace your evolution in terms of syntheses?

GD: I see my evolution otherwise. You know the 'Letter to a Harsh Critic':[2] that's where I explain my evolution as I see it.

AV: Thought as provocation and adventure?

GD: In what I have written, I believe strongly in this problem of the image of thought and of a thought liberated from the image. It's already in *Difference and Repetition*, but also in *Proust and Signs*, and again in *A Thousand Plateaus*.

AV: You have an ability to find, despite everything and everyone, true problems.

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[2] *Negotiations*, 3-12.

GD: If that's true, it's because I believe in the necessity of constructing a concept of the problem. I tried to do so in *Difference and Repetition* and would like to take up this question again. But practically speaking, this approach has led me to ask, in each case, how a problem might be posed. It is in this manner, it seems to me, that philosophy might be considered a science: the science of determining the conditions of a problem.

AV: Is there a beginning of a rhizome Deleuze-Guattari-Foucault-Lyotard-Klossowski-etc.?

GD: That could have happened, but it didn't happen. In fact, there is just a rhizome between Félix and myself.

AV: The conclusion of *A Thousand Plateaus* consists in a topological model which is radically original in philosophy. Is it transposable into mathematics, biology?

GD: To my mind, the conclusion of *A Thousand Plateaus* is a table of categories (but an incomplete, insufficient one). Not in the style of Kant, but in the style of Whitehead. So that 'category' takes on a new, very special sense. I would like to work more on this point. You ask if a mathematical or biological transposition is possible. No doubt it is the other way around: I feel that I am Bergsonian – when Bergson says that modern science has not found its metaphysics, the metaphysics it needs. It is that metaphysics that interests me.

AV: Could it be said that a love of life, in all its frightening complexity, has informed your work all along?

GD: Yes. This is what disgusts me, in theory as in practice – every type of complaint in regard of life, every tragic culture, that is to say, neuroses. I really can't stand neuroses.

AV: Are you a non-metaphysical philosopher?

GD: No, I feel I am a pure metaphysician.

AV: In your view, can a century be Deleuzian, light? Or else are you a pessimist as to the possibility of our being delivered from identity and the power of traces?

GD: No, I'm not at all pessimistic since I don't believe in the irreversibility of situations. Take the current catastrophic state of literature and thought. To me, that doesn't seem grave for the future.

AV: And after *A Thousand Plateaus*?

GD: I just finished a book on Francis Bacon, and have only two other projects: one on 'Thought and Cinema' and another which will be a large book on 'What is Philosophy' (taking up the problem of categories).

AV: The world is double, macrophysical (where the image of thought works well enough) and microphysical (and your model, years after the same revolution in science, in art, takes account of this in philosophy). Is there a polemical relation between these two points of view?

GD: The distinction between macro and micro is very important, but it belongs more to Félix than myself. For me, it's more the distinction between two types of multiplicities. This is what is essential for me: that one of these two types refers to micro-multiplicities is only a secondary consequence. For the problem of thought, just as for the sciences, the notion of multiplicity, as introduced by Riemann, seems to me more important than that of microphysics.

'I Feel I am a Pure Metaphysician': The Consequences of Deleuze's Affirmation

Arnaud Villani

I have often noted the remarkable extent to which, since 1981, this affirmation[1] has transformed the major axes of my interpretation of Deleuze. And for good reason: In an anti-metaphysical epoch wholly occupied, in Heidegger's wake, with 'overcoming metaphysics as one overcomes tears', here is a philosopher who dares to affirm his filiation with Bergson and Whitehead. It is important first of all not to doubt the sincerity of his remarks, and this against the tendency (Cressole, Badiou) that would attribute to Deleuze postures devised primarily with a view to the effects his words would have upon his students. Furthermore, it is important explicitly to draw out their consequences for his philosophy, and then for philosophy as a whole. This is what I propose to do here.

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[1] See present volume, 42.

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To understand what is at stake in this formula, we must reprise the problem of the moral and the political. In *Précis de philosophie nue*,[2] I tried to develop the hypothesis of a sort of immanent eternity, an eternity of this earthly life, in so far as every second of a person's life, properly scrutinised, offers, both in sensibility (the senses, sensuality, the passions) and in thought, a kind of infinite opening. Sensoriality (affectivity) and thought are hypercomplex spaces, given over to the infinite. Nothing limits them, either in space or in time, and not only because they often unfold outside space and time. We could, in very classical terms, call the first sphere 'aesthetic', the second 'noetic'. It might be thought that this infinity (so keenly felt in the descriptions of Virginia Woolf, James Joyce, and in Roussel's *La vue*) owes to the fact that the given, offering something upon which to nourish and develop sensibility, passion and thought, never really constitutes an obstacle for them. It is not the *subject* of these domains, but rather their *object.* When we consider the practical sphere, on the other hand, the status of the external given is inverted. It becomes all-powerful, authoritarian, inflexible. Not without reason do we speak of 'brute fact'. And the whole problem of the practical sphere consists in circumventing this resistance, in coming to terms with it or accommodating it, or most often in vanquishing it as one does an enemy.

Therefore the practical sphere better deserves the name of 'drastical'. This is the name I will reserve for it, considering, apart from the sense of the verb *dran* in Greek (to act), that the complexity that characterises the first two spheres must, in the act and in the 'decision' that precedes it, be *firmly, pitilessly restrained in order to become effective*. But is not such a restriction also to be found in sensibility (as was understood by Bergson, for whom the colour red was the 'summary' of trillions of vibrations per second), and even in thought, since all noetic activity is subject from the very beginning to the severe limitation of the terms in which it is developed? For to think without language is impossible; and words, by themselves, apart from their relations with others, are never susceptible to *infinite* modifications, nuances or distinctions.

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[2] Nice: Éditions de la revue NU(e), 2005.

Certainly, sensibility and thought must be entrusted to a language in order to become effective (*wirklich* – it is the spirit of this word which commands Hegel to eject from the dialectic the crazy riches of 'sense-certainty' and its appearances, incapable of being *spoken*). But the proof that these two domains harbour an open infinity is the eagerness exhibited by totalitarian systems in trying to check them. Whereas the practical consists essentially in a *choice*, in a *drastic reduction of complexity*, a gesture that could be likened to that of Procrustes, when he stretched or sliced travellers to make them fit his bed. To choose is to endow one's act with a meaning, by depriving it deliberately of that which one does not choose. Thus political choice, moral choice (Hercules before the roads of vice and virtue), the choice of a unique method in the domain of technique and science. The anguish of choice is the *angustiae*, the narrow defile through which we must pass.

I will provisionally make the following remark: If Deleuze is able to convince a neophyte from the word go of the considerable importance of his philosophy with regard to questions of art and to all that pertains to sensibility, affect, a 'new image of thought', his work poses redoubtable problems of interpretation when one considers its ethical and political leanings. Since up until now its most profound basis has not been interrogated, this difficulty has engendered lines of argument as erroneous as can be, interpretations which literally invert the Deleuzian philosophy and contradict its most frequently affirmed and reiterated postulates. All of which should be a first warning for us: we must not take lightly Deleuze's affirmation of a metaphysics. It concerns his whole philosophy. In other words, it invites us to rethink in a new light, in this great philosopher of freedom, the relations between sensibility, thought and action. And in particular, to consider the reasons why – as might also have been the case with Nietzsche's 'great politics' – the work of a very great philosopher for whom the infinite in thought and in the senses were always of the first importance, seems to end up with apparently fugitive arguments, or *prima facie* disappointing solutions, in the domains of the moral and the political.

CONSTRUCTING A MODEL OF COMPLEX ACTION

Let it be understood: it is not a matter here of developing a gnoseology of complexity – although it could indeed be said that the latter is a feature of Deleuze's philosophy, in the use he makes of Bergson or Leibniz, and in the theory of *multiplicity*, *rhizome* or *chaosmos*. But for us, from now on, it will rather be a question of understanding the *severance* which, it is said, separates the sensible and intelligible spheres from that of action. Sensibility has no limits, thought can go to infinity, without even speaking of the relations of sensorial sensibility to the sensibility of sentiments, of the relations of sensations between themselves, of relations between all thoughts, and finally of relations between the two spheres. But the *acts* which they permit (and which permit them) rest upon the *decision* (trenchant by definition) to refuse the infinite. Now, the metaphor for the act has remained unchanged since the 'epactic discourse' attributed to Socrates.[3] *Agô* for a horse-breeder, is 'to make the heads of cattle advance by driving them before oneself, to make them pass, one by one, from the dispersion of the pasture into the confinement [denumerable, and this is even probably the moment of the invention of numbers] of the enclosure'. *Agô*, which is found in our 'action', always has a drastic aspect. It abbreviates a natural complexity into a cultural simplicity.

For the choice to be a choice, it must restrict the field, it must effect a passage from a volume to a surface, from a surface to a line, from a line to a point. But let us admit that complexity can be compacted or abbreviated into a point without being lost (the thematic of naturing-nature) and that once the eye, the sluice, the threshold, is passed, it will redeploy itself by *spacing itself out*, by once again taking on volume. Let us admit then that choice will no longer be a matter of fleeing complexity or of making 'difference expire', and refuse to harden *airêsis* (the differing choice) into an unpardonable heresy, or the divergent political position into a one-way ticket to the scaffold or the gulag. Would this not then be a fine genealogy for the Deleuzian theory of *inclusive disjunction*?

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[3] The epactic model of discourse (as in Plato's *epaktikoi logoi*) insists upon an ascent to the absolute definition of concepts before discussion commences – hence the Platonic quest for the Idea. But the original sense of the Greek verb *épagô* is 'to drive a herd before one', in other words to make a diversity of dispersed animals pass into the unity of an assembled herd in the enclosure.

The model that I put forward borrows from Bergson, in pursuing his intuition. It is that of the *double cone*: The problem of action, whether political or moral, is visibly concentrated at the 'bottleneck' through which the content of the first cone passes into the second – the image of the hourglass. Now, precisely, choice is always a function of time. We might say that urgency is the mother of choice. Choice is 'pressing'. A space (to be defined) of complexity, one image of which might be the coexistence of virtuals or 'pure memory', coincides with another space through the uncircumventable tract of a temporal passage. The grains present themselves – a 'presentiment' of themselves – at the bottleneck. To succeed in endowing each grain with the 'spirit of complexity' represented by the whole to which it belongs – this could, as in the Battle of the Caudine Forks, free this spirit, make it once more occupy the whole space. In Husserl, this would be the problem of present attention, the thin line, the points between the trailing lines of retention and protention. In Deleuze, the problem would be at least as complex, with the special status of the 'and', the *aiôn* which 'leaps over' the present like a formal narrowing of time, or again, the suspension, in the evolution of cinema, of the 'sensori-motor' and intrigue, which are completely aligned with the impoverished model of action, in a 'neo-realism' capable of redeploying affects and percepts in all their proper richness.

In the virtual (in what Bergson calls 'dream') there is nothing but energy; no forces or forms. There is no opportunity to collapse the quantum wave function, to distribute it into assignable particles. But in dream, in narcotics, in surrealism, in the non-act, the *real* is lost. And here is precisely the occasion to redefine the latter more conceptually. The 'real' in Deleuze would be the *inclusive disjunction of the actual and the virtual, of intelligent sensibility and action.* For it is evident that the tendency to define the real in terms of action and 'fact' is the naïveté proper to traditional thinkers when they succumb to a kind of narrow thinking. The true problem (and thus philosophy) begins when one tries to think the relation of the ideative sphere, in all its richness, and the sphere of action, in its apparent poverty – if you like, the relation between qualitative multiplicity (free repartition in the whole field) and quantitative multiplicity (where, the elements being significantly reduced, they can be tracked 'by eye' and each individual located within the field) – the two senses of the radical **nem-*.[4] In a word, the relation of the heterogenising and the homogenising. How to make of action a multiplicative, potentialising, opening movement? How to do politics without totally quitting poetics? How to keep intelligence and sensibility in action?

As will have been understood, the opposition is not, to a great extent, between sciences and art, technique and philosophy, politics and poetics; but rather, in each domain, between that which opens and multiplies and that which closes and restrains. The theory of infinite sensibility – which I call *sursensibility* – analyses those moments where sensibility is married with other faculties and rises to power, producing the synergy of intelligence, memory and imagination. Kant sketched this possibility in the aesthetic idea, 'which prompts much thought.'[5] In *noetics*, contemporary thought makes up for lost time in seeking all possible means of developing a 'complex thought'. We must be attentive, however, to what philosophy already has to offer from this point of view, with the 'thinking of totality' or 'inseparate thought' of myth and of the first Greek thinkers; with the 'symbol' in the pre-Socratic and tragic thinkers; 'hyperbole' in Hölderlin; the 'choice of choice' in Kierkegaard; the 'interval' or 'dialectical passage' in Hegel and Bergson. For its part, contemporary epistemological research continues to privilege complexity, with Atlan's 'self-organisation', Morin's 'ternary concept', the 'homeorhesis' of theories of flows, and Bertalanffy, von Neumann and Luhmann's 'systems theory'.[6]

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[4] See *A Thousand Plateaus*, 557n.51.

[5] Kant, *Critique of Aesthetic Judgment.* trans. W.S.Pluhar, Indianapolis: Hackett, 1987), 182 (§49).

If metaphysics can be called the science of the highest realities, the 'first' realities in all senses of the term, do we not have here the means of endowing this venerable 'science' with a reality which resists enclosing it in the corsets of general and special metaphysics? Wouldn't the first fact of metaphysics as first science be this difficulty of doing justice to complexity, to multiplicity, to singularity, to the 'density' which the poet Hopkins means to signify when he tries to give an account of the astonishing 'burl' of a divine real? If rite, myth and religion can translate the overflowing *feeling* which results from the first fact of the infinity of the 'real' (a sort of 'I believe', an adhesion to a type of 'faith', an unreflective 'natural attitude'), *metaphysics* might be the decision *in thought* to reflect upon the possibility of *giving a full and*

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[6] See F. Fogelman Soulié & M. Milgram (eds), *Les Théories de la complexité: Autour de l'euvre d'Henri Atlan (La Couleur des idées)* (Paris: Seuil, 1991) and H. Atlan, *Les étincelles de hasard* (2 Vols, Paris: Seuil, 2003); E. Morin, *La nature de la nature* (Paris: Seuil, 1977), J. de Rosnay, *Le macroscope* (Paris: Seuil, 1975), L. Bertalanffy *Théorie générale des systèmes* (Paris: Dunod, 2002), C. Baraldi, G. Corsi, E. Esposito (eds) *Luhmann in glossario* (Milan: Franco Angeli, 1996).

just account of this hyper-physical infinity. But then, could one imagine any problem which better articulates what is at stake here, than that of thinking the loss that accompanies certain modes of thinking, and all action in general? To pose this question in all consciousness, is to be a metaphysician. And I wager that Deleuze, in calling himself, and in feeling himself to be, a pure metaphysician, wanted first of all to bring this idea, this problem, to the fore.

THE METAPHYSICS OF COMPLEX ACTION

We begin with a commonsense remark: The epoch of gods (Gods) and of transcendent objects is not all that old. A few thousand years ago, there were only intensities. It is the *sacer*, denoting the fearful reception of intensity, that in *religio* is translated into the precondition to every manner of ritualising, phrasing, and transforming intensity into names and dogmas. Now, these intensities, even if they refer to hypermundane realities, are nevertheless themselves *of this world.* It is in this world that we experience them. What Hegel and Feuerbach after him saw, and rightly no doubt, as the projection of the 'part of the immutable' or of the 'figure of the ideal' in a 'wholly other' or an elsewhere, begins with that mysterious frontier between the internal and external where shamans little by little imposed the idea of the soul, capable of a 'delocalising' voyage. Metaphysics begins when the possibility is perceived of a distinction still more radical than that between internal and external, thought and action, the animate and the inanimate. Metaphysics, in its classical form, seems to be born when something comes to light of an absolute difference, a difference in nature, between the intensity which endures forever or preserves itself, and the intensity which ends by declining, diminishing, being abolished.

The tendency of metaphysics, and of a religion that has cut its links with paganism – that is to say, with a certain *natural* unity of intensity and non-intense space – consists in a most risky wager: concentrating all intensity into an unreachable and unexperiencable space, into a hyperbolic Beyond, which thus benefits from all the 'great words' that make us dream: Ideal, Absolute, Infinite, Eternal, Sublime, Immutable, All-Powerful, etc. Pondering this more closely, one finds here a thinking of the *razzia*: the plundering of all the riches of one place and their transference *en masse* into another, preferably hidden (*adêlon*). The Greeks and Romans understood each other quite well when it came to this art of razing whole towns, leaving nothing behind in their wake.

In other words: to have done with the intensity of this world and to repatriate the Infinite and the Too-much into 'heaven'. Religion and metaphysics will then be arranged so as to 'breath' and 'ventriloquise', each on its own account, the revelations of the Absolute in person (what Nietzsche calls 'the telephone to the beyond'), revelations which only the initiated can grasp and interpret. It will then remain only for them to trace thought and action – which remain (whether one likes it or not) in the intramundane – from these phrases emitted by the Absolute. So many metaphors and apophatic warnings are deployed from on high that it will be necessary to suggest this place devoted to '*to mê dunon*', that which never sets.

One might think that things have moved on and that we are now grown-ups, having attained 'majority' as Kant hoped. If it is undesirable to put down these great constructions of the imagination, of thought and sensibility – whose architectural equivalent indicates at least that the 'divine places', according to Jean-Luc Nancy's fine thought, are valued for their 'volume' and not necessarily for their content[7] – on the other hand it is more than time to return to *intramundane intensity*. Which comes back to saying – and this is exactly the meaning of the formula 'God is dead' and, in its positive aspect, Nietzsche's cry 'long live *physis!*', that it is from 'down here' that the riches of the sensible and of the thought which is devoted to it, must come forth, as we ourselves do. Our problem is no longer that of sacrificing these riches by forcing them through the disfiguring defile of a 'narrow gap', so as to find them again, supposedly transfigured, there where there is in all probability neither world nor sense to perceive them. We have not changed the statement of the problem: 'How to save the richness of the instant?' But we have modified its implications. An immanent metaphysics does not save the world by throwing it overboard, it examines the possibility of preserving the immanent riches of sensibility and thought in synergy, in an action which might perpetuate and *live up to* them. It appears then that the first coherent gesture of a metaphysics of complex action consists in developing a theory of art. And this is what, incontestably, Nietzsche and Deleuze succeeded in doing.

Hegel, who exploits the breach opened up by Kant towards a metaphysics of immanence, but proves equally unable to bring the project to fruition, proves most lucid when he opens the *Phenomenology of Spirit* with the central problem of *Sinnliche Gewissheit* ('*Sense-Certainty*'). We know his response, which consists in the immense detour through the *Phenomenology* itself to recuperate *in fine* this dazzling certitude of the sensible finally reconciled with Spirit. This response disappointed the great art-theorist Maldiney. He did not hesitate, in his *Regard, parole, espace*,[8] to denounce it as a 'false beginning' for phenomenology. For every artist, as we know, even if his work is particularly *pensive*, departs from this marvellous intuition to which, in a sense, his work pays homage. The only theorist, I would say, who permits us to see clearly in this debate, a debate whose essential importance it is time to consider, is Ehrenzweig. His idea of a 'labyrinth of creation' (exposited in *L'ordre caché de l'art*)[9] already constitutes a theory of complex action. He maintains convincingly that a series of decisions (concerning for example the relation of two neighbouring colours) can come, in the best of cases, to endow *action* (the ensemble of gestures which constitute the work) with as many riches as can be comprised in sensibility, imagination, memory and thought, as comprised in 'the experience' of the artist.

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[7] See J-L. Nancy, 'Of Divine Places' in *The Inoperative Community*, ed. P. Connor, Minneapolis: University of Minnesota Press, 1991, 110-50.

Recall also that Deleuze's *Logic of Sensation* shows how Bacon's creative act liberates the canvas from all that is opposed to the 'rising of the wave of sensation'. It is more than likely that a similar study of his *Proust and Signs* would see in the involuntary, conceived as 'the spider's strategy', a way of bringing forth intensities and liberating them within the act itself. It would not be difficult, once the problem of immanent metaphysics in Deleuze is seen as the *isolation of*

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[8] Lausanne: L'Age d'homme, 1994

[9] Paris: Gallimard, 1982.

the conditions of possibility for a complex act, to find this problem in the theory of the concept, in disjunctive syntheses, or in the fold. All these assets could be summarised as part of the effort to allow the 'encounter' to deliver all its power, to go, as he says, 'to the limits of what it can do'.

A TYPOLOGY OF COMPLEX ACTION

We seek an action which frees, unshackles, opens before the event (the flow which comes to encounter another flow) a smooth space, without 'frictions' to restrain it, which will permit it to *liberate the architectonic volume* which it comprises (this concern is manifest, for example, in Deleuze's *Kant's Critical Philosophy*). Such an action would be as complex as the intelligent sensibility that was its source – the 'drastic' would have the same status as the 'aesthetic' and the 'noetic'.

First of all – and without insisting on this, since Deleuze himself does not allude to it – one might, in the margins of this typology which alone can lead to a 'superior empiricism' (that is to say one *where action would not be condemned to an essential poverty*, but would 'overflow'), would suggest a new interpretation of *mimesis*. I mention this possibility because many of the questions I posed to Gilles Deleuze in 1981[10] turned around a Romantic reading of '*physis*'. As Aristotle, the inventor of the formula, knew, and as the Romantics rediscovered in the 'sentiment of (the power of) nature', *mimesis physeôs* never has anything to do with an 'imitation of the natural', but everything to do with a contagion of naturing forces. The 'intelligent sensibility' of the Romantic Friedrich, that of Monet or of Sisley, that of Macke or of

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[10] See present volume, 39.

Kandinsky during his non-figurative breakthrough in the period of the *Blaue Reiter*, leads, as if 'involuntarily', to the only pictorial gestures capable of rediscovering, at the end of action, the full complexity which initiated the attempt.

I could say the same of another action in which it would be difficult, in truth, to distinguish between the conception of action and action itself. I mean the *ruse*, that veritable constellation of intelligence which escorted Greek thought and *praxis* continually for six centuries. Detienne and Vernant's analyses[11] have brought to light the necessary qualities of mind and the essential grasp of the 'favourable time', the 'opportune moment' (*Kairos*). We must understand these requirements once more. To my eyes, they wholly coincide with the idea of *punctualisation*. The spirit must be acute (*agkhinoia*) and apt at conjecture (*eustochia*), but the situation must be analysed *in its widest context*. Hegel insists also on the ruse's acute, 'piquant' aspect: He employs the radical **ak*- to designate its *fine point*.[12] Comprised in this image is the *bottleneck* of the hourglass of which we spoke at the outset: the nondenumerable overflowing of the temporal and spatial situation must be *concentrated* in the favourable instant, characterised, let us not forget, as *the instant which will never return*. For just one sole instant is capable of realising this *aleph*, this *maximum in minimo* of the theologians (namely the *Virgin's womb*), an immense space concentrated into a point and awaiting its redeployment. On this condition, action might recuperate all the tenor of sensible intuition and the reflection upon its components – an action which is complex in so far as it harbours what is effectively the counterpoint of the situation, marries itself to the fluctuation of things themselves, and, respecting the 'way of things' by furnishing their image in negative, permits not only the unscathed exit from a potentially deadly impasse, but even gives us the perfect example of a true 'act of knowledge'. 'To act in full knowledge of the facts', as Aristotle's 'prudence' would have it (that *phronêsis* analysed so ably by Aubenque)[13] – this expression might well find a more profound sense here.

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[11] See M. Detienne & J-P. Vernant, *Les Ruses de l'intelligence: la mètis des Grecs* (Paris: Flammarion, 1974).

[12] In the *First Philosophy of the Spirit* – See G.W.F. Hegel *System of Ethical Life and First Philosophy of Spirit,* ed. trans. H.S. Harris & T.M. Knox. (NY: SUNY Press, 1979).

If the imitation of naturing and the intelligence of the ruse might constitute the first types of complex action – both, let us note, relating to the force of 'nature' as all-overflowing and undulating situation (Nietzsche's 'tempestuous sea' of the real) – they do not, however, tell us *how* sensible intelligence transforms itself into action. The moment of passage remains mysterious, and neither Hegel nor de Certeau managed to penetrate its secret. It would seem that Deleuze dedicated a large part of his work to inquiries concerning this passage. And if he said that I 'mediterranianised' him,[14] it is because he must have felt how this inquiry led back – for me, in any case – to Greek thought. Consider firstly to what extent he privileged in Spinoza *active* passions, in Nietzsche *active* forces. Examine the concept which he borrows, in fine Deleuzian fashion, from Spinoza: *expression*. It could be summed up by speaking of 'that which follows from the necessity of a nature'. Equally, note the following: Not only does he distinguish, in the three syntheses, the immanent which opens, juxtaposes and potentialises, from the transcendent which, each time, ends in an *overnarrow* gesture, extracting substance, proscribing one of its possibilities, releasing responsibilities. He already produces a *theory of the act* which is entirely continuous with the increase in power of sensibility and intellection: this can be seen in Daphnis and Chloé's 'so this is love'; for when it happens, love is as much a new sensibility as a brusque comprehension of life and the opening of a field of infinite action. The immanent conjunctive synthesis is an *intelligent and sensible act.*

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[13] P. Aubenque *La prudence chez Aristote* (Paris: PUF, 2004).

[14] See Deleuze's letter, reproduced in A. Villani, *La guêpe et l'orchidée* (Paris: Belin, 1999).

In general fashion – and this proves to what extent this problematic of action is central in Deleuze's work, even if it never appears in explicitly thematised form – everything comes back to the theory of difference. As Deleuze perfectly understood (but what *didn't* he understand?), difference 'alone' is pure chaos, for it cannot be referred to anything that would even allow it to be apprehended. A difference in potential is necessary to allow a sensation to be apprehended, but sensation is a *series of sensations*, thus a difference of differences of potential. Inversely, when articulated through the identical, difference is sequestered into an identitarian logic which makes it pass to a secondary plane – that is to say, annuls its singularity. There remains, then, just one other possibility, which Deleuze calls 'difference *and* repetition'. It is a question of producing an (infinite) series of differences of differences, of differences '*en bloc*', producing the movement of all these differences differing from themselves at every moment; in short, the rhizome, the bloc of memories or sensations, heterogeneous continuity, the fold. So that *the fold appears to us as the 'concept' of every complex action* in so far as it perpetuates the intelligent sensibility from which it originates and no longer leaves any visible scission between knowledge and action. The fold is an *act of sensible intelligence*. It is obviously on the basis of such reflections, germane to Deleuze's thought in its detail and as a whole, and only upon them, that we must try to elaborate with all the necessary finesse the Deleuzian/Guattarian concept of micropolitics. But this will be the object of another study.

CONCLUSION

Why are totalitarian ideologies forever the shameful impasses of History, those where humanity did not merely go astray, but in a sense saw its hideous limit appear in outline, like the skull-and-crossbones of a pirate crew preparing to board? Because, not content with developing a sub-sensibility (indifference to the other, sadistic hatred, insensibility to compassion, affected sentimentality, a passion for death and suffering) and a sad caricature of thought, they *dessicated, as do all tyrannies, the very root of action.*

The act contents itself with being the irreflective obedience to order-words, however inhuman they might be. As to the acts of those in charge, they are designed to suffocate all liberty to act, every active invention.

Inversely – and this may well sound like the very model of art according to Nietzsche (as I tried to show in the *Cahier de l'Herne* dedicated to that author)[15] – the act of creation does not even achieve its highest complexity in the 'masterpiece'. The greatest creator is he who creates 'something with which to create' (I have called this, on the model of the Aristotelian 'thought of thought', a '*physis physeôs*', a 'production of production'). More generally, before dreaming of moving on to a 'post-Deleuzianism', as seems a fashionable wish, have we truly drawn all the possible usage from Deleuze's insistence upon the difference between *active* and *reactive* forces? In his work there is a profound reflection on action. For my part, I will continue to prefer a system where the aesthetic and noetic are as open, multiform and complex as they can be when one welcomes with rigour the requisites of an immanent metaphysics: that is to say a philosophy of the infinite, even if the 'drastic' must remain *pointillist*, precisely because a theory of their relations, whether in Deleuze or in Nietzsche, remains in part to be developed. For if, inversely, the drastic is affirmed, programmed, hammered home, whilst the other two spheres remain simplistic and narrow, superficial and embryonic, action will be nothing more than the effect of its own declaration or, as Deleuze feared, this series of 'order-words' which, alas, we are accustomed to call 'language'. What is more, who does not see that sensibility and thought taken seriously and *rising to power*, indicating their infinite nature, are themselves *already* actions? When Deleuze redeploys Plotinus and his theory of contemplation, this is what he wishes us to understand. There will be then only one object of metaphysics conceived as immanent: active (creative) sensibility, the act of intellection (and not solely intelligence *in act*); and an action, ultimately, which, far from immobilising the real, takes up arms with it, finally liberating its immense virtual forces.

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[15] A.Villani, 'Nietzsche et la musique' in C. Tacou & M. Crépon (eds.) *Cahier de l'Herne Nietzsche*, 2000.

Subtraction and Contraction: Deleuze, Immanence, and Matter and Memory.

Quentin Meillassoux

In memory of François Zourabichvili

We begin with a remark from Chapter 2 of *What is Philosophy*?, which discusses the plane of immanence. This book, of course, is by Deleuze and Guattari, but the text, in this case, clearly indicates a Deleuzian provenance:

> Spinoza was the philosopher who knew full well that immanence was only immanent to itself and therefore that it was a plane traversed by movements of the infinite, filled with intensive ordinates. He is therefore the prince of philosophers. Perhaps he is the only philosopher never to have compromised with transcendence and to have hunted it down everywhere.[1]

Further on, Deleuze writes:

> Spinoza is the vertigo of immanence from which so many philosophers try in vain to escape. Will we ever be mature

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[1] *What is Philosophy?*, 48.

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> enough for a Spinozist inspiration? It happened once with Bergson: the beginning of *Matter and Memory* marks out a place that slices through the chaos – both the infinite movement of a substance that continually propagates itself, and the image of thought that everywhere continually spreads a pure consciousness in principle (immanence is not immanent 'to' consciousness but the other way around).[2]

There are at least two ways to approach such a text. The first way – the most natural way – would be to try to understand by applying oneself to a more in-depth reading of Deleuze. This would necessitate, for example, an elucidation of what Deleuze means by 'plane of immanence' or 'chaos'. It would also mean resituating this text in the light of Deleuze's *Cinema* – and more especially in the light of the two commentaries in *The Movement-Image* dedicated to the first chapter of *Matter and Memory*.[3] But there is a second way of approaching this text, and it is this alternative that we shall pursue here. It might at first seem somewhat artificial, but we hope that its aim and its interest will rapidly become evident.[4]

In what, then, does this reading consist? No longer in trying to understand the text in question on the basis of a certain reading of Deleuze, but in trying to understand – or to better understand – Deleuze, on the basis of a certain reading of the text. In other words, it consists of making this text, not the *object*, but the *instrument* of the elucidation.

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[2] *Ibid.*, 48-9. Translation modified.

[3] *Cinema 1: The Movement-Image*, Chapters 1 (3-12) and 4 (58-72).

[4] Although this article is concerned with the link between *Matter and Memory* and Deleuze's philosophy, we will make no further reference to the analyses in *Cinema* of Bergson's masterwork, and the reader may, quite rightly, be surprised at this. But our aim is to clarify, to grasp the intimate relation between these two thinkers, something which is not the same as undertaking an exegesis of those Deleuzian texts expressly dedicated to Bergson. Our path, as will be seen, is constructive, not exegetical. And although the convergence of these two perspectives – that of reconstruction and that of commentary – may naturally follow from our enterprise, this cannot be fully demonstrated within the current article.

To understand this point of view, let us place ourselves in the following imaginary situation: let us decide to read Deleuze as a pre-Socratic, of whose writings we possess only a few rare fragments, including the text in question, which we will call the 'Fragment of the Double Crown' since in it two philosophers are said to be princes. To these fragments, we must add a 'life' of Deleuze by Diogenes Laertius,[5] which teaches us little, apart from the fact that he was known as an original philosopher, rather than as a simple disciple of Spinoza or Bergson; and that his philosophy was known as a philosophy of immanence. This very term, in its banality, means nothing more precise to us than those terms such as 'water', 'air' or 'fire' which designate the first principle of this or that pre-Socratic. The project of we 'Deleuzian philologists', then, is as follows:to extrapolate, on the basis of this fragment of the crown, the meaning that the pre-Socratic Deleuze attached to the notion – crucial for him, mysterious for us – of immanence.

How shall we proceed?

If we hope to understand immanence on the basis of this one text alone, we must turn, not to Deleuze, but to Spinoza and to Bergson, whose works, unlike Deleuze's, have been passed down to us in their totality. For in this text, Deleuze tells us not what immanence *is*, but *where it is to be found* – pinpointing the place where 'complete' immanence, immanence '*par excellence*', is situated. If we wish to understand this concept, it thus seems that we must turn firstly to Spinoza, the greater prince of immanence, and only secondly to Bergson, the lesser prince of immanence.

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[5] One might think here of André Bernold's beautiful and amusing text 'Suidas' (*Philosophie* 47, Autumn 1995: 8-9).

Imagine a particular school of thought, constituting itself around this interpretative strategy – 'The Major Crown School'. This school, in truth, is going to run into a certain difficulty. If we turn to Spinoza, we will end up encountering the following aporia: we know that according to Deleuze, immanence in some way 'saturates' Spinoza's philosophy. Everything in Spinoza, Deleuze tells us, breathes immanence. But to say that immanence is everywhere in Spinoza, is to render it as difficult to perceive as a diffuse light: if it is everywhere, then it is nowhere in particular. And this is why the attempt to understand Deleuzian immanence on the basis of Spinoza will not be greatly profitable for us.

In this case, let us take a second school of interpretation, that of the 'Minor Crown', whose heuristic principle will be as follows: what is most interesting in this fragment is what it tells us about Bergson, namely that immanence is something that *happened* – once, and once only – to Bergson. If for Spinoza's philosophy immanence is a state, for Bergson's it is an event. This princely immanence which came over Bergson, did so in one text only – *Matter and Memory* – but, quite clearly, what's more, only in one part of this text: it is suggested to us that the beginning of *Matter and Memory* constitutes a 'peak of immanence' in all of Bergson's thought. Now, this makes Bergson most precious in our quest to understand what Deleuze means by immanence; for it implies that in *Matter and Memory* is to be found that which is missing in Spinoza's philosophy, *viz.*, a *differential of immanence*. Now, as physicists are well aware, to isolate or to constitute a magnitude, it is essential to have at one's disposal a variation, a difference in magnitude: to isolate the action of a force, we must have access to a variation of speed. So we can say the following: to isolate Deleuzian immanence, we must have available a variation of immanence, in the shape of a withdrawal, a reflux, of immanence. Now, it is immanence, according to Deleuze, that would ebb away after the beginning of *Matter and Memory*.

We may assume this 'beginning' to designate the first chapter of *Matter and Memory* – that is to say the theory of images, and with it the theory of pure perception. This is what seems to be suggested by the strange expression in our text: 'consciousness in principle'. This expression, in fact, quite overtly refers to the theory of pure perception – to which we shall return – a theory which, Bergson tells us, is true in principle, but not in fact – that is to say, once one ceases to think perception as undiluted with memory. We can thus say the following: to understand Deleuzian immanence, we must ask what ebbs away, what is lost, after the first chapter – and in particular, after the theory of pure perception which is at the heart of it

However, this perspective meets with a problem: if something ebbs away, from Deleuze's point of view, from Bergson's point of view nothing seems to be lost. Obviously, Bergson never wrote anything like 'immanence came to me once, but only once – and then, nevermore!' … Like every philosopher, Bergson maintained that his argument lost nothing in its development, that it approached truth more closely as it progressed. The problem, in short, is as follows: how to seize this reflux, if we know nothing of the Deleuzian sense of immanence, and if Bergson himself makes no indication of any retreat in his argument? We must distinguish a norm, a scale of measurement internal to *Matter and Memory* – a norm in light of which we would be able to register a variation. The only solution is to maintain that it is possible to diagnose the existence of a reflux, if not from Bergson's point of view, at least from the point of view of the *aspiration to be* Bergsonian. Something must be lost from a point of view immanent to the text: and thus from the point of view of a Bergsonian, if not from that of Bergson himself. So we must examine the exigencies which Bergson imposes on himself in the preface to *Matter and Memory* – exigencies which, according to him, the theory of the first chapter satisfies – and then establish how what follows in the text, beginning with the introduction of memory, fails to respond to them with the same degree of radicality. These exigencies will stand as the conditions of immanence which the first chapter satisfies to a degree unequalled by the rest of the work.

We would then find ourselves before the following possibility: we have said that Bergson holds that the theory of pure perception, true in principle, is not so in fact – for this theory does not take into account the fact that every perception is mixed with memory. If we can manage to prove that the pure and simple truth of the theory of pure perception was a *sine qua non* condition for a wholly immanent philosophy, we could then ask ourselves how such a theory could be modified so that it would be true not merely in principle, *but also in fact*.

And in this way we might stand a chance of constructing a fictional theory – one which would be neither Bergson's or Deleuze's but which, drawn entirely from Bergson, would present instructive homologies with Deleuze's theory. In effect, we would have constructed an original philosophy of princely immanence which consequently would be similar to Deleuze's in many respects, and would aid us in understanding the latter.

Now, why attempt such a construction, when we have available to us Deleuze's entire philosophical *oeuvre*, and not just sparse fragments?

For at least two reasons:

1) The first is of a general order: it is always interesting to try to understand a philosopher without interpreting them in the strict sense, but by asking whether it is possible to reconstruct them: because as partial as such a reconstruction might be, it does assure us of truly understanding what we are talking about. Given also that our understanding of Deleuze is itself, let us admit, incomplete, we might anticipate through this indirect approach the possibility of better understanding that which resists interpretation.

2) The second reason is as follows. We would like to show that the fictional system we are to work out functions as a sort of reduced model which brings to light the essential link between many aspects of Deleuze's work. It cannot be denied that this reduced model will also seem a reductive one: it will build Deleuzian 'sim-concepts' without the power to recreate the subtlety of the originals. But this simulacra of Deleuzian philosophy will perhaps have the advantage of exhibiting something – even if only a little –

of the hidden structure of the Idea. It will display, in any case, a necessary chain of decisions of thought, capable of clarifying the coherence of their model.

1. THE ANTI-KANTIAN STAKES OF *MATTER AND MEMORY*

Let us try to show how the theory of pure perception, as unveiled in the first chapter, seems to respond in a more satisfying fashion than the rest of *Matter and Memory* to Bergson's own requirements, as laid out in his 'Preface to the Seventh Edition'.[6]

It does indeed seem, in light of this preface, that a fundamental objective of *Matter and Memory* was to render Kantian critique unnecessary, and thereby to deny the need for limiting the applicability of metaphysical knowledge. This is a project one might call immanentist, precisely in so far as it is metaphysical: because metaphysics, for Bergson, means here (that is to say, at the point where metaphysics is opposed to critique): the refusal of the existence of an enigmatic thing in itself, supposedly different from the phenomenon. On the contrary, it will be a question of grasping that being is nothing that transcends the appearance – that being is more, perhaps, but not essentially other, than the appearance. The theory of the image answers to this project.

Bergson writes: '[R]ealism and Idealism both go too far [...] [I]t is a mistake to reduce matter to the representation which we have of it, a mistake also to make of it a thing able to produce in us representations, but itself of another nature than they.'[7] Matter must be considered as a set of images – and by this term, we must understand what common sense itself understands spontaneously when it conceives of matter: 'For common sense, the object exists in itself, and, on the other hand, the object is pictorial, as we perceive it: Image it is, but self-existing image.'[8] In thus maintaining that matter exists in itself just as we perceive it, Bergson explicitly undertakes to circumvent, and even to render unnecessary, Kant's Copernican revolution. Criticism is explicitly set up as the philosophical adversary that must be opposed, by neutralising the opposition to which it gives birth, that between realism and idealism – an opposition which, in turn, is indexed to the opposition between Descartes and Berkeley. Descartes 'put matter too far from us when he made it one with geometrical extension',[9] for this results in making incomprehensible the emergence within it of sensible qualities. So Berkeley was right to affirm that secondary qualities had as much objective reality as primary qualities – but his illusion was to believe that this makes it necessary to transport matter into the mind. For such a subjectivisation of matter means that it is incapable of accounting for the objective order of phenomena as ratified by the success of physics, constraining him to make such a mathematical order of phenomena the result of a divine, providential subjectivity.

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[6] H. Bergson, *Matter and Memory*, trans. N.M. Paul and W. S. Palmer (NY: Zone, 1991), 9-16.

Kantian critique is the consequence and result of this double impasse, since it undertakes to ratify the subjectivisation of the intuited object, whilst thinking the objective order of phenomena as a condition for experience, and even for perception.

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[7] *Ibid.*, 9. Translation modified.

[8] *Ibid.*, 10.

[9] *Ibid.*, 11.

2. Pure Perception

How does the theory of pure perception, put forward in the first chapter, answer to Bergson's 'contra-critical' project? Let's briefly recount its essential features. The theory of pure perception is what we might call a *subtractive* theory of perception: it seeks to establish that there is less in perception than in matter – less in representation than in presentation. Returning now to images: images, Bergson tells us, act and react one upon another according to constant laws, which are laws of nature. In this ensemble of images, nothing new seems to happen except through the intermediary of certain special images, the foremost example of which is my body. For my body is an image which acts like other images, receiving and imparting movement, with this one difference: that it 'appears to choose, within certain limits, the manner in which it shall restore what it receives'. My body is thus a 'centre of action', not a producer of representations. Whence Bergson's double definition: '*I call* matter *the aggregate of images, and* perception of matter *these same images referred to the eventual action of one particular image, my body.*'[10]

What is the essential import of such a subtractive theory of perception? It appears to be as follows: if, to pass from matter to perception, we must add something, this adjunction would be properly unthinkable, and the mystery of representation would remain entirely intact. But this is not at all the case if we pass from the first to the second term by way of a diminution, and if the representation of an image were held to be less than its simple presence. Now, if living beings constitute 'centres of indetermination' in the universe, then their simple presence must be understood to presuppose the suppression of all the parts of the object that are without interest for their functions. Bergson thus supposes that living beings allow those exterior actions to which they are indifferent, to traverse them; whilst other beings, isolated, become perceptions by virtue of this isolation itself.

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[10] *Ibid.*, 22.

Whence the relation, literally that of part to whole, that exists between conscious perception and matter. We 'might even say', writes Bergson, 'that the perception of any material point whatsoever is infinitely greater and more complete than ours.'[11] To perceive is to come to rest on the surface of images, it is to impose upon the latter a superficial becoming, far removed from the infinite profundity of material perception.

So, we perceive but a tiny part of the images which form our environment – and it is within this part that our choices operate. There are, therefore – and this point must be emphasised, since Bergson himself does not do so, and we will have need of it in what follows – there are therefore, it seems to us, *two* selections at work in the theory of perception: the 'selection of images', which gives its title to the first chapter, is both a selection made by the body, *before* the choice, and a selection proceeding from the choice made by the mind within the perceptive elements *already* selected by the body from the infinity of images. For if the mind is free, it is free in so far as it chooses, selects certain actions, from amongst the multiplicity of possible actions which it perceives in the world itself; but mind cannot choose unless an *anterior* selection, itself *unfree*, is already in operation – *viz.,* the selection of images by bodies, a selection which, this time, constitutes the *terms* of the choice.

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[11] *Ibid.*, 38.

The body is like a continuous emission of an infinite matter whose particles constitute the terms of the choice offered to the mind. The body selects the terms, the mind chooses between the terms. There are thus three realities within perception: matter, body, mind. Communication, selection, action.

Alternatively, we could put things as follows: basically, what allows there to be bodies is finitude. Yes, the extraordinary gain of the body for Bergson is the finite; it is a massive interruption, carried out within the infinitude of communications. The body is like a windscreen for the mind against the infinite: whereas in every parcel of matter, however minute it might be, we can envisage an infinity of information, the body conquers finitude through the power of refusal. And right here is the emergence of the living being at the very heart of the inorganic: a barricade erected by a formidable power of *disinterest for that which communicates.* The living is not primarily the emergence of a power of interested choice, but the emergence of a massive disinterest in the real, to the profit of certain rare segments of the latter, which constitute the whole of perception. The body is that which discerns, in the infinity of imagistic communication, certain rare virtual actions capable of interesting action. It is only secondarily, in a second moment, when the body has made consciousness disinterested in almost all images, that the free choice of the mind can come into effect. The selection we shall call 'first', that of the body, is the following: perception as set of possible actions. The selection we shall call 'second', that of the mind, is – let us note – far less impoverishing than that of the body: the mind chooses an option at the expense of a finite number of equally possible options, whereas the body selects a finite number of options, at the expense of an infinity of images which pass through it without trace.

We say, then, that perhaps the most remarkable characteristic of the Bergsonian theory of perception – and that which makes it an anti-Kantian theory of rare radicality – is that for Bergson, perception is not a *synthesis* but an *ascesis*. Perception does not, as in Kant, submit sensible matter to a subjective form, because the link, the connection, the form, belongs wholly to matter. Perception does not connect, it disconnects. It does not inform a content but incises an order. It does not enrich matter, but on the contrary impoverishes it.

3. MEMORY-CONTRACTION

Let's return to our initial project. The perspective we have adopted is as follows: to try to show that the theory of pure perception responds better than the rest of *Matter and Memory* to the requirements of anti-Kantian immanence. To uphold this thesis, therefore, would mean demonstrating how this requirement seems to be betrayed the moment that Bergson makes of such a theory – which refuses to see any essential difference between matter and perception – a theory that is true in principle but not in fact – and this because perception is in fact always mixed with memory.

Our task is to isolate the reason why the immanentist requirement must consist in maintaining that this theory is true not only in principle but also in fact – and to try to show how such a thesis might be defended.

So, the coincidence of perception with the object perceived thus holds, according to Bergson, in principle rather than in fact. And this because the ground of real and quasi-instantaneous intuition upon which our perception rests 'is a small matter compared with all that memory adds to it'.[12] But here Bergson brings in two types of memory.

This distinction, however, does not coincide with the famous distinction of Chapter 2 between the two memories, that is to say the distinction between the habit memory inherent to the motor mechanisms of bodies, and the memory-images of properly mental memory. The distinction which interests us, and which already appears in the first chapter, is deployed within the memory put into play by the mind itself. It opposes, within mental memory, the two forms which the latter takes in its mixture with perception. These two memories might be called recall-memory and contraction-memory.

Recall-memory constitutes a complex circuit with perception, by means of which what Bergson calls in Chapter 2 'attentive perception' becomes possible. It consists in the fact that every memory-image capable of interpreting our current perception intertwines so closely with it that we can no longer discern what is perception and what memory. The example Bergson gives is that of reading, which he says is like a veritable work of divination:

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[12] *Ibid.*, 66.

we do not simply passively perceive the signs on the page; for the mind, on the basis of various characteristic traits, fills the interval with memory-images projected onto the paper and substituted for the actual printed characters. The second type of memory which impregnates our perception is not that which impregnates the present with our memory of the past, but that which constitutes that present itself: contraction-memory. For however brief a perception might be, it always occupies a certain duration and thus necessitates an effort of memory which prolongs a plurality of moments one into the other. So that, as Bergson writes: 'memory in these two forms, covering as it does with a cloak of recollections a core of immediate perception, and also contracting a multiplicity of external moments into a single internal moment, constitutes the principal share of individual consciousness in perception, the subjective side of the knowledge of things'.[13]

The problem of the cognition of matter thus becomes the following: our perception seems (this was the decisive advance made in the first chapter) to join directly with matter in itself. In the object, we perceive the image in itself which it effectively is. Matter contains no depths, no hidden aspect. In this sense, Bergson's immanentism held fast to the fact that matter is given wholly as that which it is: no space being left for a thing in itself inaccessible to cognition, a hidden transcendence. And, what's more, the world was not immanent *to* consciousness, it was not a transcendence-in-immanence like Husserlian objectivity.

On the contrary, it was consciousness that slid over the surface of matter in itself, the latter being identical to what common sense believes it is in grasping it. But in introducing memory, Bergson seems to distance himself strongly from such common sense. For from that point on, matter becomes what remains of perception once one has retracted that which memory, in its two forms, continually introduces into it.

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[13] *Ibid.*, 34.

Now, it appears to us that this correction irremediably compromises Bergson's immanentism, and this, not because of the introduction of memory-recall, but rather that of memory-contraction. Memory-recall, in fact, does not obliterate the possibility of an intuition of matter in itself. We can, by according sufficient attention to the perceived object, make it so that the stereotypes of the past will not cover over the singularity of the real thing. This is, for example, what we do when proof-reading a text: we force ourselves to read the words as they are written, and not as we know they are written. An effort of concentration thus suffices, in principle, to extirpate the veil that memory-recall throws over present perception, so as to liberate matter from the mechanisms of recognition. The immanentism of pure perception is thus unaffected by the addition of memory-recall. But the same is not true, we would suggest, of memory-contraction. To see why, we must first give a more precise account of what this second form of memory consists in, and above all, what the operation of extraction consists in, whereby this memory is removed from the perception with which it is supposedly mixed. The essential characteristics of this second form of memory are described in the fourth and last chapter of *Matter and Memory*.

Contracting memory originates in the Bergsonian theory of the rhythm of durations. Bergson will introduce this rhythm with a significant and still celebrated example: that of the vibration of light. In the space of a second, he writes, red light accomplishes 400 trillion vibrations – in other words an immense number of events, which it would take us no less than 25,000 years to enumerate, were each vibration to last long enough to impinge upon our consciousness. So we carry out an incredible contraction of material reality when we perceive in one moment what includes within itself an immense number of events. Now, it is this work of contraction that gives rise to qualities. According to Bergson, the heterogeneity of qualities is due to the contraction of homogeneous – and in virtue of this fact, quantifiable – vibrations, from which matter is composed.

Let's cite the crucial passage :

> May we not conceive that [...] the irreducibility of two perceived colours is due mainly to the narrow duration into which are contracted the billions of vibrations which they execute in one of our moments? If we could stretch out this duration, that is to say, live it at a slower rhythm, should we not, as the rhythm slowed down, see these colours pale and lengthen into successive impressions, still coloured, no doubt, but nearer and nearer to coincidence with pure vibrations? In cases where the rhythm of the movement is slow enough to tally with the habits of our consciousness – as in the case of the deep notes of the musical scale, for instance – do we not feel that the quality perceived analyses itself into repeated and successive vibrations, bound together by an internal continuity?[14]

In other words, what matter is in itself can be grasped again through a certain thought-experiment, whether or not we admit the idea of a variability of rhythms of duration, of a degree of tension as Bergson calls it, which makes us comprise under the form of distinct qualities an immense number of events which, for matter, represent so many moments in which the qualities are strung out. The slower the rhythm is, the more distinct the material events, and the more diluted the qualities, once the latter become noticeably dispersed in the course of temporal succession. The notion of rhythm thus gives us to apprehend what we might call a 'concrete scale of temporalities'. We only live at one scale of matter – immensely vaster than that of the atom, and immensely less vast than that of galaxies. We thus occupy a scale of durations, a particular rhythm of the current of time, which renders us unconscious of all events below two millionths of a second, whereas such a duration is sufficient for luminous matter to produce millions of vibrations, that is to say millions of distinct events.

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[14] *Ibid.*, 203.

4. Critique of Memory-Contraction.

We will call 'detension'[15] the operation through which Bergson 'decontracts' the qualitative product of memory, so as to decant material perception from its mnemonic and subjective envelope – and this to rediscover matter such as it is in itself, rather than for us. Let us try to explain, then, what seems to us to pose a problem in this theory of detension, all the while attempting to give a Bergsonian dynamic to our dissatisfaction.

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[15] Obviously, in a different sense to that which Bergson gives to this term when he uses it in chapter 3 of *Creative Evolution* (trans. A. Mitchell, NY: Dover, 1998), to designate the engendering of space by duration, at the moment where the latter attains the limits of its creative *élan*.

We know how Bergson criticises the thesis according to which there would be only a difference of degree between perception and memory, that is to say the empiricist thesis according to which memory would be only an attenuated perception: if this was the case, he remarks, we would also have to maintain the inverse proposition – that is, that an intense memory could not be distinguished from a weak perception – an inversion which suffices to demonstrate the incoherence of the thesis. This being the case, we will express in a similar fashion our doubts concerning the operation of detension: if the slowing of the rhythm of duration is equivalent to dilution, or to a 'stringing-out', as Bergson says, of qualities, then we must also maintain the inverse, that *every experience of the dilution of colours or of the movement of sound towards the bass is equivalent to the experience of a slowing of time*. Or further, if one maintains that material duration makes colours paler and sonorities deeper, one must then also maintain that every perception of a pale colour or of a low sound makes us change in our rhythm of duration. But this is evidently not the case, since on the contrary we enjoy a capacity to traverse the palette of the painter or the scale of the piano without at all modifying our vital rhythm, since the low notes do not modify the rhythmic exigencies of the score or of the metronome. The rhythm of duration and the tonality of the scale are thus indifferent one to the other: not only because the lowest notes can be played in a more rapid rhythm than the highest, but also because time can pass quicker whilst I listen to a certain low sequence that I particularly like, whereas time might seem to drag listening to a high sequence that I do not enjoy.

On this basis, it seems that I cannot carry out a real detension of perception, in order to disentangle matter in itself from subjective memory. Examining the question more closely, it might be said that the difficulty in disentangling perception from memory-contraction comes from the fact that the latter is supposed to constitute the very qualities of perception – which is not the case with memory-recall. Whereas in the case of the latter, I can make the concrete experiment of the dissociation of memory and perception – the experience of attentive reading – here this is no longer possible. In fact, I find myself face to face with the following aporetic alternative: either I try to intuit the result of detension directly – but in that case I would be led back to the experience of *my own* duration, and not that of material duration, the experience of colours which pale or of sounds which become lower. Or I return to science, distinguishing the vibratory and homogeneous nature of matter – but in this case I content myself with registering the result of an experiment, rather than thinking the supposedly continuous nature of homogeneous matter and of heterogeneous perception. In the latter case, therefore, I accede to the vibratory nature of matter, but only by way of a science which is discontinuous with my concrete perception of qualities.

In other words, memory-contraction seems to abolish the principal result of the theory of pure perception, namely that of the cognisability of the in-itself. For matter appears to us as that which has not been made the object of the work of contraction. But since this contraction has always already taken place, since its effect is supposed to reach the elementary components of perception, we cannot see any convincing way to take the *reverse path*, so as to rediscover matter in itself not yet affected by our subjective duration. In yet other words, the vice of contracting-memory seems to be that it plunges us once again, from a theory of perception-ascesis – a profoundly original moment of the Bergsonian conception, a moment also when his anti-criticism is at its most radical – into a theory of perception-synthesis, one which by virtue of this fact is subject to the Kantian separation of the for-us and the in-itself. For the force of the ascetic theory of perception consisted in the fact that the form of matter was posited in matter itself: synthesis was material, and consisted in the regulated relations that the images maintained one with another; representation added no sort of synthesis to matter. But everything changes with the contracting theory of memory; for now perception once again introduces a form into matter itself, a synthesis – specifically, a temporal compression – which is hailed as the genesis of immediate qualities. But if perception is synthetic, then we are truly condemned never to discover the nature of the matter so synthesised, since we are trapped within the limits of such a synthesis. This is result of the experiment we have made of our incapacity to intuit a detension which takes us outside the qualitative world proper to our intimate duration.

To better grasp the difficulty, we might invoke Kant's *Anticipations of Perception*. We know that, in the first *Critique*'s *Analytic of Principles*, Kant maintains that we can anticipate not only the form of the phenomena, but also, to a certain extent, its matter – and this by affirming that every reality admits of a degree, that is to say an intensive quantity, not divisible into units but into differentials. We know in fact that time is divisible to infinity, and that consequently between a degree *x* of a given quality, a degree supposed conscious, and the degree 0 of consciousness, are ranged an infinity of moments in time, which are the object of syntheses that are not yet conscious. Thus, the immediately apparent qualities of perception have in fact already been informed by consciousness. Perception is the sum – or, better, the integral – of differentials which alone can be identified with the thing in itself. But to rediscover this thing in itself such as it is, we must have at our disposal an operation of derivation that we would be sure would correspond to the exact inverse of the pre-conscious integration of perception. Now, it is this which we cannot determine with any certainty in any case. In this sense, Bergson appears to founder upon a difficulty which, apart from some obvious differences, recalls that which contributes to Salomon Maïmon's justification of his scepticism: for Maïmon, in his *Essay on Transcendental Philosophy*, having precisely identified the noumena with the differential of consciousness, and the phenomena with its integration by the productive imagination, proscribed himself from operating the reverse path through the understanding – the path that would go from the phenomena to the noumena. According to him, the noumena must remain unknown to us, because we could never be sure that the derivation proposed by the philosopher to rediscover the noumena would be the exact symmetrical counterpart of the integration within consciousness of such a noumena.[16]

In short, it seems to us that all the anti-Kantian and immanentist gains of perception-ascesis are put at risk by

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[16] For a more detailed examination of this aspect of the *Essay on Transcendental Philosophy* see J. Rivelaygue, *Leçons de métaphysique allemande*, vol.I (Paris: Grasset, 1990), 134-149.

Bergson's return to the circle of subjective synthesis. As soon as Bergson introduces the work of synthesis into subjectivity, he brings back the possibility of a thing in itself inaccessible to thought – and thus the possibility of a radical transcendence. The stakes of the discussion thus become as follows: can one envisage a theory of perception-ascesis which avoids passing via the synthetic moment of contraction? What would such a theory look like, and how might one try to justify it?

5. THE RETURN TO PURE PERCEPTION

How to think pure perception without contracting-memory? Let us return to the rationale which seemed to lead Bergson to introduce the idea of contraction. This rationale, if we reflect upon it, seems to be reducible to one fact: *viz.*, that the science of elementary matter decomposes minimal conscious durations into extraordinarily rapid events – specifically, the vibrations of light. It is such a vibratory reality of matter that the theory of contracting memory seeks to account for, by pinpointing the process by which this material state is transformed for us into distinct qualities. But is there anything in this fact that a theory of the image alone could not account for? It seems that the difficulty comes from the fact that an image – that of a perception or colour – is supposed to contain many other images – those of 'vibrathomogenes'. Now if an image was to present to us matter such as it is in itself, must not its prodigious vibration also appear to us? Since this is not the case, we must indeed admit that our grasping of the world introduces an operation which modifies it.

However, Bergson himself gives us the means to respond easily to this objection: has he not told us that the theory of the image supposed that there were many more things in matter than in representation? Did he not found his immanentism on the fact that matter is *not other, but more* than representation? This being accepted, what prevents us from attributing to matter all the images that we can extract from it? For if matter is a set of picturesque images, there is nothing to stop us saying that it is also, in addition, a set of images in which qualities no longer have any place: nothing stops us from making of matter all the images which we might have at every scale of time, and indeed of space. This, let us repeat, was the very force of the subtractive theory of pure perception: the thing in itself is all the points of view it is possible to take on that thing: from the most intimate, those of its tiniest details, to the most remote. In that case, why not say the same of luminous matter, and hold that light is *all* the images that can be taken from it: the colours of the spectrum, as well as homogeneous vibrations? Nothing prevents us from according to the matter-image these two points of view: maintaining that it is heterogenous and homogeneous *as well*, both image-perception *and* experimental image, coloured image *and* vibratory image. This amounts simply to saying of matter that it is composed of radically distinct images according to its temporal and spatial scales. In other words, it amounts to according to matter all the rhythms of duration, and to making of human perception not the *contraction* of material quantity, but the *selection* of one of the rhythms of a matter-image which contains each and every one of them.

6. The Subtractive Model

From this point on, we can start to examine what the purely subtractive model drawn from *Matter and Memory* would consist in – a model of subtractions without contractions.

Here are the two postulates from which we begin:

1) Matter is composed of images. These images all communicate one with another, according to laws that we identify with the laws of nature. This communication we will name with the term *flux* – the flux by which images receive and transmit movement to images. Matter thus consists in a multiplicity at once qualitative and quantitative, picturesque and homogeneous.

We can then agree on the following terminology: we will call *heterogeneous* a multiplicity that is not simply qualitative, but at once qualitative and quantitative. If the homogeneous remains identifiable with quantity, the heterogeneous ceases to be identifiable with quality. The heterogeneous is more heterogeneous than quality, comprising not only the differences of qualities between themselves, but also the differences of quantities between themselves, and the difference of quality in general from quantity.

2) To these images, connected to each other by flows, we must add *interceptions*, cuts, which from the point of view of images mean nothing more than a local isolation – their becoming-superficial. Here, we distance ourselves, for reasons of clarity, from Bergson's theory taken strictly: rather than saying that the rarefaction of images in perception is due to the fact that the living being allows itself to be traversed by most images only to retain a few of

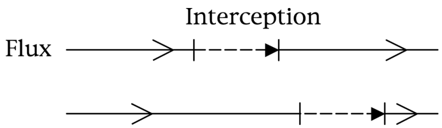
them, we say that this rarefaction is due to cuts, barrings, which only permit certain flows to penetrate into consciousness. The essential remains: perception is in every way still thought as a rarefaction of matter.

We can formulate these two postulates more precisely by including both in the following proposition: *there is becoming, and becoming is fluxes and their interceptions.* This statement allows us to say the following: a flux is not sufficient to constitute a becoming – for this, there must also be interception. Fluxes, certainly, transmit movement: but this movement is not a becoming, in the sense that, ruled by the laws of nature, it connects every image to every other image, according to a necessity which saturates the real in some way. Every thing being connected to every other according to laws, the cognition of an image is sufficient in principle for us to determine the present, past and future movement of all the others – and this to such a point that the very difference between the three dimensions of time is erased, to the profit of an immutable web of transmissions of movements. One is faced with an immobility made of movements, analogous to that of a powerful jet of water, in which the continuous movement of matter gives rise to a continuous immobility of form. Flows, left to themselves, are just such a pure mobility, immobilising themselves by the very fact that no obstacle obstructs their deployment: they are the bonds between all things ruled by fixed laws.

For there to be becoming, something must happen, and for something to happen, it is not enough that something comes to pass – on the contrary, it must be the case that something does not pass: there must be a disconnection. This is the only way to introduce a becoming into matter, without introducing anything other than matter: it is the only way for us to uphold Deleuze's 'magical formula: PLURALISM = MONISM',[17] without its leading us back to dualism. The monism of heterogeneous matter will accommodate within itself the pluralism of eventality, without for all that accommodating anything other than matter – that is, without introducing ontological duality.

Let us see how such an operation is possible. The condition of there being a becoming is that a change is produced which cannot be reduced to a material flux. This imposes the following thesis upon us: there must exist a becoming of interceptions themselves. It must be that the interceptions change. But how is such a change thinkable? In view of what we have said above, this can only happen in one way: *the interceptions of flux must move along the lines of flux.*

So we obtain schema 1:



Schema 1: Interceptions of flux and flux of interceptions.

We can see here that a becoming is always two becomings – for there to be becoming, becoming must become twice: as flux of images, and as flux of interception of images. Becoming is thus composed of a double 'arrowing', which, however, introduces no ontological dualism. The first arrow is that of flux. Only the second arrow introduces becoming. Through this double arrowing, then, one can achieve *the grafting of the Bergsonian theme of the image onto the Stoic theme of incorporeals*, as mobilised by Deleuze in *Logic of Sense*.[18] We shall thus dub the temporal dimension of flux *Chronos*, and the temporal dimension of interceptions, *Aiôn*. What authorises us to adopt, not only the Stoic language, but also the Deleuzian terminology as it is put to work in *Logic of Sense*? Two things:

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[17] *A Thousand Plateaus*, 20.

1) Firstly, we know that the division between *Aiôn* and *Chronos* in *Logic of Sense* distinguishes the temporality of deep causes, the temporality of corporeal mixtures, from that of incorporeal events. Now, it is indeed to this type of division that the preceding double arrowing corresponds: fluxes are indeed dynamic mixtures of matter, and the interceptions are indeed incorporeals, since they are nothing material. In addition, the becoming of interceptions is a becoming which rises to the surface from the depths of images, since the result of the interception is the becoming-superficial of matter: its reduction to its envelopment in perception. So that we can legitimately take up Deleuze's exclamation with regard to incorporeals: '*Everything now returns to the surface*'.[19]

2) Secondly, we can attribute to *Aiôn*, thus redefined as displacement of cuts, a property homologous to that of the Deleuzian *Aiôn*: namely *eventality*, understood as a unique Event in which all events communicate, 'the affirmation of all chance in a single moment', the 'unique cast for all

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[18] *Logic of Sense*, 'First Series of Paradoxes of Pure Becoming', 3-6.

[19] *Ibid.*, 10.

dicethrows'.[20] In fact, in order to think the process whereby the interceptions are displaced, the temporality in which the interceptions change, we must exclude every form of material explanation.

If the displacement of a disconnection proceeds from material laws, it will be reduced to a flux like any other – and no becoming would exist. But if there is becoming, no physical law can account for it. Neither determinism, nor probability – the double explicative paradigm of material processes – can therefore be mobilised to account for the displacement of incorporeals. So if we wish to say something positive with regard to such a becoming of breaks, it falls to us to posit that this becoming certainly constitutes a chance occurrence, but one which is non-probabilisable, since it is the result of a unique throw of the dice, launched from all eternity upon the immutable table of fluxes.[21]

Let us attempt, then, to indicate more precisely the meaning of *Aiôn* so understood as the displacement of disconnections. Firstly, we must return to the being of disconnections. We said above that one thing at stake in the subtractive model was the avoidance of every form of dualism, or of differentiation between modes of being. Disconnected-being cannot therefore be anything other than flux-being. Now, in order to maintain this, it is not enough to say that disconnected-being is nothing: for to say this would be to lead ourselves back to a Epicurean–style dualism – that is to say, a dualism of matter and void.

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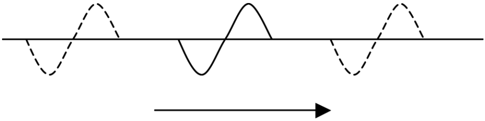
[20] *Ibid.*, 205.

[21] On Deleuzian chance, understood as unique dice-throw and eternal return, see Alain Badiou's commentary in *Deleuze: The Clamor of Being* (trans. L. Burchill, Minneapolis: Minnesota University Press, 2000), 'Eternal return and chance', 67-78.

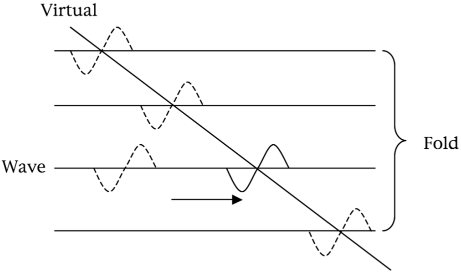
The 'ontological landscape' furnished by our model in fact resembles an 'inverse Epicureanism': not one of real atoms displacing each other in a hazardous fashion (precipitated by the *clinamen*) in an infinite void, but one of 'atoms of void' displacing each other in a hazardous fashion within the infinite plenitude of fluxes. It must therefore be that disconnection itself is ultimately reduced to the plenitude of heterogeneous flux. But how to think a break of flux, which is itself a flux, without annulling it as break? Very simply, by reducing the break to a *detour* of flux, accompanied at the same time by a *retardation effect* imposed upon this same flux. It suffices to multiply the detour to infinity to obtain a retardation itself as durable as desired. A break is a local accumulation to the *n*th power of detours of flux. We therefore find ourselves within a strictly continuist ontology, which produces 0 on the basis of an infinite summation of 1 – or which produces nothing on the basis of a infinite summation of the real.

In identifying break with detour, we assure ourselves that nothing exists apart from matter. But it remains true that, if there is becoming, we must maintain the distinction between *Chronos* and *Aiôn*. Why? Becoming, as we have said, depends on the becoming of breaks – and therefore on the becoming of detours. The becoming of a detour is its displacement on a line of flux. But how, or under what conditions, can such a displacement be thought? Under one simple condition: *we must have a past.* Now, *Chronos* tells us nothing about the past of a break. This can be seen quite easily in the following schema:



Schema 2: The wave.

If a detour had a material past, it would then be reduced to a *wave* – the wave whose displacement is shown in the schema. In the most general sense we understand by 'wave' a material movement whose past as well as its future can in principle be reconstructed, in a deterministic or probabilistic way. To be pregnant with its past, if one might so speak, as well as with its future – to detain one and the other, enveloped in its actual-being – this is what is proper to the wave. Now, the detour is not materially distinct from the wave – since it itself is made of matter only – but its displacement must be, since its temporality is hazardous. We must therefore sketch a *second line of the past*, alone capable of distinguishing these two indiscernibles, the wave and the interception. We therefore have the following schema:



Schema 3: The Virtual.

This second line of the past, which is no longer that

of the wave, I name *the virtual*. We can fix the vocabulary, then: a detour possessing a material past will be said to be a wave; a detour proceeding from the line of the virtual will be said to be *a fold*. Without entering into detail, we can see clearly that the virtual thus characterised has many decisive points in common with the Deleuzian virtual:
– The virtual is not indeterminate, but entirely determined;
– The virtual is real – if not, there could be no becoming of the fold – the virtual is thus opposed to the actual, but not to the real;
– The virtual is not, like the possible, the phantasmatic double of the actual – identical to the actual but minus existence – rather, the virtual and the actual have no reason to resemble each other;
– Finally, the virtual is the ontological condition of authentic becoming, that is to say of the unforeseeable creation of novelty.[22]

But it will perhaps be argued that this introduction of the theme of the virtual into the interceptive model is of no interest. All we have done is to inject into our model the Bergsonian virtual, inherent to the conception of duration as unforeseeable creation; and by this fact, and for all that the virtual undoubtedly represents the essential Bergsonism heritage in Deleuze's thinking, the model proposed will only be as homologous with Deleuze as Bergson is. All of which is certainly correct. But what makes the introduction of the virtual into the subtractive model interesting is that it means we have to modify, on an essential point, the Bergsonian notion of the virtual. The modification might be formulated thus: *we are led to think the virtual independently of the couplet quantity-quality*. Now, this couplet, in Bergson, constitutes a primordial polarity for the thinking of pure duration. In the *Essay on the Immediate Data of Consciousness*,[23] for example, pure duration is qualitative multiplicity, as opposed to an homogeneous and quantitative matter which by virtue of this has no duration. Whereas in *Matter and Memory*, as we have seen, quality and quantity are now thought in continuity with each other – but it is precisely memory's role to obtain quality via the contraction of quantity.

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[22] On these aspects of the virtual, see in particular: 'The Actual and the Virtual' in *Dialogues II*, 112-5; and A. Badiou, *Deleuze, op.cit.:* 'The Virtual', 43-64.

On the other hand, in the subtractive model, this polarity becomes inadequate for thinking the virtual, and this for the simple reason that the fluxes are already both wholly qualitative and wholly quantitative. More particularly, quality ceases to be in itself the mark of novelty. Which implies that the language of unforeseeable creation will not be primordially a language of quality, but a language of *folding* – of the fold's becoming-virtual: a language which would be, ultimately, a topology, or rather a *geology* of the virtual. Through this we do indeed engender an effect of homology with Deleuze: namely a Bergsonian heritage of the virtual, expressed in geological rather than qualitative terms:[24] to say that 'there is becoming' is to say that 'there are virtual folds', or that 'there is folding'.

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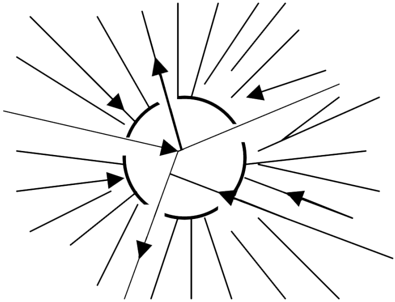
[23] Translated by F.L.Pogson as *Time and Free Will* (London: Allen & Unwin, 1950).

[24] One thinks here of two texts of Deleuze's: *The Fold*; and, in *A Thousand Plateaus*, '10,000BC: The Geology of Morals' (39-74).

To progress further along the path of a reconstruction of Deleuzian thought via the beginning of *Matter and Memory*, we must now emphasise the following point: we began knowingly from a theory which is not exactly that of pure perception, but which is somewhat less rich. Because not only did we divide *Matter and Memory*, making the first chapter autonomous, but we also divided the theory of pure perception itself. Let us explain. In the theory of pure perception, Bergson gives himself an indeterminate centre of action, that is to say a free being: it is such a freedom that is at the origin of the selection, amongst images, of those alone which interest the living being. Now, the refusal of all dualism constrains us, for our part, not to accord existence to beings endowed with freedom. For we would then have two types of being, free beings and beings subject to material laws. If Deleuze sees an immanentism in pure perception, it is no doubt because he divines a monism beneath the apparent dualism of freedom and matter. To extract this monism, it must be shown that what Bergson calls freedom can be obtained as a particular case of subtractive becoming. In other words, it must be shown in what way the living being is a particular case of such a becoming.

Let us reformulate things more clearly. It must indeed be seen that in admitting of fluxes and interceptions, we have not yet admitted of any living being, nor *a fortiori* any free being. An interception, even a sum of interceptions, do not make a living being. For what is a living being, according to the Bergsonian inspiration? It is a *local rarefaction* of fluxes: because a living being is a body – that is to say, a *selection* – but a selection that we have named as *primary*: a selection anterior to all free choice, and one which offers us the terms from which a freedom might potentially be chosen. In other words, a living being is a *place* where fluxes can no longer pass through fully and indiscriminately. Consequently, we can advance the following definition of the living being: *a living being is a discontinuous loop of interceptions.* A loop, because it is necessary to assure a place for the rarefaction of fluxes; a discontinuous loop, because a living being cannot entirely cut itself off from the fluxes – otherwise it would no longer have any affective and/or perceptive relation with the surrounding world. I mean by 'rarefaction' any localised impoverishment of fluxes – thus, every living being is a rarefaction. A rarefaction is more than an interception: an interception does not make a rarefaction, whereas a rarefaction is made solely from interceptions of fluxes.

We obtain schema 4, the schema of the living being or the body :



Schema 4: The Body

But we might then pose a new question, *viz.*: Is there a becoming of living beings? Or again: Is there an evental becoming of rarefactions? If we suppose it possible to think the living being, then there *must* be such a becoming. For if there was no becoming of rarefactions, one could only consider what a living being was made of, the matter that constituted its site. One could think what it is made of, but not what it is: one could think it as organism, but not as rarefaction. One could think the material substance of bodies, but not the bodies themselves as site of rarefaction, of the selection of images. But how to think the non-organic living being, since rarefaction itself is not made from nothing – since there does not exist any vital fluid, any matter other than that of physics, which would render singular the mode of being of a living being? One solution to this difficulty is the following: thinking the living being must come down to thinking the *becoming* of zones of rarefaction. There must exist a non-organic past of bodies – there must exist virtual rarefactions. We need a non-organic past of the living being, an inorganic becoming of bodies. Or further, we need a *body without organs*.[25] Then, if the foldings remain sufficiently coherent to constitute the foldings of rarefactions, we would be able to think life on the basis of its own evolution, and thus isolate a *typology* of vital becomings, becomings which cannot be identified with organic fluxes.

If we entrust to science the care of describing and thinking the states of things, that is to say the states of flux – we will reserve for philosophy the task of describing and thinking virtual becomings. Let us call *evaluation* every typology of becomings that are vital, but inorganic. What typology will be adopted by our evaluation? What are the major types of vital becomings admitted by the living being understood as discontinuous loop of interception? Two elementary cases present themselves: that of the narrowing and that of the broadening of discontinuities. The first *increases the power of disinterest* of the living being, the second signals itself through an *increased openness* to a part of the fluxes. We will call the second becoming *active*, the first *reactive*.

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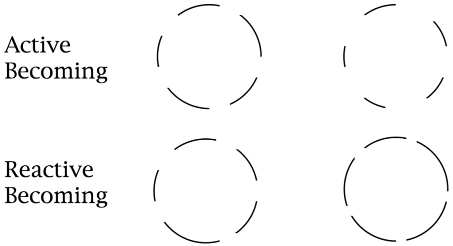
[25] On the Body without Organs, see *Anti-Oedipus*.



Schema 5: Active becoming, reactive becoming.

But before going further, it is time to show precisely in what way the interceptive model is distinct from that of pure perception according to Bergson – and why this distinction should interest us. The distinction is the following: Bergson begins with the postulate that there exist beings capable of acting freely – that is to say, centres of selection of images, the supposed selection being a selection of the *second type* (that which designates a *free choice* between various options). From this he then infers the nature of perception, which turns out to be a selection of the first type: an *unfree* selection from the terms of the choice. We have proceeded in the other direction: we gave ourselves *only* the first selections – unfree selections, that is – and then constituted the living being as a particular configuration of those first selections. Thereby, only part of the theory of pure perception is adopted:

because only one type of selection is introduced into the constructed model: unfree selection. These selections are then endowed with an unforeseeable becoming, alone capable of producing a novelty, thus making possible a distinction between two regimes of selection – active and reactive. We therefore understand that the advantage of the subtractive model is to allow *the grafting of Bergsonian selection onto Nietzschean selection.* For having removed from the Bergsonian model the notion of freewill recused by Nietzsche, we can bring together the two senses – the Nietzschean and the Bergsonian – of the term 'selection': that which designates the selection of images by perception, and that which designates the typology of vital becomings. A new effect of homology with Deleuze: the subtractive model allows us to think the meaning of his predilection for two philosophers who seem prima facie so very dissimilar. But in order to obtain this rapprochement rigorously, we must construct the concept of the active more precisely.

What is a reactive becoming, according to the present model? It is a becoming which manifests itself through a disinterested retreat inherent to the very constitution of the living being. This disinterest, precisely in so far as it is given as constitutive of the essence of the living being, we will give the name of *stupidity* [*bêtise*]. Stupidity, the stubborn stupidity of the proverbial mule, is for the living being always a way of conserving itself in its being, without opening out onto exteriority. On the contrary, an active becoming is always manifested through the fact that something *happens* – and more precisely, something *interesting.* So the categories of interesting and uninteresting are, for us, substituted for those of freedom and unfreedom. For the two becomings

– active and reactive (or stupid) – are both anterior to all free choice: they affect the space of choice, anterior to any choice being made. This is why becoming – and particularly active becoming – must be thought as essentially *passive*; must be thought, even, as an increase of the passivity of the living being, of its 'passability', a way for it to register an increased affectivity to a number of external fluxes. This increase is not itself material, since it is a folding: but it is a becoming which makes an increased flux of matter pass into the body. The concepts of encounter, of passivity, and even of affect – concepts resonant with the Deleuzian thinking of the event – thus take on a vital, not merely organic, significance here. To the active body, capable of an innovative, inventive becoming, something always happens: its increase of force does not come from an autonomous decision of a constitutive subject, but from an experience that is always undergone, an affective test in which a radical exteriority gives itself, an exteriority never before felt as such.[26]

By way of a conclusion, let us now come to that which seems to us to be the principal interest of the subtractive model.

The model allows us to give a precise response to a question that might suggest itself as regards the notion of life in Deleuze, and also in Nietzsche – a question which, we believe, already traverses the work of these two philosophers: how does the living being succumb to reactivity? A question that one might equally formulate as Deleuze does in *Anti-Oedipus*: are all forces doomed to become reactive?

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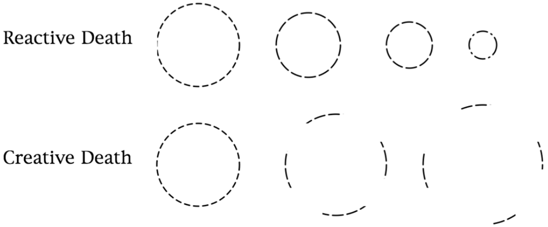
[26] On thought and its relation to stupidity, see particularly Chapter 3 of *Difference and Repetition*, and also François Zourabichvili's analysis in *Deleuze. Une philosophie de l'événement*, (Paris: PUF, 1994; republished in 2004 with a new introduction), 24-33.

That a vital becoming should be active is not difficult to understand: whether or not one agrees that a being tends to persevere in its being, it is easy to grasp that the living being tends to extend the surface of its relation to the world. But that a being should diminish its power, and thus diminish its receptivity – its inventive passibility – is obviously an enigma. It is an enigma that is reinforced when we consider that a reactive being can propagate its reactivity to other bodies, separate the active from what it can do, and that reactivity even seems ultimately to affect those experiences which in themselves are the most innovative, the most revolutionary. Indeed, the question is also that of dualism : because if we cannot manage to grasp in what way life is virtually reactive, we risk ending up with a separation between two modes of being whose communication will be averred unthinkable, even whilst it is, on the contrary, quite manifest. In short, how to understand that life should be complicit with reactivity ?

The subtractive model gives a precise response to this question. And this, for a simple reason: such a model leads us to maintain that there exist two types of death. *And it is because there are two types of deaths that there are two types of lives.*

Let us explain, and conclude.

Note firstly that we do indeed discover, in our model, an essential ambiguity of death. Because two deaths appear to be conceivable for inorganic bodies, two ways of 'erasing' the discontinuous loops: either by a *closing in*, and a progressive ossification of the loop of interception, or by *dissipation* and progressive disappearance of the loop itself. Or again: either a death by diminution of the surface of the loop (ossification of bodies), or a death by diminution of the loop (dissipation of bodies). This is what the following schema shows more clearly:



Schema 6: Reactive death, creative death.

We could say that death by diminution of the surface of the loop is equivalent to a monadological death, a death by vanishing: folded in upon itself, the body shrinks more and more, until completely annihilated. The *reactive* power of death might well be conceived in this way: for the reactive tends toward a death by narcosis, by exhaustion, by an ever-increasing indifference to the world. And we could name as the *priest* the conceptual persona heralding such a regime of death.

But how to think this other possibility of death, by diminution of the loop, by dissipation of the body, by an ever-wider opening of the latter onto the external flux, up to a complete dissolution? And what conceptual persona, this time, will incarnate such a deadly becoming?

It seems to us that it is the possibility of this second death that *affectively* dominated our very first reading of the beginning of *Matter and Memory*: reading this text, so gripping in many ways, we felt, however, at the same time, a vague terror. And this impression of terror was due to the following: as a good materialist, we had always considered death as a return of the body to inorganic matter – thus, for the subject, as a simple nothing. But if matter is what Bergson says it is, then death – the return to the material state – would not at all be identified with nothing, but rather with madness – and even an *infinite madness*. For becoming-material would be the effacement of the selection of images. And it would seem then that to make an image of death, we would have to conceive what our life would be if all the movements of the earth, all the noises of the earth, all the smells, the tastes, all the light – of the earth and of elsewhere, came to us in a moment, in an instant – like an atrocious screaming tumult of all things, traversing us continually and instantaneously. As if the nothing of death could not be understood as a simple void, but on the contrary only as a saturation, an abominable superfluity of existence. Death, thus understood, is the triumphant reign of communication. To die is to become a pure point of passage, a pure centre of communication of all things with all things. It will be seen, then, that the living being is not the emergence of pain in an atrophied world, but on the contrary the diminution of madness in a becoming-terror of chaos, bringing the latter to an infinite speed. Of this death-madness, this death-terror, one might say something like that which Deleuze says of chaos, in the conclusion to *What is Philosophy*?:

> We require just a little order to protect us from chaos. Nothing is more distressing than a thought that escapes itself, than ideas that fly off, that disappear hardly formed, already

> eroded by forgetfulness or precipitated into others that we no longer master.[27]

The deadly becoming of communication thus brings with it an important difference from the reactive death of the priest: the fact that it *resembles active-becoming*, and is even, up to a certain point, indiscernible from the latter. As if the sciences of communication – advertising, marketing, etc. – which, Deleuze says (also in *What is Philosophy*?), have arrogated the concept to themselves – as if these disciplines were the terrifying continuation of authentic creation in the inconsistent and insignificant tumult of information.[28]

In the subtractive system, then, the *communicator* must be made an original conceptual persona, alongside the priest: he who founds becomings which are no longer reactive, but *creative* – becomings which decant death at the very heart of creation, by apparently marrying it with movement, and with words. Becomings which are not those of a stupidity closed in on itself, but which are rather those of a certain obstinate silliness, of a frenetic openness to whatever appearances of novelty come along. The terror of the philosopher before philosophies of communication, or at least certain of their avatars – the way the philosopher flees, as Deleuze says, as soon as they propose a 'discussion' – would be a terror before his own possible death – that which he courts dangerously: death-madness, death-inconsistency, and not death-narcosis. Degradation in the uninterrupted flood of communication, and not somnolence in the reinforced mutilation of affects.

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[27] *What is Philosophy?*, 201.

[28] *Ibid*., 10

We can see here, in passing, a second anti-Kantian characteristic of the subtractive model: not only does one attain the in-itself via a perception-ascesis, but what's more, that towards which the philosopher invites us to incline cannot be thought as Idea, even as regulative Idea. And this for a very simple reason: in this model, *there could be nothing worse than to achieve that towards which we tend*. One tends towards chaos when one invents, when one creates, but there is nothing one intends less than actually catching up with it. It is at once a tendential and an anti-regulative model: we must continually approach the chaos which governs the propensity to create, and continually guard against falling into it.

And so finally we clearly understand the source of the priest's power, that is to say the origin of the seductive force of the reactive over the living being: this seduction comes from the fact that the priest can at least promise us *a nice easy death*, a death that reinforces infinitely the process of birth, which was already originally a process of disinterest with regard to flux. The priest promises us a second birth, a birth that is an isolation, an indifference raised to the second power against the external world, a rarefaction greater than that of coming into the world – in short, a sort of immortality, after its own fashion. The model of the two deaths thus permits us, without founding any dualism, to understand the complicity of life with reactivity: *becoming-reactive is what defends life against its becoming-creative* – or more precisely: narcosis-becoming stops us from becoming-mad. For this is the great seduction of reactivity: which philosopher, faced with a communicator, wouldn't silently wish to become a priest?

In short, we have two deaths, one of which is worse than the other – and this is indeed why to think with Deleuze – really to think – is something as rare as it is difficult: because to think is to become a neighbour to the worst of the two, and to risk the becoming-chaos of life, its infinite becoming-creative. To think is twice victorious to cross the Acheron: it is to visit the dead, or rather death, and above all to succeed in returning; to remain a structured living being, having tested oneself against the nascent destructuration of new fluxes; to maintain oneself in the Outside, but to hold oneself close, thus to some degree closed, and thus to discipline into writing a chaotic experience. Or again, to say it even better, no longer with Nerval but with Deleuze: to think is *thrice victorious* to cross the Acheron.[29] For it is to have the courage to *set out once again* towards the worst of two deaths, after having escaped at least once before: it is to return to the worst, knowing all the while that it is the worst – because, after all, how could one do otherwise?

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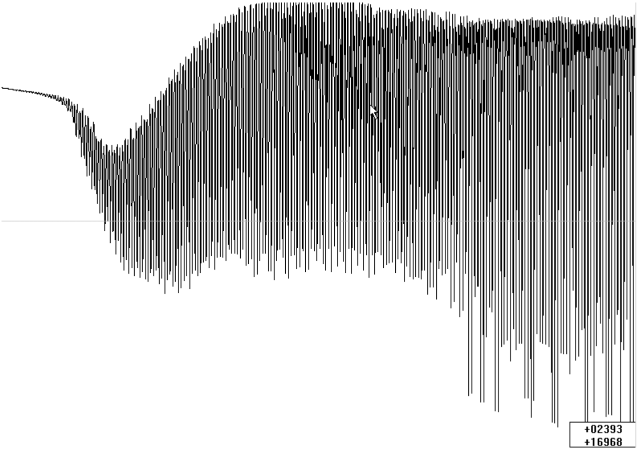
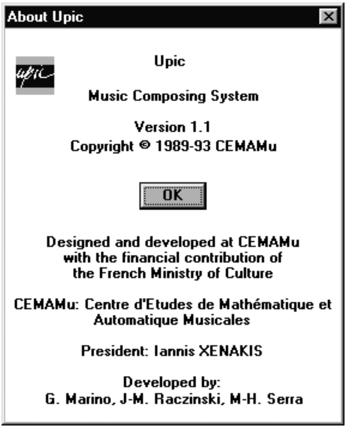
[29] See *What is Philosophy?*, 202.





About Upic

Upic

Music Composing System

Version 1.1
Copyright © 1989-93 CEMAMu

Designed and developed at CEMAMu
with the financial contribution of
the French Ministry of Culture

CEMAMu: Centre d'Etudes de Mathématique et
Automatique Musicales

President: Iannis XENAKIS

Developed by:
G. Marino, J-M. Raczinski, M-H. Serra

Blackest Ever Black

Haswell & Hecker

REDISCOVERING THE POLYAGOGY OF ABSTRACT MATTER[1]

> As I see it, music is a domain where the most profound questions of philosophy, thought, behaviour, and the theory of the universe ought to pose themselves to the composer.[2]

The images in the following pages are screenshots taken during the drafting of the electronic 'score' of Haswell & Hecker's collaborative sound work, *Blackest Ever Black,*[3] composed using Iannis Xenakis's UPIC.[4] The conception and continued development of the UPIC – a digital system allowing the creation of music through the simple act of

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[1] Text by Robin Mackay in collaboration with Russell Haswell and Florian Hecker.

[2] Xenakis, in H. Lohner, 'Interview with Iannis Xenakis', *Computer Music Journal* 10: 4, Winter 1986: 50-5, 54.

[3] Warner Classics and Jazz (UK) WEA 64321CD / WEA 69972LP.

[4] Unité polyagogique informatique du CEMAMu: See H. Lohner, 'The UPIC System', in *Computer Music Journal* 10:4, Winter 1986: 42-9; B. A. Varga, *Conversations with Iannis Xenakis* (London: Faber, 1996) 194-8; and Iannis Xenakis, *Formalized Music: Thought and Mathematics in Music*, trans. S. Kanach (NY: Pendragon, 1992), 329-34. CEMAMu, the Centre d'Etudes de Mathématique et Automatique Musicales, is a nonprofit co-operative founded by Xenakis in 1966 to conduct research and development in electronic and automated music (See *Conversations*, 118-33). On the aims of CEMAMu, see Lohner, 'The UPIC System', 43.

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drawing – may seem, if not a departure, then something of a minor element of Xenakis's *oeuvre* (only a handful of Xenakis's works were composed exclusively using the UPIC). But an examination of the thinking behind this technology sheds much light on the philosophical importance and integrity of Xenakis's work, and its points of intersection with the philosophy of Deleuze (and Deleuze/ Guattari).

Haswell and Hecker have spoken of the four movements of *Blackest Ever Black* as 'assist[ing] the experience of synaesthesia'.[5] And indeed, the UPIC emerged in the context of Xenakis's lifelong efforts to express in his work abstract forms which he saw as belonging essentially to no particular medium, any more than they were the exclusive province of the sciences or the arts. But what is the significance of synaesthesia, and of the UPIC's graphism-sound translation, in relation to Xenakis's interrogation of music?

For Xenakis, forms themselves were a sort of epiphenomenal 'froth' generated by the ordered relations between multiplicities of elements. To discover the mathematical structures underlying their emergence, and to understand what happened when the composer 'incarnated' them in time, was to require a series of mathematically-inspired conceptual 'generalisations', which saw Xenakis leave all musical tradition behind.

By the time of 1953-4's *Metastaseis*, Xenakis's key conceptual innovations – involving above all a thinking of the dialectical couplets unity/multiplicity, local/global and continuity/discontinuity – were already in place: The use

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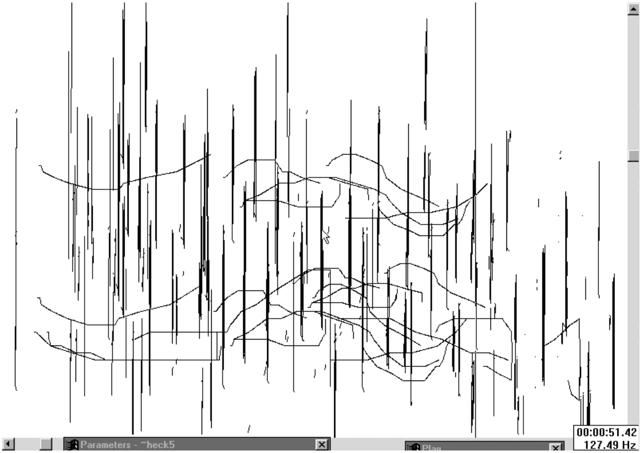
[5] Curtis Roads, *Blackest Ever UPIC*, sleevenotes to *Blackest Ever Black*.



of 'sound masses', 'clouds' or 'complexes', defined through global textural and dynamic properties, and within which a multiplicity of individual lines are locally determined mathematically or statistically; giving rise immediately to the problem of continuity between one mass, state, or constellation, and another – precisely, metastaseis – whence Xenakis's characteristic use of glissandi.[6]

In a reprise of Leibniz's theory of *petites-perceptions*, according to which in perceiving the sound of the sea we operate an 'integration' of infinite unconscious perceptions of individual waves, a crucial inspiration for *Metastaseis* was the wartime experience of 'the transformation of the regular, rhythmic noise of a hundred thousand people into some fantastic disorder' – the mathematics of a political singularity as native workers faced occupying Nazi troops.[7] The question of the nature of continuous transitions intersects with the question of the individuation of masses: why are certain clusters of frequencies registered as 'a' sound, and at what point does it change in nature, becoming many? Throughout *Blackest Ever Black,* simple units of sound gradually, insensibly shift and diverge into separate lines; as if, where there previously was a cloud or a swarm, we now see its constituent members, waves subtracted from the sea.

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[6] Equally so in his architectural work – the Philips Pavilion, constructed during his time working with Le Corbusier, and employing the same curve functions as the *Metastaseis* score, constituted 'a glissando in space' (Varga, *Conversations*, 24).

It was not only mathematics, but equally a close attention to the physical and perceptual parameters of sound as *material,* that would allow Xenakis to escape the impasse he diagnosed in serialism,[8] towards what could properly be called a structuralism, indeed a post-structuralism.[9] For the latter, serial music would be just another fetter to be shed,[10] a brake on the exploration of the objective Idea (in a quasi-Platonic sense, as we shall see) of music, informed by a sonic materialism.

According to Xenakis, serialism's baffling overcomplexity for the listener stems from its being based upon insufficiently interrogated categories of musical thought. The theoretical passing over of the greater part of the complex transformations that intervene between the tone-row and sound-matter itself, mean that what is quite systematic 'outside-time' becomes disarrayed 'in-time' as those dimensions

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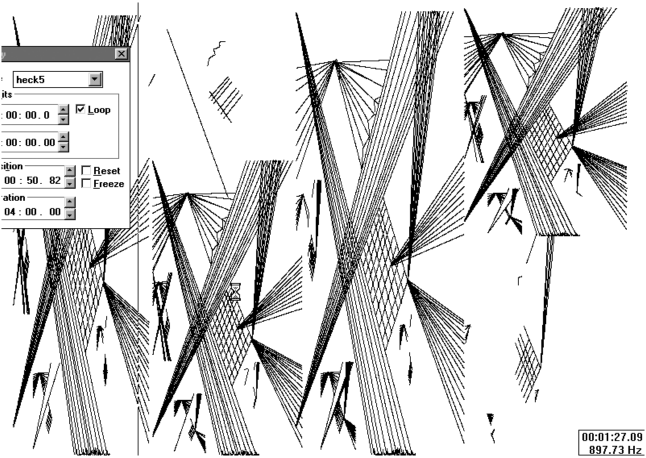
[7] Xenakis, in Varga, *Conversations,* 52.

[8] See I. Xenakis, 'Le crise de la musique sérielle', in *Gravesener Blätter*, Vol. 1, 1955: 2-4.

[9] On Xenakis as structuralist, see T. Campener *Iannis Xenakis: strutturalismo e poetica della sonorità oggettiva*, at http://users.unimi.it/~gpiana/dm9/campaner/xen.htm.

[10] Xenakis, in Varga, *Conversations,* 51.



of sound suppressed under serialism's 'tautological unity'[11] emerge haphazardly in auditory experience, uncontrolled and unorganised. Serial music also leaves 'out of account the problem of continuity-discontinuity':[12] Although, naturally, continuous and discontinuous change took place within compositions, the problematic was not afforded the attention Xenakis believed it merited in music as in mathematics.[13] And so ultimately, the rigorous but arbitrarily-applied system of serialism failed the intelligence of the musical ear. To rectify this situation, Xenakis would seek an understanding of both the logic of musical perception and the mathematical structure of music, bringing them together into a new, generalised theory and practice.

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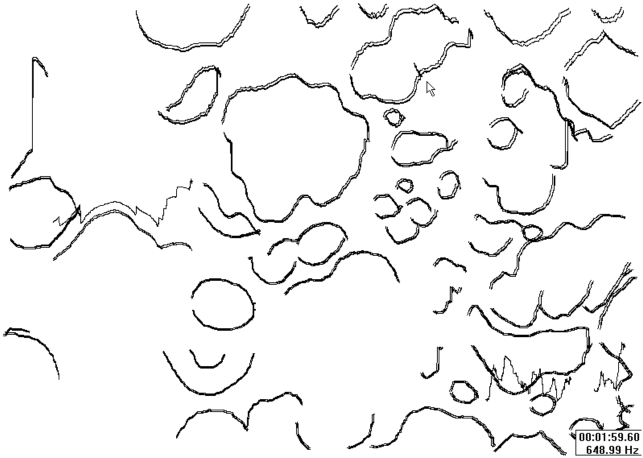
[11] Xenakis, *Formalized Music*, 204.

[12] Xenakis, in Varga, *Conversations,* 76-7.

[13] *Ibid.,* 72-3.



This would enable him to 'fertilize'[14] music with mathematics, rather than imposing formal systems upon music with little regard for the knot intricating together mathematics, music and the physical sciences since the dawn of Western Civilisation.[15] In order to theorise how 'to make the sound itself live', it had to be realised that 'the inner life of music is not only in the general line of the composition, of the thought, but also within the tiniest details'.[16] If on the macrocompositional level serialism represented a necessary escape from the tonal,[17] its proponents' lack of attention to timbre[18] or to the analysis of sound masses bespoke a failure to listen to what the sound was telling them, beyond the overcoding they had imposed upon it. Ultimately the richness of sound overflowed their enterprise. The UPIC would need to apply a 'new simplicity', it would map the structure of music beginning with sound itself.

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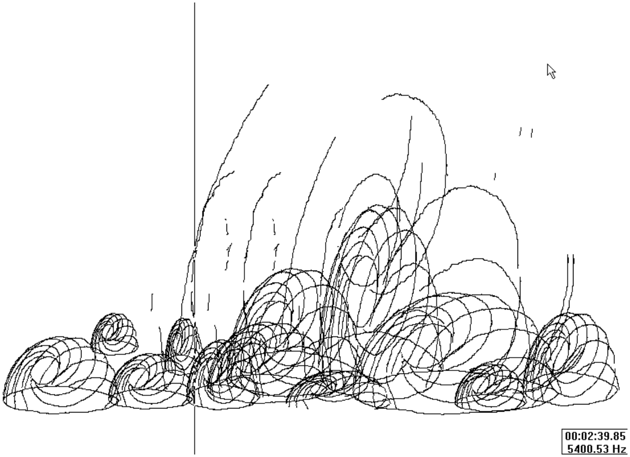
[14] Revault d'Allones's expression, in I. Xenakis, *Arts/Sciences:Alloys*, trans. S. Kanach (NY: Pendragon, 1985), 386.

[15] As is well known, Messiaen's benificent influence on Xenakis began with his advice not to worry about conventional musical studies, but to use what Xenakis already had at his disposal: his knowledge of mathematics, and his Greek heritage. Xenakis's theoretical work is deeply rooted in his researches into presocratic thought (see Xenakis, *Formalized Music* 201-209).

[16] Xenakis, in Varga, *Conversations,* 64.

When Boulez later denounced Xenakis's music as 'too simple', Xenakis would argue that 'if music reaches a point where it has become too complex, you need a new kind of simplicity. Complexity is not synonymous with aesthetic interest.'[19] That the UPIC, in particular, was used as proof of lack of sophistication by Xenakis's detractors indicates a



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[17] *Ibid,* 54.

[18] *Ibid.*

[19] *Ibid.,* 29.

failure to understand the principle at work: 'a maximum of calculated sobriety in relation to the disparate elements and parameters' is necessary in order to 'open onto something cosmic'; 'a sober gesture, an act of consistency, capture or extraction that works in a material that is not meager but prodigiously simplified, creatively limited, selected.'[20]

With the UPIC, Xenakis realised the plan (conceived during his time with *musique concrète* pioneer Pierre Schaeffer in the early 1960s)[21] of extending to the *molecular* level of sound the theories that he had already applied to *molar* statistical aggregates on a macrocompositional level in exploring the problems of continuity and individuation of sound masses. With the use of computers, 'the circle would become complete, not only in the field of macroform but also in the smallest domain, that of sound synthesis.'[22]

But within this domain also, Xenakis immediately identified – and set to work breaking from – conventional wisdom: electronic sound-synthesis at the time was based exclusively upon Fourier's demonstration that any complex wave can be analysed into a series of simple sine waves.[23] Rather than assembling sound from such notionally 'natural' ready-mades (virtual regularly oscillating bodies), CEMAMu's approach would be to 'take the pressure versus time curve as a starting point – that is, what we hear' – a continuous series of intensities (differences in pressure) of arbitrary complexity: 'Instead of going backwards, we start with the curve', says Xenakis;[24] 'I wanted to take possession

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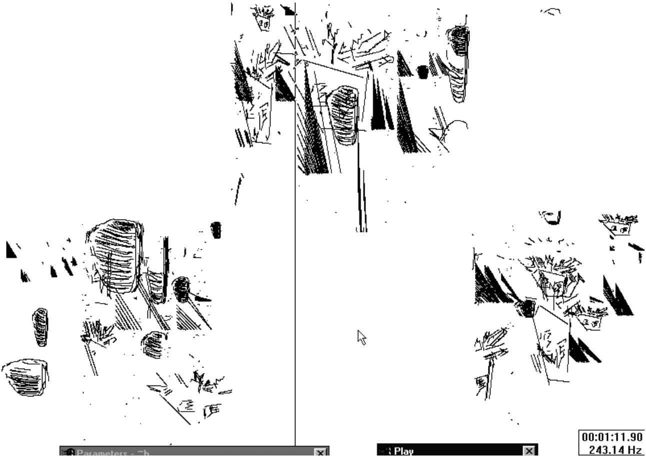
[20] *A Thousand Plateaus*, 344-5.

[21] Xenakis, in Varga, *Conversations,* 42-4.

[22] *Ibid.,* 43.

[23] *Ibid.,* 43-4.

[24] *Ibid.*, 119.



of the sound in a more conscious and thorough manner – *the material of the sound*'.[25]

But if the 'crisis of serialism' and the journey into concrete sound helped break out of the stave, reinforcing the fact that 'sound is much more general than pitch',[26] and that '[i]t's important […] to go beyond the limits of the pitch versus time domain',[27] Xenakis had already been instinctively drawn to 'impure' sounds, the 'rougher […] richer' tones possible through unconventional usages of acoustic instruments, precisely because they produced effects falling outside 'the traditional pitch versus time relationship and the musical idea that is linked to it'.[28] So that when he came to work with Schaeffer, Xenakis found no difficulty in understanding why the latter 'despised sine waves' and worked instead 'with concrete sounds because they are really alive,'[29] and soon set about providing the enabling technology for the experimental electronic 'biology' of this sonic life.[30] In the wake of works such as *Metastaseis*, with their gigantic hand-drawn scores, and ever-enthusiastic for a 'generalisation' of methods and technical automation (Xenakis, for whom the orchestra is 'a machine […] which makes sounds'),[31] in the late 60s he began work on what would become the UPIC, a system allowing the composer to experiment interactively, using graphical gestures, with 'the material of the sound'.

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[25] *Ibid.*, 44. Italics ours.

[26] *Ibid.,* 67.

[27] *Ibid.*

[28] *Ibid.,* 67.

Just as serialism demanded specialist knowledge and codes, so early computer music systems demanded a detailed technical knowledge. Again, the UPIC aimed to break decisively from this, using a simple pen and tablet interface to focus attention on the act of composition. The composer would be given the simplest and least intrusive tool to realise their musical ideas, and would meanwhile participate implicitly in Xenakis's probing of the alliance between mathematical structure, the physics of sound, and the psychology of musical perception; between abstract structures, material synthesis, and artistic composition.

The UPIC puts the composer in control of every level of what is presented as a minimal hierarchy of composition – from the creation of waveforms that will determine the

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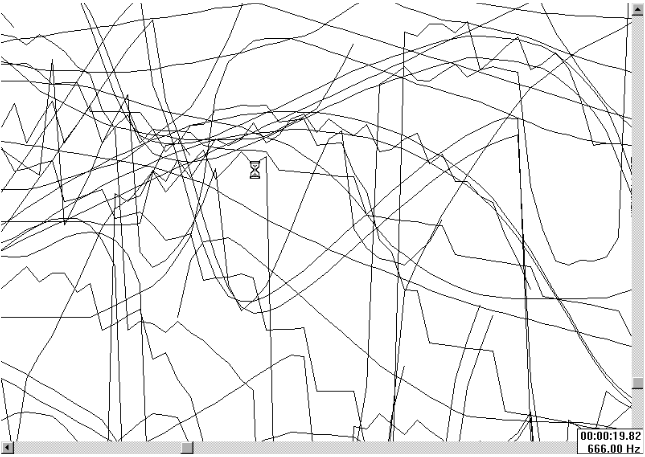
[29] Xenakis, in Varga, *Conversations*, 44.

[30] To "study the evolution of timbres, dynamics, and register [...] to make chromosomes of attacks" – Xenakis, quoted in Harley, 'Electroacoustic Music', 35.

[31] Xenakis, in Varga, *Conversations*, 67.



timbre, volume and intensity of the sounds to be employed, to the 'orchestration' of these voices into 'pages' of the score, and the mixing and layering of pages into a final recording. Importantly, no level of the hierarchy need ever be closed off in order for the composer to work on the next;[32] one might then describe the system as one of 'transparent stratification', rendering completely open to experimentation the levels of organisation necessarily in play in any musical composition. In addition, the UPIC user decides how, in Xenakis's terms, to bring the 'outside time' pages of the score 'into time': A page of music could be assigned, in the first version of the UPIC, a duration from 0.2 seconds to 30 minutes,[33] in later versions from 6 milliseconds to 2 hours.[34]

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[32] Lohner, 'The UPIC System', 46.

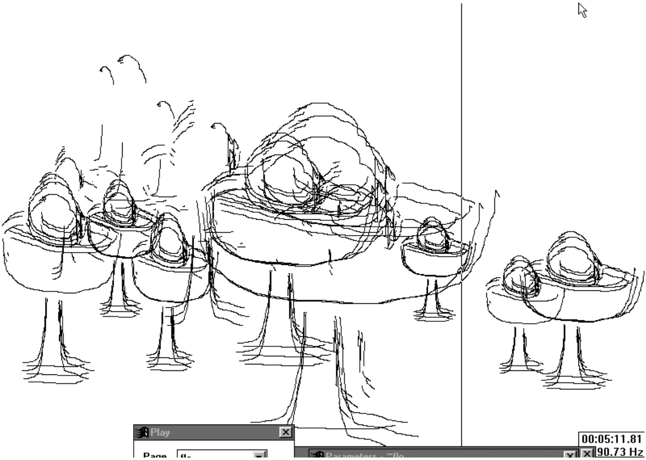
[33] *Ibid.*, 48.

[34] Roads, 'Blackest ever UPIC'.

This unprecedented elasticity of musical time encouraged by the UPIC is present as an ordering principle in *Blackest Ever Black*, where Haswell & Hecker use elements whose family resemblances are barely consciously recognisable, as they undergo extreme transformations, morphing from the instantaneous to the highly attenuated.

> The molecular has the capacity to make the *elementary* communicate with the *cosmic*: precisely because it effects a dissolution of form that connects the most diverse longitudes and latitudes, the most varied speeds and slownesses, which guarantees a continuum by stretching variation far beyond its formal limits.[35]

This simultaneous harnessing of the cosmic and the elementary makes of the most radical material experimentation at the same time a radical democratisation



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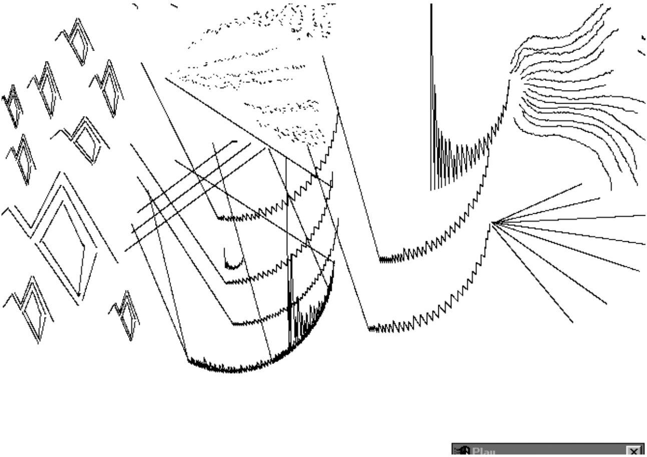
[35] *A Thousand Plateaus*, 308-9.



of means. *Contra* any theoretical elitism, the UPIC's lines of sound provide a 'more universal'[36] medium to 'produce, explore, and create new musical worlds' – 'everybody can understand a line'.[37] Theory-laden avant-garde practices ultimately operated a new overcoding of the music they had liberated from the classical tradition, at once constituting a new priestly caste versed in particular theories, and cutting off whole tracts of unexplored terrain, creating, in Xenakis's word, new musical 'islands'.[38] Whereas the stave is an unresolved mix of the symbolic and graphical, and whereas serialism tended only to exacerbate this condition whilst at the same time reterritorialising upon a model drawn from badly-analysed structural composites (the twelve tones and their transformations) – as if one had dismantled the house of music only to rebuild it using an esoteric new system of construction, rendering it uninhabitable in the process – with the UPIC, Xenakis sought to attain maximum deterritorialisation by using a technology unmediated by theories because based exclusively on elementary acoustics,[39] but allowing the composer, through the graphical interface, sensitively to construct a new *habitus*, a minimum reterritorialisation ('just a little order [...] to protect us from chaos'):[40] a tool that operates not with overcoded conventional points, but with 'graphisms',[41] '*arcs sonores*'.[42]

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[36] Xenakis, in Lohner, 'Interview', 51.

[37] *Ibid.*

[38] Xenakis, in Varga, *Conversations,* 54, 59. Xenakis would later identify mathematically the transformations of serialism with the Klein Group.

It is this twofold goal of maximum deterritorialisation and universal accessibility that Xenakis calls *polyagogy*.[43] And it is important to observe that the UPIC was not conceived merely as a way to make experimental composition more efficient for the composer, but moreover as a way to make it literally 'child's play'. Xenakis's commitment to opening up these new spaces of musical freedom to all was indicated at the founding of CEMAMu, which sought to establish 'a new general level of awareness' through the recognition, and practice, that 'everyone is creative,'[44] and by enabling and encouraging children to 'evolve away from the tonal

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[39] Xenakis, in Lohner, 'Interview', 51.

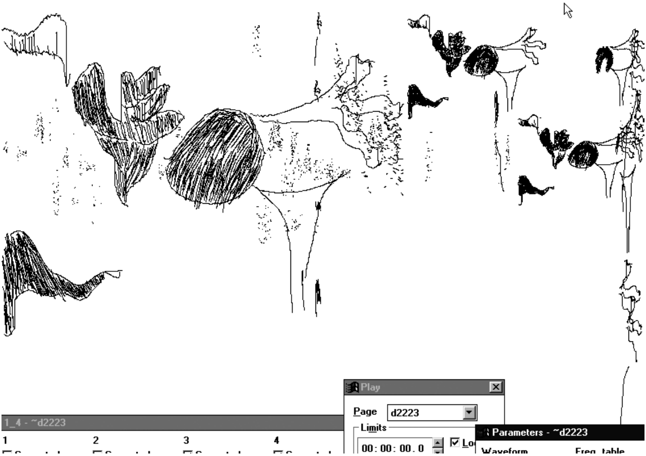
[40] *What is Philosophy?*, 201.

[41] Xenakis, in Lohner, 'Interview', 52.

[42] Lohner, 'The UPIC System,' 48.

[43] '"*Polyagogique*" is my coinage – "*agogie*" means training or introduction into a field; "*poly*" means many.' Xenakis, in Varga, *Conversations*, 121.

[44] Lohner, 'The UPIC System', 43.



system still generally prevalent in Western civilization.’[45] It is not that the child can ‘play at’ being a composer, but that the composer finds himself raised to the status of the child in relation to sound, having to jettison all he ‘knows’ about music: solfeggio, harmony, counterpoint, and so on, all turn out to be obstacles in the way of a real becoming-music (just as Messiaen had divined in the case of Xenakis himself). The employment of manual gesture creates a direct coupling between sound and mind (‘direct to the *mind*’;[46] ‘The hand is the organ of the body that is closest to the brain’[47] – with the UPIC, ‘we can solve the problems of the composition directly, with our hands.’)[48]

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45. *Ibid.*

46. Xenakis, in Lohner, ‘Interview,’ 51.

47. *Ibid.*

48. Xenakis, in Varga, *Conversations*, 120.

Image:Ateliers UPIC

It is not so much any particular piece composed with the UPIC that matters, but this *becoming* in which the user learns a ‘hand-eye-ear’ coordination as novel to the seasoned composer as to the child, an ‘interdisciplinary pedagogy through playing’.[49]

Blackest Ever Black recovers the power of this vision, thirty years after the first working model of the UPIC was completed, and in an age where the digital manipulation of sound has become ubiquitous to the point of banality. Xenakis’s vision for a mass-market production of the UPIC[50] failed, of course; but in certain sense his pioneering explorations of sound did presage modern pop producers for whom ‘sonic construction’ is the object of meticulous technical adjustments quite divorced from any traditional musical concerns. But equally, in an age of digital sampling, where a second of the most anodyne pop recording has been subjected to more electronic manipulation than Stockhausen's entire *oeuvre*, we might ask how the UPIC can stand as anything other than a relic of a highbrow dream, whose austere, uptight, still too-classical sensibility was overturned even as its aims were realised in popular musics.

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[49] This is carried even further in the latest versions of the UPIC which allow realtime manipulation.

[50] See Lohner, ‘The UPIC System’, 44.

The evolution of electronic instrumentation has taken us from a machine where the musician must physically link up circuits and oscillators, through keyboards with banks of pre-programmed sounds, to sampling technology, where any sound can become a ready-made instrument. Now hard-disk recording, like the UPIC, gives access directly to 'the curve', to a base-level sonic material which is transparently stratified and editable on all levels. Indeed, it is quite possible using HDR to 'draw' waveforms onto the screen just as in the UPIC. But the extreme facility and infinite potential of this technology seems to fail Xenakis's test of the power of simplicity, and in contemporary dance music the gap is all too often filled by barely-remixed tradition and modish cliché. Despite honorable exceptions, for the most part dance musics remain tonal and monorhythmic, composed of recognisable samples or fourier-synthesised tones.[51] It is tempting to venture an analogy between music and videogames (1978 being the year of *Mycenae Alpha* and *Space Invaders* alike): where the rudimentary technology of early games demanded a real and compelling synaesthetic becoming between human and machine, contemporary games, with their immaculate representational capabilities, can, and all-too often do, fail to create that symbiotic bond, becoming glossy representational entertainment instead.

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[51] It is also noteworthy, and reflects some of the paradox of Xenakis's legacy, that whilst UPIC aims at a maximal 'generalisation' in all dimensions, as Curtis Roads remarks, 'the sound palette of the UPIC is utterly singular' (Roads, 'Blackest Ever UPIC') – unlike HDR, it is, properly speaking, a musical instrument. Unless used in a spirit of deliberate obfuscation its sound-space is quite characteristic and has real integrity. Of course, this recognisable consistency owes something to the fact that Xenakis's aim with UPIC, as with his composition, is never to explode and destroy, but to isolate just what it is that holds things together: what is sonic consistency?

The key to appreciating the UPIC's continued importance, therefore, is to understand it in the context of the polyagogical campaign to liberate children from Western musical heritage before they had been enculturated into it. Now, it may well be that in reterritorialising the abstract matter of sound back upon the landscape of excitational attractors and rhythmic tics, the outer edges of pop music initiate a slow drift of the human towards the plane of abstract sound, through a rhythmic contagion that we might place side-by-side with this polyagogy. Indeed, this subterranean kinship is dramatised in the lightshows and quaking electronic sub-bass eruptions of Haswell and Hecker's 'UPIC diffusion sessions', which continue a tradition of 'disorienting, hallucinatory light-shows'[52] engineered by Xenakis himself. But popular electronic music tends to thrive on producing excitation via jarring, violent sonic alienations; whereas, if simply listening to *Blackest Ever Black* heralds the shock of an encounter with sound as if for the first time, this should not obscure the fact that Xenakis envisioned a participatory and continuous process of sonic re-education (or de-education), with the hand-eye interface of the UPIC providing the graceful 'glissando' between the natural proclivities of the human ear and the vast virtuality of sound.

Creating a 'plane of consistency' between the hand-eye

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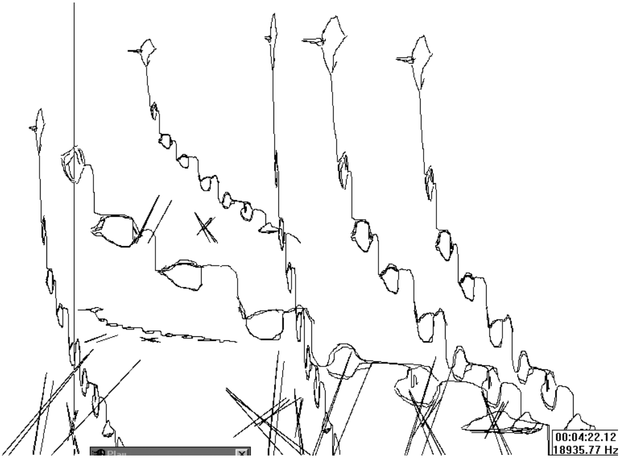
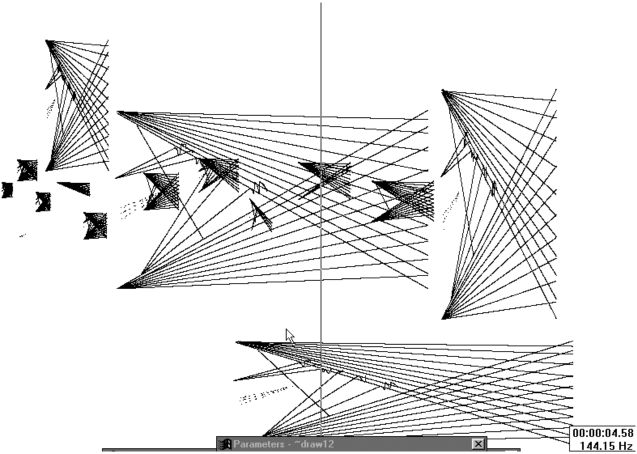
[52] J. Harley 'The Electroacoustic Music of Iannis Xenakis' *Computer Music Journal* 26:1, Spring 2002: 33-57, 33.



apparatus and sonic materiality, the UPIC realises an abstract phylum that spans both and which is the seat of synaesthesia. In occluding forms and their production behind opaque codes, symbolic practices (such as serialism) militate against synaesthesia: the 'section' they take through musical possibility is not a clean enough cut. Of course, synaesthesia is not a goal in itself, either for Xenakis, for the UPIC, or for Haswell & Hecker; but it seems to play the role of a sign that one has accessed forms no longer belonging to the human organism and its perceptual system, but traversing it from the outside.

Beyond this vision of a 'becoming', polyagogy might also be said to correspond in certain respects with Deleuze's call for an experimental programme of 'transcendental empiricism'; it initiates an encounter that lays bare the *audiendum* – that which can only be heard, and therefore



cannot be heard qua (re)cognisable;[53] that is to say, sound-material as series of intensities, or differences in molecular pressure – the 'phenomenon closest to the noumenon':

> [W]e are in a kind of continuum from […] usual objects that we use in music down to the aspects of music that are inaudible, but which produce these events on a higher level.[54]

Further, it offers a theoretical possibility of accounting for how this material is integrated, individuated, amassed into recognisable forms, opening the way to a 'disjointed, superior or transcendent exercise'[55] of the musical faculty.[56] The UPIC reinstates a phylogenetic link to the noumenal continuum or the hidden in-itself of sonic difference, allowing us to render sonorous that which cannot/can only be heard. Whereafter, '[i]t is now a problem of consistency or consolidation: how to consolidate the material, make it consistent, so that it can harness unthinkable, invisible, nonsonorous forces';[57] 'to elaborate a material of [sound] in order to capture forces that are not sonic in themselves.'[58]

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[53] See *Difference and Repetition*, 138-45.

[54] Xenakis, in Lohner, 'Interview', 53.

[55] *Difference and Repetition*, 143.

[56] See *Difference and Repetition*, 138-45.

This raises the question of expression: In *Blackest Ever Black* Haswell & Hecker use the UPIC as a stenographer to translate into sound graphisms ranging from images of contemporary events, to their own designs, and finally surrealist automatic drawings. But of course there is no question of 'dumbly literal sonic analogy'[59] here. The UPIC may 'allow the child to find out what a fish, a house, or a tree sounds like,'[60] just as Haswell & Hecker give us the opportunity to 'listen to the shapes of leaves, terrorist atrocities and kebabs.'[61] But neither invite us to play a game of recognition, but instead draw us into a polyagogical *dérive*. Just as synaesthesia, far from being a sort of harmony between recognisable forms, is a sign that one is encountering something from outside, so what is 'expressed' in UPIC works are these structures that intersect us obliquely: it is the machine that will *instruct* us as to what the drawings are really 'of' so that we are momentarily transported outside ourselves; inciting us to further polyagogical investigation.[62]

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[57] *A Thousand Plateaus*, 343.

[58] *Ibid.,* 342.

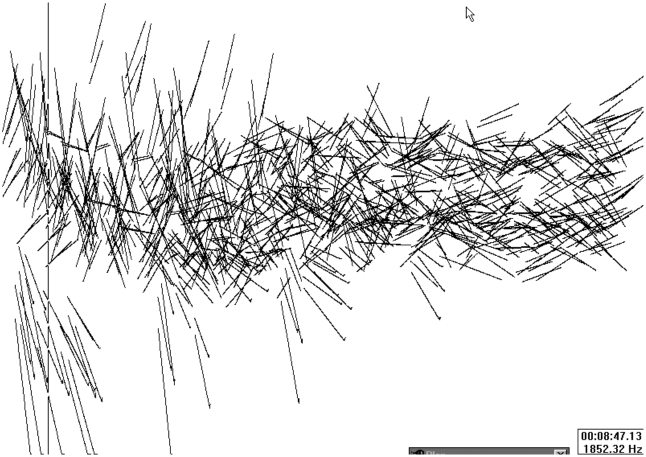
[59] D. Fox, 'Seen and Heard', *Frieze* 98 (Apr. 2006).

[60] Xenakis, in Varga, *Conversations*, 121.

[61] Roads, 'Blackest Ever UPIC'.

[62] In relation to the notion of expression, it should be noted that for the 1976 defence of his doctorate (published as *Arts/Sciences: Alloys* – see note 14 above), Xenakis chose

Throughout its four movements *Blackest Ever Black* is haunted by fugitive figures from outside, sonic personae in closely-marshalled crowds. The listener naturally tries, but ultimately fails, to apply to them the test of recognition: cicadas, screaming fireworks, foaming waves, crackling clouds of static, swarmachines of sound. Sometimes the glissandi and the sonic latitude recall those 'cosmic' instruments that lurk in the margins of the orchestra, indicating the spaces beyond – the onde martinot beloved of Messiaen (which 'make[s] audible the truth that all



Michel Serres as one of the panel; the Serres whose *Le Système de Leibniz* (Paris: PUF, 1969) advocated reading Leibniz as a proto-structuralist, for whom the relations uncovered by different modes of knowledge were more or less distinct expressions of a universal structural order. From this point of view, one might profitably investigate the relation between Leibniz's *mathesis universalis*, Xenakis's 'global morphology', and the work of A. Lautman (recently republished as *Les mathématiques, les idées et le réel physique*, Paris: Vrin, 2006).

becomings are molecular'),[63] the theremin, the reputedly madness-inducing hydrocrystalophone or glass harmonica, or the inharmonic spectra of the mark tree. But during periods of densely-differentiated sound, the listener feels rather as if she is eavesdropping on an encrypted transmission from another planet,[64] being absorbed into some unknown material in a state of extreme torsion, or witnessing the catastrophic collapse of microphysical filamentary structures, the breakdown of cells or gradual processes of liquefaction; and every so often, an echo of Xenakis's war, the ominous whine of warplanes on the horizon.

Thus *Blackest Ever Black* invokes a universe of unnameable phantom objects, colliding, brushing, scraping, resonating and devouring each other, suddenly expiring or becoming incandescent; sometimes metallic and buzzing with electricity, sometimes mobile and animate (usually insectoid – from Messiaen to Xenakis, 'the reign of birds seems to have been replaced by the age of insects, with its much more molecular vibrations, chirring, rustling, buzzing, clicking, scratching and scraping'.)[65]

According to Xenakis, time, pitch, interval, and intensity can all be characterised as real numbers; but, in the midst of this mathematical regime according to which 'we are all pythagoreans',[66] *timbre* is not structural and cannot be ordered; it is a matter of vague zones of indiscernibility, connected in topologically unforeseeable and manifold fashions[67] – ORGAN PIPE TO MEET LITTLE FLUTE ON THE PLANE OF CONSISTENCY.[68] The system of heterogeneous series of quantitative multiplicities is coupled with a qualitative multiplicity of the Bergsonian-Riemannian (the conjugation is Deleuze's, of course) continuous manifold type, on the basis of a subterranean play of pure difference. And, in this sound-world of 'protoplasmic-like material'[69] ('material [as] molecularised matter')[70] which so scandalised Xenakis's peers, continuity is the rule. Terrestrial instruments become families of topological invariants (varying according to size and elasticity of materials); and outside their multidimensional, infinite yet circumscribed zone, lurk instruments with which we are by rights, as Leibniz would say, incompossible. The 'stretching [of] variation far beyond its formal limits'[71] precipitates a type of cosmic regression to the embryonic state of music – *before music was born, there was the great vibrating cosmic egg, the organ-without-organs*: 'Embryology

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[63] *A Thousand Plateaus*, 308.

[64] 'When astrophysicists receive signals from space with radio telescopes it's important that they should recognize the quality and quantity of periodicity so that they can draw conclusions with regard to the phenomena that occur in space […] messages transmitted by intelligent beings have to be differentiated from natural signals [which] are more or less periodical […] [T]he messages sent by intelligent beings also arrive in the form of periodic signals to a certain extent, otherwise the result would be just noise […] [This] very profound problem […] corresponds exactly to the question of pattern recognition in the field of sound synthesis and melodic patterns.' – Xenakis, in Varga, *Conversations*, 92.

[65] *A Thousand Plateaus*, 308

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[66] Xenakis, *Formalized Music*, 202.

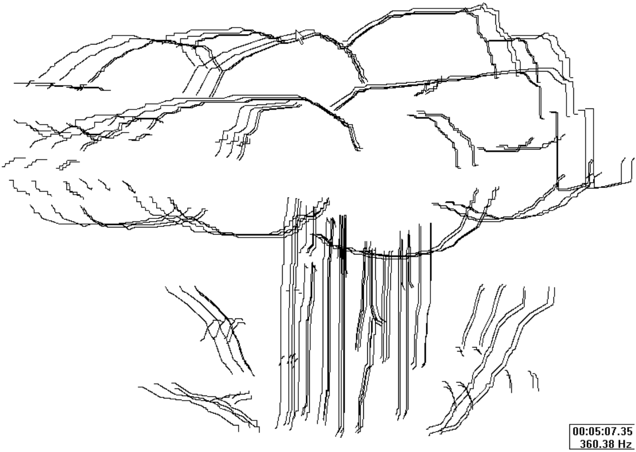
[67] 'We can't say that between two timbres only one path can be traced.' – Xenakis, in Varga, *Conversations,* 83.

[68] '[…] take the low G tone on an organ, the waveform has a certain complexity. As you go towards higher pitches, the complexity diminishes until it becomes almost a sine wave […] So […] the more you gravitate toward the higher notes, it converges toward the sound of a little flute.' Xenakis, in Lohner, 'Interview', 52.

[69] Xenakis, in Varga, *Conversations,* 35 (Serialist Antoine Goléa's description of *Metastaseis* upon its first performance in Donaueschingen in 1959).

[70] *A Thousand Plateaus*, 342.

[71] *Ibid.*, 309.



already displays the truth that there are systematic vital movements, torsions and drifts, that only the embryo can sustain: an adult would be torn apart by them.'[72] As Haswell & Hecker duly demonstrate, the UPIC's polyagogy gently returns composer and audience alike to a larval state, giving us a way of traversing and inhabiting this whole extended sonoverse, with 'just a little order'[73] to survive these wrenching transformations. Rather than throwing us in at the deep end, polyagogy, comprising a cartography of the objective Idea of music, teaches us to swim in sound; as described by Deleuze:

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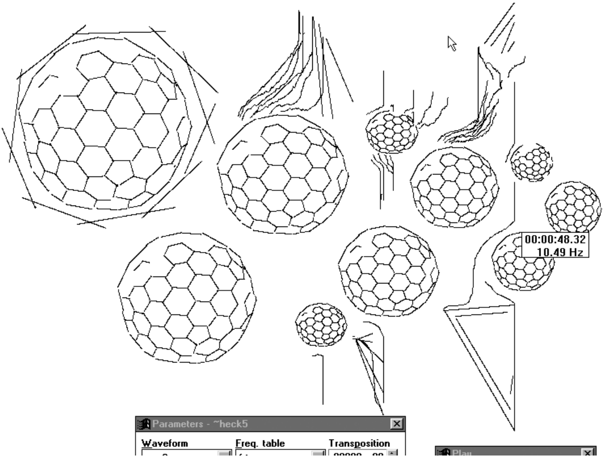
[72] *Difference and Repetition,* 118; '"Regression" will be misunderstood as long as we fail to see in it the activation of a larval subject, the only patient able to endure the demands of a systematic dynamism' – Deleuze, 'The Method of Dramatisation' in *Desert Islands and Other Texts*, 98.

[73] *What is Philosophy?*, 201.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> To learn is to enter into the universal of the relations which constitute the Idea, and into their corresponding singularities [...] To learn to swim is to conjugate the distinctive points of our bodies with the singular points of the objective Idea in order to form a problematic field.[74]

Polyagogy as discipline of becoming and problematisation of the body: What Xenakis says of performers of his music surely filters down to the audience also: 'I do take into account [their] physical limitations […] but what is limitation today may not be so tomorrow.'[75] 'It is the composer's privilege to determine his works, down to the minutest detail'[76] but this also will 'give the artist […] the joy of triumph – triumph that he can surpass his own capabilities'[77] in an encounter with a higher order of generality that reunites and reconnects actually-existing-musics ('islands')[78] into an pangaeic, cosmic Idea in continuous variation:

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[74] *Difference and Repetition*, 165.

[75] Xenakis, in Varga, *Conversations,* 65.

[76] *Ibid.,* 56.

> We should be able to construct the most general musical edifice in which the utterances of Bach, Beethoven or Schönberg, for example, would be unique realisations of a gigantic virtuality.[79]

Regardless of whether Xenakis regrets the 'perpetual compromise'[80] that prevents him from being a 'pure ontologist' like Parmenides, he realises that such 'perpetual compromise' is also a 'perpetual exploration'[81] of this virtuality, a transcendental empiricism. For music is in fact nothing *but* this compromise between the mathematical and the biological, between structure and hand, between the Idea 'outside time' – a continuous plane populated by 'tones without sound'[82] – and their qualitative manifestation under certain conditions of selection, those of the duration which 'we' are. Here we remark Xenakis's proximity to his contemporary, and Deleuze's mathematical inspiration, Albert Lautman, whose Platonism speaks of a dialectic (comprising precisely those couplets discontinuous/continuous, local/global, unity/multiplicity, which underpin Xenakis's *oeuvre*) eternally inaccessible to us except through an ongoing speculative contemplation of the mathematical theories that 'incarnate' it.[83] Ideas, or problems, are just those things that lie out of reach, that we struggle to grasp, making life both unbearable and bearable, and music recalls this struggle, as 'dream or nightmare'.[84]

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[77] *Ibid.,* 66.

[78] Xenakis, in Varga, *Conversations,* 51, 59.

[79] Xenakis, *Formalized Music*, 207.

[80] Xenakis, in Lohner, 'Interview', 55.

[81] *Ibid.*, 54.

[82] Lohner, 'The UPIC System', 46.

This allows us to say that synaesthesia is the *anamnesis* proper to the polyagogical apprenticeship: A sensation of that which can neither be heard or seen, 'colours of sound',[85] a 'transcendent employment' of the faculties and the collapse of their borders – it is the remembrance of mathematics in its purest form, disincarnated from even the symbolic. Is music anything else?

As well as his endorsement of the Leibnizian theory of *petites-perceptions*, Xenakis himself also seems to personify a type of 'transcendental deduction' that recalls the hallucinatory theory of perception put forward by Deleuze:[86] the legacy of the war – chronic tinnitus, a lost eye – obliges Xenakis to reconquer the world through abstract principles, venturing 'generalisations' like a solitary musing Beckettian, or one of Kafka's animals, from inside 'a deep well [...] and I'm still there, so that I have to think harder than if I were able to grasp reality immediately.'[87] An undoubted advantage given that, as Bergson showed us, the 'immediate given is not immediately given';[88] and we saw how the UPIC aimed to reproduce this 'becoming-child' in forcing the composer to jettison all they knew about music. This emphasis on reconstructing the world from within sets Xenakis and Deleuze alike against a zen-like model of contemplation: As Deleuze and Guattari argue, in a passage that resonates with Xenakis's rather withering dismissal of Cage's attempts to 'let the universe speak' by suppressing the agency of the composer:[89]

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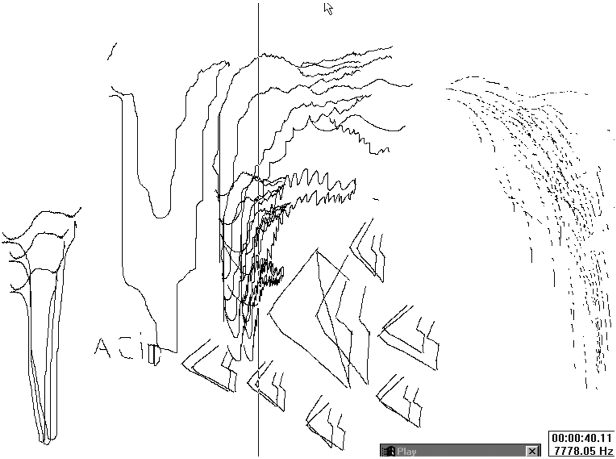
[83] See Lautman, *Les mathématiques, les idées et le réel physique*, *op.cit*.

[84] Deleuze, 'The Method of Dramatisation', 99.

[85] Xenakis, in Varga, *Conversations,* 72; 'Increasingly, it is the "colour" of the sound that matters' (*What is Philosophy?* 191). Messiaen himself insisted that he *saw* the colours of music – as 'musician's colours, not to be confused with painter's colours.' – appearing all at once, as in the stained-glass at the Sainte-Chapelle in Paris, which according to Messiaen was a 'luminous revelation' to him. And Xenakis himself (in Varga, *Conversations*, 173) will invoke the 'Inner Colour' that cannot be predicted, even by an experienced composer, from the clusters of individual notes involved. *Cf. A Thousand Plateaus* 347-8: 'the phenomena of synaesthesia […] are not reducible to a simple colour-sound correspondence; sounds have a piloting role and induce colours that *are superposed* upon the colours we see, lending them a properly sonorous rhythm and movement'.

[86] See *The Fold*, 93-4.



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[87] Xenakis, in Varga, *Conversations,* 48-9.

[88] Deleuze, 'Bergson 1859-1941', in *Desert Islands and Other Texts*, 23.

[89] 'We all have fortuitous sounds in our daily life. They are completely banal and boring … Silence is banal … I'm not interested in reproducing banalities' (Xenakis, *Alloys*, 94-5). Nevertheless Xenakis respected Cage greatly and was an early supporter of his work – see Varga, *Conversations,* 55-6.

> The claim is that one is opening music to all events, all irruptions, but one ends up reproducing a scrambling that prevents any event from happening [...] instead of producing a cosmic machine capable of 'rendering sonorous'.[90]

Contemplation is already action, selection, composition,[91] in so far as this contemplation takes the actively exploratory form of a transcendental empiricism: not content to 'let music be', it attentively probes the being of music in order to discover its material basis and its life.

> In writing electronic music you also have to direct the invention of new tools.[92]

If the greatest creative act is to create something with which to create – to imitate '*physis physeôs*'[93] – then the UPIC could be said to be, if not Xenakis's most important work, then certainly a most significant, if still latent, part of his creative legacy to future musicians, more of whom it is to be hoped will take up the gauntlet of *Blackest Ever Black*'s 'grand celebration of Xenakis's sound universe'[94] and put the polyagogy of abstract matter back into practice, creating a music that 'moves the soul, "perplexes" it'.[95] A music, then, to be accompanied by a philosophy that likewise 'tends to elaborate a material of thought in order to capture forces that are not thinkable in themselves.'[96]

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[90] *A Thousand Plateaus,* 343-4. Deleuze & Guattari do, in fact, go on to mention Cage.

[91] See A. Villani, present volume, 62.

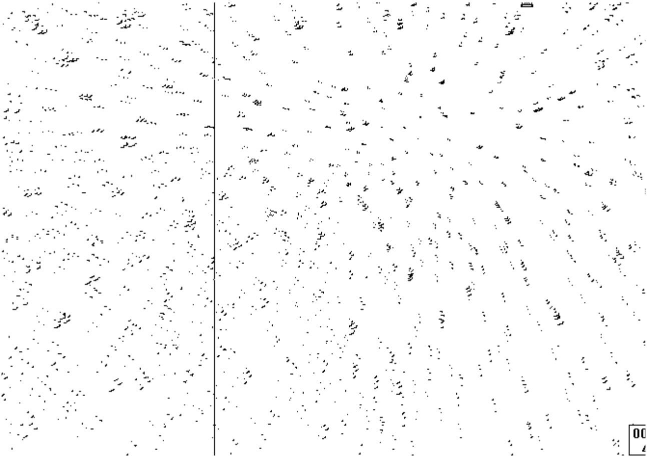
[92] Xenakis, in Lohner, 'Interview', 50.

[93] See Villani, present volume, 62.

[94] Roads, 'Blackest Ever UPIC'.

[95] *Difference and Repetition*, 140.

[96] *A Thousand Plateaus*, 342.



ÉTUDES
SUR
LA MATHÈSE
OU
ANARCHIE ET HIÉRARCHIE
DE LA
SCIENCE
avec une Application spéciale de la Médecine

DU DOCTEUR
Jean MALFATTI de MONTEREGGIO

TRADUCTION DE
CHRISTIEN OSTROWSKI

INTRODUCTION DE
GILLES DELEUZE

Scientia vitæ, in vita scientiæ

EDITIONS DU GRIFFON D'OR
PARIS
1946

Mathesis, Science and Philosophy[1]

Gilles Deleuze

It might be interesting to define mathesis in terms of its relations with science and philosophy. Inevitably, such a definition remains to some extent external to mathesis itself; it is simple, provisional, and tends only to show that, beyond any particular historical moment, mathesis describes one of the great ever-present attitudes of mind. That is to say that one will find in the following only a critique of the arguments that scientists and philosophers tend to invoke against mathesis, and above all a specification of how the word 'initiated' ought to be understood. Not that we should forget, certainly, the plane of Indian civilisation within which mathesis was deployed; this is most essential. For we will not say that mathesis can be abstracted, in any measure, from this civilisation; but only that at the heart of our Western mentality can be discerned certain fundamental needs which, already, can only be satisfied by mathesis – as a sort of introduction, a preface to itself. From this point of view, Dr. Malfatti's book presents a capital interest. No doubt, other works have since appeared which delve deeper into Indian consciousness, but few introduce the notion of mathesis in itself, in terms of its relations with science and philosophy, better than the present work.

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[1] Deleuze's text appears as an introduction to Jean Malfatti de Montereggio's *Études sur la Mathèse ou anarchie et hiérarchie de la science* (Paris: Éditions Du Griffon D'Or, 1946).

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It is not easy to understand the exact sense of the discussions that periodically oppose philosophers and scientists – they do not speak the same language. Science installs itself within the object, reconstructing or discovering reality itself at the level of the object of thought, without ever posing to itself the problem of the conditions of possibility. The philosopher, on the contrary, situates the object, as representation, in its relation to the cognising subject. It is of little consequence to him, M. Alquié remarks, to know what matter might ultimately be – atoms, say – since the latter, like every other representation, have a philosophical status only in reference to the mind that represents them. And it is hard to see what difference even the latest discoveries in modern physics could make, for example, to the conceptions of Berkeley, dating from the eighteenth century. Thus a fundamental dualism poses itself within knowledge, between Science and Philosophy – the principle of an anarchy. It is basically the Cartesian opposition between extended substance and thinking substance.

The Cartesian case is all the more interesting in that Descartes never renounced the unity of knowledge, the *mathesis universalis*. And it is intriguing to see how the latter is situated on the theoretical plane: the knowing mind, as distinct as it might be in itself from the extension with which it appears to have strictly nothing in common, nonetheless deploys the order of things in thinking the order of its representations. At the very moment where unity is affirmed, this unity breaks apart and destroys itself.

But in being broken apart, Descartes now remarks, unity finds its true sense in re-forming upon another plane, where it finds its true meaning. In so far as the theoretical disunion of thought and extension is affirmed, so too is the fact of their practical union, as a definition of life. Unity does not come about at the level of an abstract God transcending humanity, but in the very name of concrete life; the Tree of Knowledge is no mere image. The unity, the hierarchy beyond all anarchic duality, is the unity of life itself, which delineates a third order, irreducible to the other two. Life is the unity of the soul as the idea of the body and of the body as the extension of the soul. Moreover, the two other orders, science and philosophy, physiology and psychology, tend to rediscover their lost unity at the level of living man. Beyond a psychology disincarnated in thought, and a physiology mineralised in matter, mathesis will be fulfilled only in a true medicine where life is defined as knowledge of life, and knowledge as life of knowledge. Hence the motto, 'Scientia vitae in vita scientiae'. A threefold consequence follows from this.

Firstly, to believe that mathesis is merely a mystical lore, inaccessible and superhuman, would be a complete mistake. This is the first misunderstanding of the word 'initiated' that is to be avoided. For mathesis deploys itself at the level of life, of living man: it is first and foremost a thinking of incarnation and of individuality. Essentially, mathesis would be the exact description of human nature.

Yet does not mathesis surpass this living human nature? For it defines itself as a collective and supreme knowledge, a universal synthesis, 'a living unity incorrectly deemed human'. Here we must agree: it must be realised that such a definition cannot be immediate but is posited last of all, receiving a precise sense. Prefiguring the relations between man and the infinite, the natural relation unites the living being with life. Life, in the first instance, seems to exist only through and within the living being, within the individual organism that puts it in action. Life exists only through these fragmentary and closed assumptions, each of which realises it on its own account and nothing more, in solitude. That is to say that universality, the community of life, denies itself, gives itself to each living being as a simple outside, an exteriority that remains foreign to it, an Other: there is a plurality of men yet, precisely, each one must in the same way assume his life for himself, without common measure with others, on his own account; the universal is immediately recuperated. And in this sense life will be defined as complicity, as opposed to a crew. For the crew is the realisation of a common world whose universality cannot be compromised or fragmented, and such that in the process of this realisation the substitution of crewmembers becomes both possible and indifferent. Such is science, on the side of the object of thought; or philosophy, on the side of the thinking subject; in both cases we have a dead crew, theoretical, non-practical and speculative. The only living Crew is that of God, and this because there is only one God, whose symbol is the circle, the perfect, indifferent figure all of whose points are an equal distance from the centre. In complicity, on the contrary, there is indeed a common world, but one whose community comes into effect, once more, through each member realising it for himself without a common measure with others, on his own account, and with no possibility of substitution. Clearly, the principal human realities of birth, love, language and death describe this same profile: Under the sign of death, everyone exists as non-substitutable and cannot have himself replaced.

And this, precisely, is the universality of death. In the same way, life is that reality wherein the universal and its proper negation are as one.

What characterises complicity is precisely that it can be ignored, denied, betrayed. The term 'everyone' denies the universal so effectively, at the very moment it affirms it, that it is easy to notice only this negative aspect. Thus, the u consists in passing from a state of latent, ignorant complicity to a complicity that knows and affirms itself as such. Not, certainly, the point where each loves as everyone, but where everyone loves in their singular manner. It is at the very moment when the living being persists stubbornly in its individuality that it affirms itself as universal. At the moment when the living being closed in upon itself, defining the universality of life as an outside, it did not see that it had, in fact, interiorised that universal: realised the universal on its own account, and defined itself as a microcosm. The first goal of mathesis is to assure this awareness of the living in relation to life and thus to ground the possibility of a knowledge of individual destiny.

Beginning with a purely natural and unconscious complicity where each individual only posits himself in opposition to others, and more generally to the universal, it is a question of passage to a complicity that knows itself, where each grasps himself as '*pars totalis*' within a universe that he already constitutes. In other words, federation. Ostrowski, the translator of this work, saw federation in a most curious fashion: 'At a moment [1849] where ancient Germany seeks to reconstruct its federative unity, lost for centuries, but probably to be rediscovered within our own, it will not be without interest to examine the efforts undertaken by this people of bold thinkers to return science to the unity it enjoyed at the outset – back to its common centre.' What is proposed is a federation as a definition of life, not a unity founded upon a cult of force.

Thus we see that unity comes about at the level of concrete man; very far from transcending the human condition, it is its exact description. It must simply be remarked that such a description must position man in relation to the infinite, the universal. Each individual exists only by virtue of denying the universal; but in so far as man's existence refers to plurality, the negation is carried out universally under the exhaustive form of each and every one – so that it is but the human way of affirming what it denies. We have called this mode of affirmation conscious complicity. And initiation is nothing other than this. Initiation does not have a mystical sense: it is the thought of life and the only possible way of thinking life. Initiation is mysterious only in the sense that the knowledge that it represents must be acquired by each person on their own account. The initiate is living man in his relationship with the infinite. And the key notion of mathesis – not at all mystical – is that individuality never separates itself from the universal, that between the living and life one finds the same relation as between life as species, and divinity. Thus, the multiplicity of living beings which knows itself as such refers itself back to unity, which it describes in inverse relief, the circle as the simplest case of the ellipse. This is why we need to take Malfatti's words literally when he reminds us that the circle, the wheel, represents God: 'Mathesis would be for man in his relations to the infinite, what locomotion is to space.'

Mathesis is therefore neither a science, nor a philosophy. It is something else: a knowledge of life. It is neither the study of being, nor the analysis of thought. Furthermore, the opposition of thought and being, of philosophy and science, have no meaning for it, seeming illusory, a false alternative. Mathesis situates itself on a plane where the life of knowledge is identical with the knowledge of life; it is simply awareness of life. Malfatti announces its *cogito* thus: *sum, ergo cogito*; *sum, ergo genero.* That is to say that its method will be neither scientific nor philosophical. To its object, which is quite particular, must respond a particular method.

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* *

Scientific method is explanation. To explain is to account for a thing through something other than itself. Heat is movement, water is composed of H_2O, but movement as object of thought is only constituted by negating that which it explains – heat qua system of sensible qualities. Equally, when we arrive at H_2O, there is water no longer. We may call these sensible qualities appearances, but it would still be the case that the very definition of the appearance is that it is not given as such. At the other extreme, philosophical method is description in the widest sense of the word; it is that reflexive analysis whereby the sensible world is described as the representation of the cognising subject – that is to say that, here once again, it receives its status from something other than itself. In the two cases of scientific and philosophical method, we discover a new opposition – that of thought and the sensible.

We had defined the object of mathesis on the basis of the opposition between science and philosophy, between the object and the subject of thought. But that was merely a first aspect of the anarchy. For the object of thought is not merely 'thought' as thinking subject; it is also 'object', as sensible object. This gives a new depth to the opposition. Everyday life traces its path within the objectivity of the sensible; objects are outside of us, they owe us nothing, they are their own significations. Philosophically speaking, colour may be a secondary quality, a representation of the cognizant mind; scientifically it may be reduced to the object of the thought 'vibration', as the last word of reality. But it is no less certain that it is given in itself to the individual, without reference to anything other than itself. The individual knows very well that things haven't been hanging around waiting for him in order to exist. The point will be raised that the object is given to me according to a certain aspect, a certain profile, depending on the point of view it is observed from. But this is not a sign of the object's dependency. On the contrary, it is the manifestation of its total objectivity. It is well known that the contemplated object detaches itself from a ground constituted by the set of other objects. Yet, precisely, the object could not sustain any relationship whatsoever with others if this relation remained external to it. For such an object to detach itself as a form upon a ground of other objects, it must first already be its own ground. So that the 3 faces through which the profile of the cube is always given – 3 faces and no more – are already all 6 faces: the cube must already be its own ground. This phenomenon refers the object to itself and not to he who perceives. But to say that the 3 faces are already 6 faces, is to posit the identity of extension (3) and comprehension (6) in the sensible object. Why this identity? Why are the 6 faces given as 3? It is simply because everyday space is 3-dimensional. In taking a moment to reflect, it will be seen that the 6 faces as such only make sense in reference to a plane. The only way for 6 faces to exist *en bloc* in a space of 3 dimensions is to present 3 of them. The identity of extension and comprehension therefore simply defines space. Which is to say that within this space, the sensible object in general, in the name of such an identity, is none other than the concept: the word 'concept' here no longer signifying 'object of thought'.

Let us keep this in mind, it being only one of the moments of the theory of numbers in mathesis. Take the number 7, as analysed by Malfatti: Firstly, 7 is represented by means of straight lines but never by the curved line: it is the appearance of three dimensions. It indicates the truth that every (individual) body can be considered as an extension of surface (4), operating in 3 directions, length, breadth and depth. Secondly, on the other hand, 7 is concept: it does not yet represent the individual become real, but is 'the multiple development of the universal in innumerable individualities; it is the father of time and his image before the divisible time that tumbles in space upon the undulating images of appearance [...] it moves above the appearance.' A philosophical or scientific critique of this conception would surely lead to error: it does not belong to the same domain, nor to the same method.

We saw that this method of mathesis found itself before an opposition to be surpassed: that of the object of thought and the sensible object. For science explains the sensible object through something other than itself, through the object of thought – a new duality, that must in turn be reduced, by reducing this object of thought back to the sensible, quantity to quality. Let us remark generally that this is the very reduction performed by the symbol. The most simple examples suffice to demonstrate this: When I say that the flag is a symbol of the homeland, I essentially present a sensible object as the incarnation of an object of thought, some piece of knowledge. Further, this sensible object is this very incarnation of knowledge. Earlier, in terms of explanation, the object of thought was the *explanans* which could only be constituted through the annulment of the sensible object it sought to explain. In contrast, in the case of the symbol, the symbolising agent is now the sensible object, and the knowledge which it symbolizes is identified totally with it. Fundamentally, the essential symbolic procedure is the poem. Take for example Mallarmé's Fan. Its subject is certainly movement in itself, as pure object of thought, beyond all sensible manifestation. It, also, moves above appearance, which keeps it at a safe distance:

Whose imprisoned stroke thrusts back
The horizon delicately

The poem's whole argument consists in incarnating in a sensible object the thought of movement, in transforming it in this object: and not merely in the open fan, which is not yet sufficiently profoundly mortified within a sensible matter, but in the fan as thing, the closed fan. Mallarmé indicates expressly this passage from the open to the closed: 'The sceptre of pink shores'; 'This closed white wing you place'.

This is but one example, indicating to us the general sense of the symbol, the incarnation of knowledge, the movement of mathesis. Unlike explanation, the symbol is the identity, the *encounter* of the sensible object and the object of thought. The sensible object is called symbol, and the object of thought, losing all scientific signification, is a hieroglyph or a cipher. In their identity, they form the concept. The symbol is its extension, the hieroglyph its comprehension. Whereupon the word 'initiated' takes on its full sense: According to Malfatti, the mysterious character of mathesis is not directed against the profane in an exclusive, mystical sense, but simply indicates the necessity of grasping the concept in the minimum of time, and that physical incarnations take place in the smallest possible space – unity within diversity, general life within particular life. At the limit, we could even say that the notion of the initiate is rationalised to the extreme. If *vocation* defines itself through the creation of a sensible object as the result of a knowledge, then mathesis qua living art of medicine is the vocation *par excellence*, the vocation of vocations, since it transforms knowledge itself into a sensible object. Thus we shall see mathesis insist upon the correspondences between material and spiritual creation.

Let us apply this symbolic approach to man. The thought of the human condition – that is, its comprehension, defines the former as existence separated from its essence. But to say that in man in general, essence and existence are dissociated, is to say that there are several men (extension). For 'if, for instance, there existed in nature twenty men, it would not be enough to investigate the cause of human nature in general' (Spinoza).[2] That is to say that each existence finds its proper essence outside of itself, within the Other. Which is to say that fundamentally, man is not only mortal: he is 'natal'. And if the parents bestow their existence upon their child, for him to do with it as he will, inversely, does not the child see in his parents the very principle of his intelligibility, his proper essence? In so far as the comprehension of the human is defined by the separation of existence and essence, the extension which is correlative to it – identical to it, even – comes down to sexuality: 'man and woman exist in two separate bodies, each one possessing the body of the other within it'. We now see that it is through man that the concept, as identity of extension and comprehension, comes into the world. In other words, *it is sexuality that grounds sensible qualities*; and Malfatti cites the words of Hippocritus: 'Man is dual, and if he were not dual, he would have no sensation.' But we have seen that sensation refers to three dimensions: So that it is not so much sexual duality as the triadic character of love, that should be remarked upon. 'What would individual life be without love of self, which alone can lead it to the life of the species, by reproducing it as eternal being, infinite, in the species? Dualism does not contain real life. Sexual love conciliates the other two, egoism and heroism.' Moreover, it is the life of the world that is established under the ternary sign: becoming qua addition, that is, birth; duration, as the multiplication through which the act of becoming is conserved; and destruction or subtraction.

What will be the human concept *par excellence*, then? God, unity of essence and existence, is conceptualised by the circle: equivalence and rest, indifference of the interfocal zone, and pregenesthetic life. With the ellipse, however (or rather the ellipsoid, always in movement), we will rediscover separation, duality, the sexual antithesis of foci. Space is the passage from the unlimited circle to the limited ellipse, time the passage from the unity of the centre to the dualism of foci: the three dimensions are born. We might define this passage as the birth of the equivocal, with the ellipsis defined as an equivocal circle. Recall how the very object of mathesis was to be found in the problem of life, of complicity: 'It is at the very moment,' says Malfatti, 'when the individual momentarily puts himself in the place of nature, that he returns his own life to the life of nature'. In this sense, sexual love is at the same time love of self and love of the species, man-become-interior and man-becoming-exterior. Let us recall on the other hand the correspondence that presides over the relations living being/universal life and universal life as species/divinity. Thus we will see Malfatti insist on the fact that the genesthetic and the pregenesthetic are inseparable because one describes the other in negative relief: 'Before I was round. Now, I am extended in the form of an egg.' Through engenderment humanity pursues its own immortality, constitutes time as the mobile image of the eternal, seeks the completion of the ellipse in the circle. To be precise, ecstasy is nothing other than the act by which the individual is raised to the level of the species. For the species can only be thought at the limits of the circle – before the fall Adam existed as *humanitas*.

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[2] [Letter 39, to Huyghens. – trans.]

It comes as no surprise that the method of mathesis rejoins its very object. It is through the same movement that mathesis situates itself beyond the opposition thinking subject/object of thought, and also that other opposition object of thought/sensible object. We will see this even more clearly with the problem of numbers. On the one hand, number exists only within the decade, that is to say, within numeration: it seems to be constructed by a mental act, transparent to itself, in the process of which we merely add a unit to the preceding number. So that number seems to be on the side of the thinking subject; and yet it is revealed as object of thought qua opacity, endowed with unforeseeable properties to the point where the mental act, supposedly transparent to itself, engenders veritable natures. It is this privilege, on the other hand, that explains why mathesis has granted number a very particular importance: the symbol *is the thought of number become sensible object.* It is intriguing to see the reproach Malfatti addresses to the comparable studies of the Greeks: Their error was to have sought the signification of number in a purely geometrical connection, thus confining it to the object of thought. But, quite on the contrary, it is the symbol, in its full sense, that must be extricated from number. The decade begins with 0, hieroglyph of man and the world, and finishes with 10, unity realised within a complete spiritual and corporeal organism. Malfatti writes of 10 that it 'wearies neither with the action of entering nor with that of leaving. It is the sovereign of the little world (microcosm) within man.'

The definition of mathesis was twofold: In its object, in relation to the duality thinking subject/object of thought; and in its method, in relation to that other duality object of thought/sensible object. We reach a point where these two themes incessantly intersect one another, are identified with each other. The first theme led us to lay down a system of correspondences *between the individual (microcosm) and the universal*; the second, *between the corporeal and the spiritual*. Do not seek, then, a philosophical 'explanation' for the union of the soul and the body. Attempt no longer to critique scientifically the correspondences established between the individual and the universe, under the grand themes of fire, of fermentation ... etc.[3] Mathesis evolves in another domain, in the double depth of the symbol: here it finds its accomplishment, as the living art of medicine, ceaselessly establishing a system of ever-closer correspondences, embracing increasingly individual realities.

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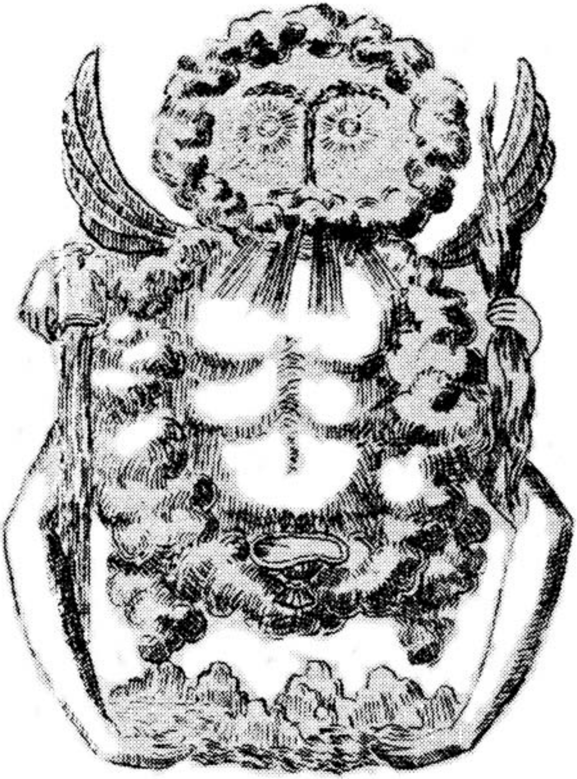
[3] Similarly, it would be pointless to seek to refute those physiological conceptions put forward, for example, in the Third Study: they belong elsewhere, to 'romantic medicine' and to 'natural philosophy'. These scientific elements drawn upon by Dr Malfatti de Montereggio were far too fragmentary to be sufficient for a complete construction. The author therefore fills the voids with bold teleological hypotheses. It is his weakness, but it is also the inevitable fate of every *a priori* synthesis.



Malfatti's Decade

'Incognitum'

Malfatti's 1845 Studies in Mathesis *attempt to recover the ancient science of mathesis, the 'great unitary system of the contemplation of the world'*[1] *from its fatal declination into, on the one hand, metaphysics, and on the other, mathematics* stricto sensu. *The* 'First Study*' claims to elucidate the metaphysical import of the decade through an examination of its importance in Hindu myth. The correspondences described by Malfatti in this study are elaborated on the basis of some strange and fascinating images from German scholar Nicolas Müller's 1822* Glauben, Wissen und Kunst der alten Hindus (Faith, Knowledge and Art of the Ancient Hindus). *Malfatti avows his indebtedness to Müller, one of those few 'who sought to penetrate the innermost meaning of the materials […] bequeathed us by this greatest of nations to whom we owe the highest of human discoveries'.*[2] *A number of these figures from Müller are reproduced in the 1946 Griffon d'Or edition of the* Studies.

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[1] J. Malfatti de Montereggio, *Études sur la Mathèse ou anarchie et hiérarchie de la science* (Paris: Éditions du Griffon d'Or, 1946), 57.

[2] *Ibid*, 16.

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In the 'First Study' Malfatti will set forth 'the Indian Organon of mathesis' in the form of a 'symbolic exposition enclosed in an elliptical hieroglyphic, deduced from the ten divine preformative powers and represented through the medium of the ten numerical signs'.[3]

According to Malfatti, the decade must be subdivided into three triads, Brahma ruling over the first triad, Vishnu the second, Shiva the third: Creation (3x1=3: the domain of unity, addition as becoming), Conservation (the domain of multiplication, through which becoming is conserved: 3x2=6), and Destruction (the domain of individuation in creation and destruction, as subtraction qua transformation; 3x3=9).[4] Thus the first three ciphers (1, 2, 3) will describe 'the passage from the sphere and the circle into the genesthetic in the form of the ellipse or ellipsoid, or revelation of the former in the latter', the emergence of the Trimurti (Brahma, Vishnu and Shiva), the 'metaphysical trinity of divine forces'.[5] The sequence of the second triad (4, 5, 6) will represent the passage from hermaphroditism to sexuation, the final triad (7, 8, 9) the passage from the general to the individual.[6]

Through the latter triads, the 'primary divine Trimurti […] passes into an external revelation […] of seven precreative powers […] the primary septuple metaphysical development personified by the allegories of Maya, Oum, Hiranyagarbha, Purusha, Prajapati, Prakriti and Prana […] [T]he cipher 4 belongs to Maya, 5 to Oum,

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[3] *Ibid.*, 57.

[4] *Ibid.*, 59-60. On individuation *Cf.* Deleuze, *Mathesis*, present volume, 146.

[5] *Ibid*, 17.

[6] *Ibid.*, 17-8.

6 to Hiranyagarbha, 7 to Purusha, 8 to Prajapati, 9 to Prakriti, and 10 to Prana'.[7]

Malfatti reconstructs mathesis by setting forth the obscure but necessary relation of each of these ciphers to the metaphysical principle personified by the respective deity. The following pages, in which we reproduce selections from Müller's images, along with extracts from Malfatti's text, can only give a reductive and partial impression of the latter's highly involved exposition.

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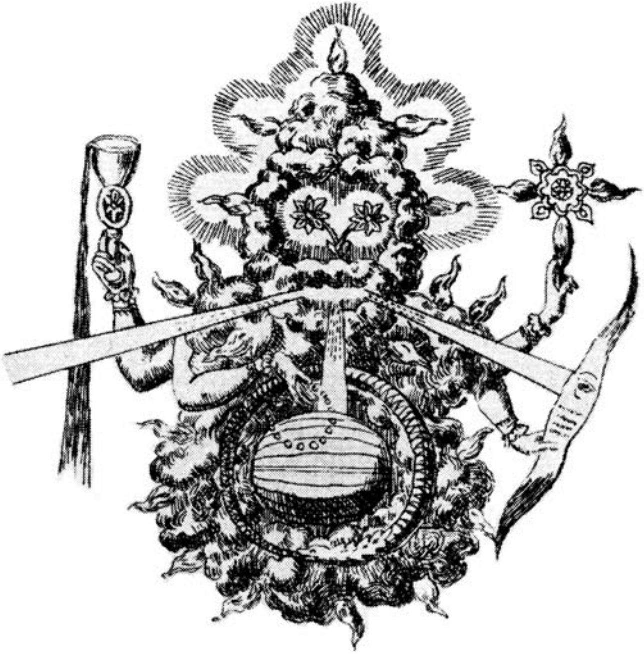
[7] *Ibid*.



Brahma = 1, 2, 3: ‘instead of eyes, we find two waterlilies in a form approximating most closely that of the cissoid; beginning together, these two lilies’ stems form the radius (stem) in place of the nose, then are divided in two opposing curves, stop at the curve of the eyebrows – in the middle the curves cross, in the place of the eyes, two lotus flowers, bringing with them the representation of the symbolic spirit – cosmo-generic.’[8]

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[8] Malfatti, 22.

'Maya = 4 […] as [Maya] opens the second triad of the pregenesthetic decade, so the cipher 4 opens that of the second triad of our genesthetic decimal […] According to doctrine, Maya is the exercise of the threefold force of the Trimurti, as ex-engenderment of the latter […] the passage of the circle into the ellipse […] Female yet endowed with virile force, she is hermaphrodite […] She is half Brahma, half Maya: According to the Veda, the spontaneous act of the separation of double sexuality in the original form of feminine and virile demi-divisibility […] Through a careful examination of her image, we find, around the centre of her stomach, four groups of hanging pearls, the first signification of the number four. But the principal ornament of her clothing consists in a rich and prominent emblem composed of an ellipse enclosed within a parallelogram […] It is to be remarked, and it confirms our point of view, that the paralellogram which encloses the ellipse has the form neither of a square nor of a rectangle parallelogram, but rather that of a lozenge such as one might arrive at by repeating an iscosceles triangle upon its base – which precisely symbolises the deployment of the Trimurti in Maya. – The square, set in motion, becomes a lozenge, as the circle does an ellipse.'[9]

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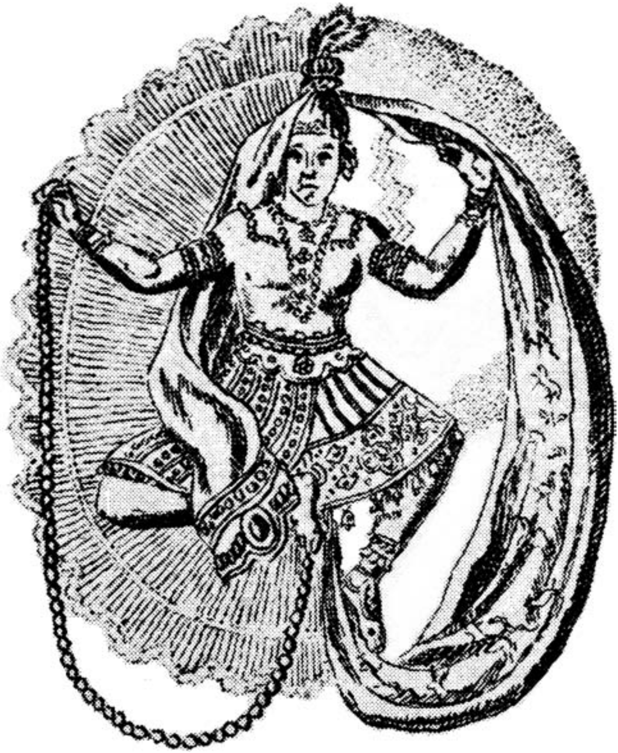
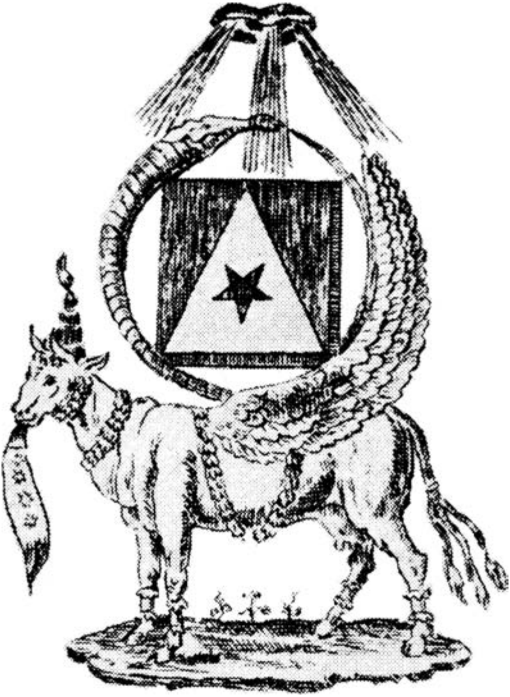
[9] Malfatti, 26, 28-9.





‘Oum = 5 […] The image of Oum, where a circle symbolising infinite time (the serpent of eternity) circumscribes a square in the middle of which is found suspended a triangle.’ Oum is ‘a proclamation of all that becomes; a prototype of the first cosmogenetic development; a breath of original life; the container of a nature to come; the envelope of science; the mystical body of Brahma – the soul of all with and within Brahma.’[10]

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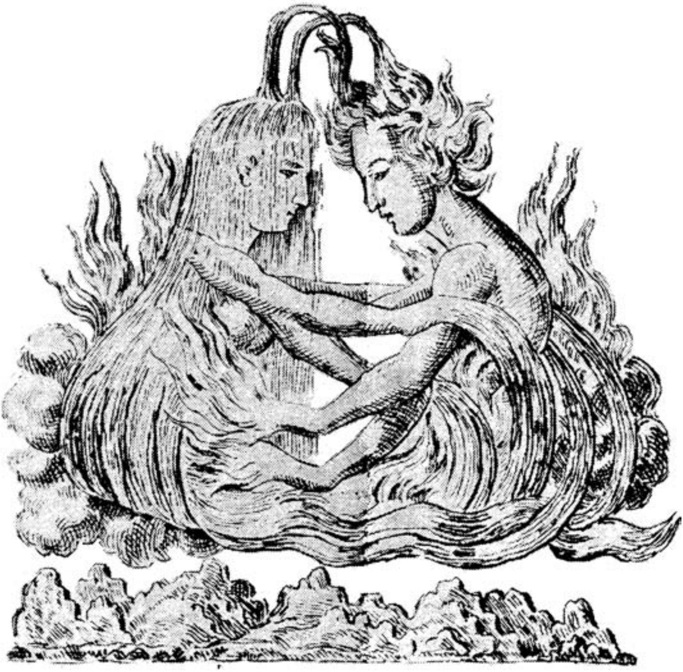
[10] Malfatti, 31-2.



Oum ‘represented in human form, as masculine and feminine in the act of coupling’.[11]

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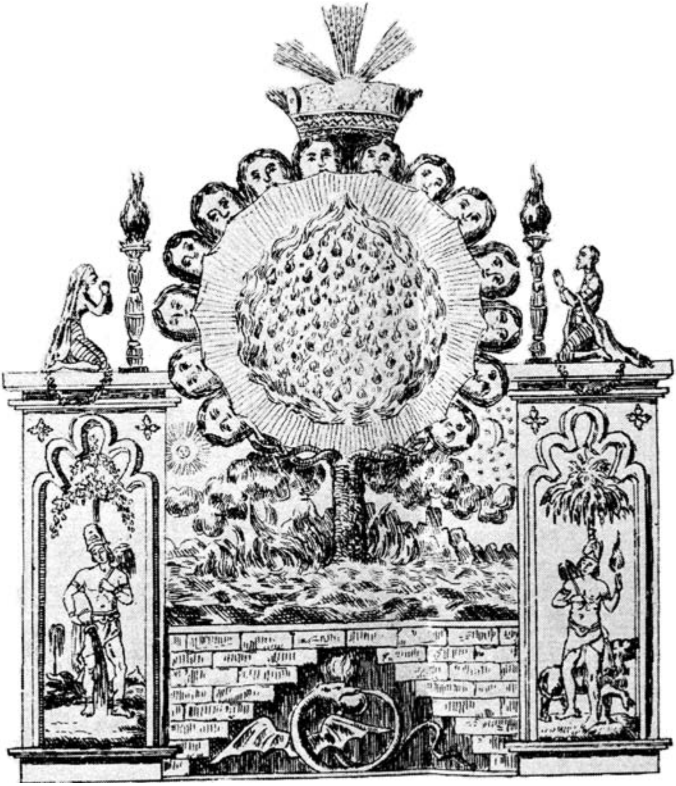
[11] *Ibid*., 32.



‘Hiranyagarbha = 6’: ‘in 6 […] is substantialised not only the totality received from the ideal and real hermaphroditism as genre, as spirit of the world closed in on itself as the egg of the world […] but also the idea of a development outside itself of finite sex in the third power of 2 = 8, a sex which, in the third triad, is expressed in an infinite individuality.’

‘The allegorical image of Hiranyagarbha consists in an altar decorated with a great altarpiece. An enormous tree-trunk plunging its roots into water, the earth and fire rising below a sky of clouds and lights. In the branches, this tree of the world holds a circle composed of fourteen heads, representing the spirit of the world which reigns in all things. – Inside, enclosed by the circle of heads, is the sea of light and of devouring flames, within which, like tongues of flame, swim the multitude of future individual souls, like golden carp in waters dappled silver by the sun.’[12]

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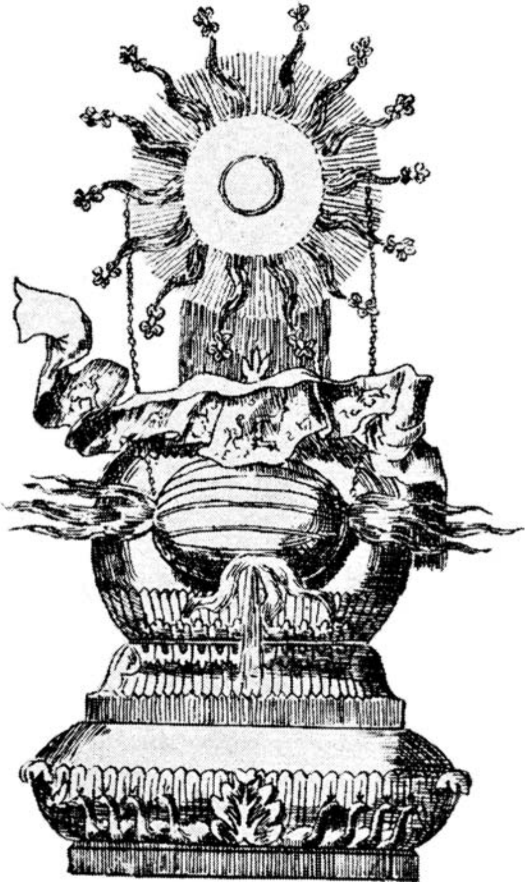
[12] Malfatti, 37-8.



'Purusha = 7 […] opens the third triad as passage from the general to the particular, from the species to the individual, and as realisation of the conversion indicated in the second triad of hermaphrodism to sex; only by this token can it be a question, in the third triad, of a truly achieved individuality […] 7 does not however yet represent the individual become real, but firstly the thought of the development of the divine Trimurti through Maya, Oum, Hiranyagarbha, as intermediate members in matter […] The idea of matter can be understood sometimes as atomistic […] and sometimes as dynamic […] The figure of Purusha conforms perfectly to this analysis […] It is a statue of large dimension, before which Brahma moves […] beneath the veil of Maya […] as a sun with powerful rays; thus the atomistic side is indubitably signified by the massive statue, as is the dynamic side by the radiating sun […] But in the middle of the massive pedestal, we see emerge from the egg in the very direction of its axis of longitude, 4 + 3 powerful jets of fire; the same thing happens in the transversal axis, but in such a way that the 4 lower jets extend themselves in breadth and depth, as if in a determined triadic and tetradic manner […] as 4 as two times 2 represents geometrically germination in space (but so far only in ideally – as surface), so also 7 can be understood as 6+1 or 4+3. – In the first case, it is the passage from the second into the third triad through the medium of a new development; in the second case, it is that geometric truth, that every (individual) body can be considered as an extension of surface (4), operating in three directions (length, breadth, depth).'[13]

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[13] Malfatti, 43-4; *Cf.* Deleuze, present volume, 149.

‘Prajapati = 8 […] In eight, individuality is finally obtained, as is seen in the figure of the cipher 8 closed in on itself with a perfect symmetry […] Eight, the third power of the first number pair (more precisely, the feminine principle, reproductive of those that went before), gives the idea of space extended in three directions; not merely geometrically-empty space, but already corporealised space, whereas the interlaced double-ellipse indicates to us, since it signifies an operation of ever-living activity, the individuality which never separates from the world of the universal; – the dualism of mind and body (sex), already expressed in the act of becoming; – the two foci in man, reason and sensibility.’[14]

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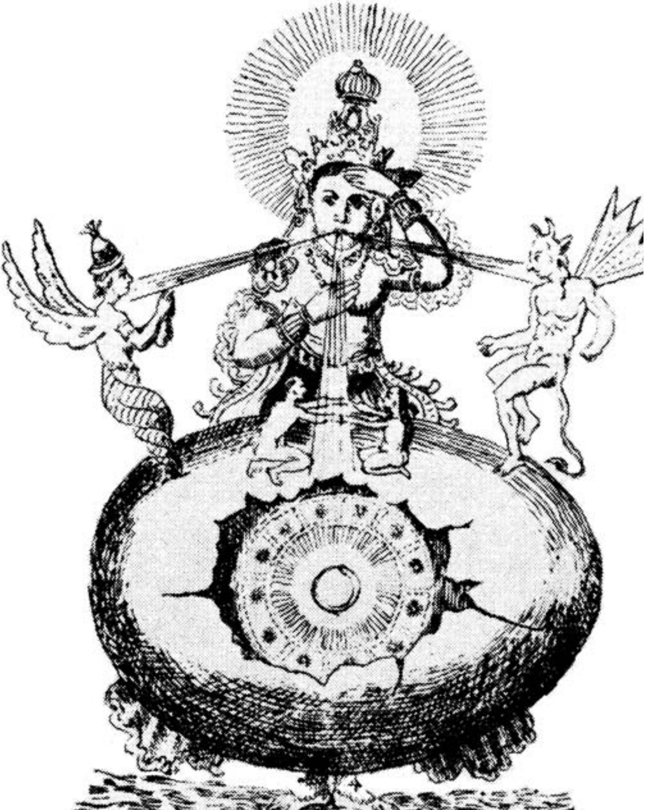
[14] Malfatti, 47.



'Prakriti = 9 […] Just like Prakriti's position in the allegories, the relation of the number 9 to the ciphers is that of a conclusion of the third triad of the decimal: 3x3=9. The idea of the individual, which – according to its geometrical meaning, in regard to its participation in the passage from the circle to the ellipse, and properly the sphere into the ellipsoid – is so well symbolised in the number 8. This idea, however, suggested to the profound contemplative faculty of the Indians an aspect of the dependence of the individual, namely that of the triple life of the egg of the world, as sidereal life, telluric life and atmospheric life. – In man it is on one hand the head, the stomach and the chest; on the other hand reason, sensibility, and heart [the soul] […] The image of Prakriti is a woman's figure with the shield of Maya at her feet, seated on a throne whose triangular base has nine surfaces; encompassed by the crown radiated by Brahma which passes across the chains of gold of the pleasure of the senses, she is charged from head to foot with interlaced chains and attaches to the head with points turned above. – In her lap are seated the divine image of the Trimurti, with most significant attributes. – Brahma holds the Veda and a lotus, Vishnu, the circle of the rotation of the world; Shiva, the flaming trident; – Prakriti throws with two hands the models of the forms of Maya into an apron attached in front, and mixes them together. – On the pedestal we see Maya, shifting the veil of the image of the world […] Prakriti was considered to be the fundamental principle of phenomenal change into the intellectual, and, in the physical sense, as the fundamental principle of the immersion of the mind in the bonds of matter.'[15]

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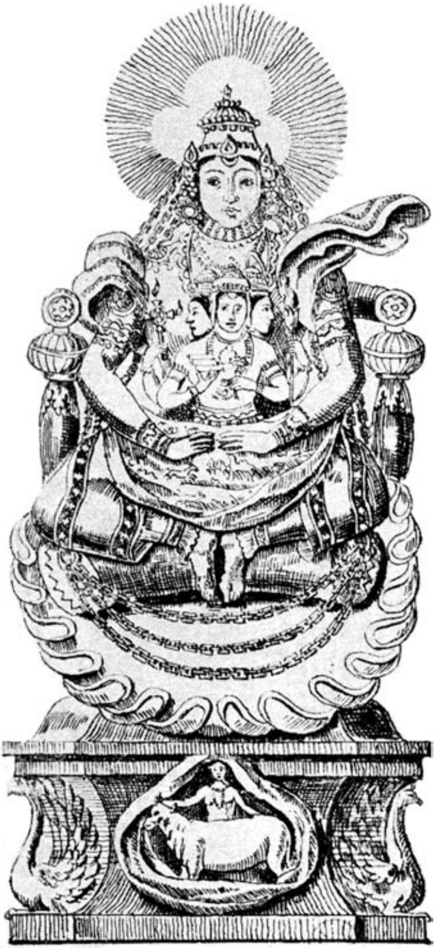
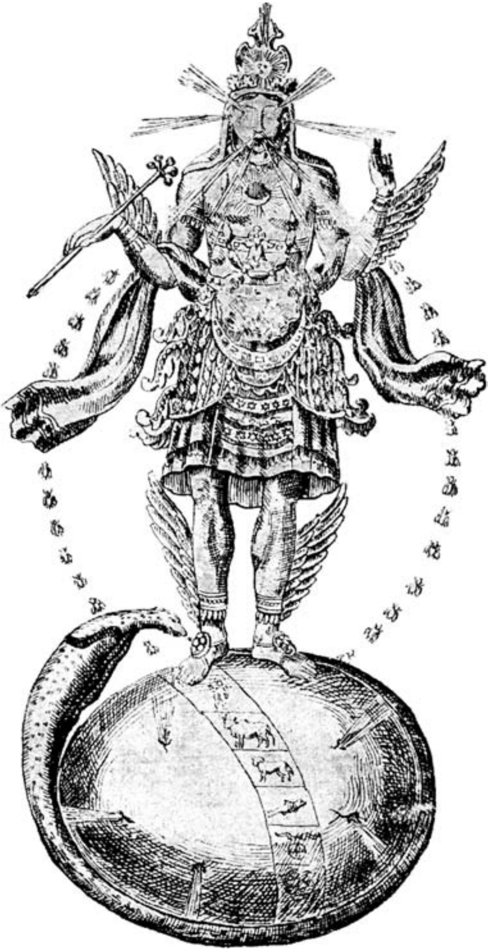
[15] Malfatti, 50-1.





‘Prana = 10 […] Prana was considered to be the original form of the breath of the world, vivifying all, at the same time that Oum was its mystical body […] The principle of movement in the original form of time and space, the pulsation of nature and the movement of the wind and spiritual pulse (the five winds of life) […] His relation with the external world is expressed by the powerful rays which shine from his eyes, nostrils, ears and mouth, through which he makes the divine essence of life ebb and flow […] Just as the sun radiates above his head, so we see shining, on his chest, the moon with the circle of clouds around his navel. He sits, as king of the breath of life, upon the egg of the world, from which, from five openings visibly give forth the currents of Prana (as image of the universe outside of man).’[16]

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[16] Malfatti, 53-5.

Aiôn and Chronos: Deleuze and the Stoic Theory of Time

John Sellars

Gilles Deleuze outlines a supposedly Stoic dual theory of time: on the one hand there is aiôn*, comprising an infinite past and future; on the other there is* chronos*, the extended present. In the scholarly literature on Stoicism, however, either a single theory is reconstructed or the evidence is dismissed as too thin and incoherent. I offer an explanation for this distance between the Deleuzian and scholarly presentations of the Stoic theory of time. I conclude by answering the question to what extent, if any, the Deleuzian theory of* aiôn *and* chronos *deserves to be called Stoic.*

In his 1969 book *The Logic of Sense* Gilles Deleuze embarks on an unexpected engagement with the ancient Stoics.[1] His project in that book is to give an account of

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[1] See G. Deleuze, *Logique du sens* (Paris: Minuit, 1969); *The Logic of Sense*, trans. M. Lester (New York: Columbia University Press, 1990), hereafter abbreviated to *LS*, followed by French/English pagination. The present article forms part of a larger project concerned with Deleuze and Stoicism. A number of other articles have recently issued from this project, notably 'An Ethics of the Event: Deleuze's Stoicism', *Angelaki* 11/3 (2006), 157-71 and 'Deleuze and Cosmopolitanism', *Radical Philosophy* 142 (2007), 30-37. These follow on from a much older article, 'The Point of View of

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http://www.urbanomic.com

linguistic meaning or sense as a non-existing entity, and in order to do this he draws upon Stoic philosophy of language, in which linguistic meaning is classified as one of four incorporeal entities outside the category of 'being' but within the broader category of 'something'.[2] According to Deleuze, Stoic ontology posits a surface populated on its two sides by corporeal causes and incorporeal effects,[3] although in fact this bears little relation to the ontology of the ancient Stoics.[4] This concern with the ontological status

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the Cosmos: Deleuze, Romanticism, Stoicism', *Pli: The Warwick Journal of Philosophy* 8 (1999), 1-24. For literature on Deleuze and Stoicism by others see J. Simont, 'Se vaincre soi-même plutôt que la fortune (Le stoïcisme chez Sartre et Deleuze)', in G. Idt, ed., *Sartre en sa maturité*, 'Études sartriennes' VI (Paris: Université Paris X, 1995), 175-91; T. Bénatouïl, 'Deux usages du stoïcisme: Deleuze, Foucault', in F. Gros and C. Lévy, eds, *Foucault et la philosophie antique* (Paris: Kimé, 2003), 17-49; S. Bowden, 'Deleuze et les Stoïciens: une logique de l'événement', *Bulletin de la Société Américaine de Philosophie de Langue Française* 15 (2005), 72-97; A. Beaulieu, 'Gilles Deleuze et les Stoïciens', in A. Beaulieu, ed., *Gilles Deleuze, héritage philosophique* (Paris: Presses Universitaires de France, 2005), 45-72. There are also discussions of Deleuze and Stoic ontology in V. Bergen, *L'Ontologie de Gilles Deleuze* (Paris: L'Harmattan, 2001), esp. 117 ff. and 273 ff.

[2] See *LS* 13-21/4-11. Here Deleuze draws upon Émile Bréhier's *La théorie des incorporels dans l'ancien stoïcisme* (Paris: Vrin, 1928; 9th edn 1997). For a brief overview of Stoic ontology see J. Sellars, *Stoicism* (Chesham: Acumen / Berkeley: University of California Press, 2006), 81-6.

[3] These incorporeal effects are, for Deleuze, also identified with events.

[4] There is indeed a contrast between existing bodies and subsisting incorporeals in Stoic ontology but it is quite different from the two-sided ontology that Deleuze develops in *LS* and credits to the Stoics. The Stoics in fact posit four types of incorporeal, of which linguistic meaning or sense (*lekton*, 'that which is said', often translated as 'sayable') is just one (the other three are time, place, and void). Deleuze's supposedly Stoic 'incorporeal effects' are merely examples of these incorporeal linguistic predicates. There is no Stoic concept of an 'incorporeal event' along the lines that Deleuze suggests. Nor is there any conception of parallel series of bodies-causes and incorporeal-effects inhabiting two sides of a single surface. Deleuze draws upon Sextus Empiricus, *Adversus Mathematicos* 9.211 (*Stoicorum Veterum Fragmenta* [hereafter *SVF*], ed. H. von Arnim, 4 vols (Leipzig: Teubner, 1903-24), 2.341; A. A. Long and D. N. Sedley, *The Hellenistic Philosophers*, 2 vols (Cambridge: Cambridge University Press, 1987), 55B) and takes Sextus's reference to incorporeal predicates as if it were a reference to incorporeals as such. Sextus's incorporeal predicates

of linguistic sense is the principal reason why Deleuze turns to the Stoics but his engagement with Stoicism in *The Logic of Sense* is by no means confined to their theory of incorporeals. He also discusses Stoic ethics and the Stoic 'image of the philosopher'.[5] One might say that Deleuze's principal theme of the logic (or ontology) of sense provides him with a way into a much broader exploration of ancient Stoicism.

Of the various aspects of Deleuze's engagement with the Stoics, it is his account of the Stoic theory of time as a dual theory of *aiôn* and *chronos* that is probably most widely known. In the wake of Deleuze's enormous influence in the English-speaking world these supposedly Stoic concepts of *aiôn* and *chronos* have taken on a life of their own and a quick internet search will turn up a wide range of references to 'the Stoic theory of *aiôn* and *chronos*' in publications from right across the spectrum of Humanities disciplines – from literary theory, film theory, architectural theory, feminist theory, and many others.

However, if one turns to the standard English-language scholarship on Stoicism one will find no reference to such a dual theory of time and no discussion of the terms *aiôn* and *chronos* with the sense that Deleuze attaches to them. The aim of what follows is to ask the question to what extent, if any, are Deleuze's concepts of *aiôn* and *chronos*

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caused by bodies are merely *lekta* and as such are examples of but one of the four types of incorporeal proposed by the Stoics. On the basis of this misreading Deleuze goes on to construct his two-sided ontological surface. His account is, moreover, inconsistent, sometimes placing sense on the incorporeal side of this surface, other times locating sense on the boundary between the two sides. For discussion of Stoic *lekta* see Sellars, *Stoicism*, 61-4.

[5] For Deleuze's remarks on Stoic ethics see the 20th and 21st series; for the 'image of the philosopher' see the 18th series.

Stoic concepts and, if not, to ask where they came from. This is a fairly modest scholarly task and I do not claim that any serious philosophical consequences follow from my response to these questions. I shall begin by outlining Deleuze's account of these terms and locate his principal source. I shall then turn to the early Stoics and see what has been said about their theory of time. Then I shall move on to the later Stoic Marcus Aurelius who, as we shall see, is particularly significant for this question. We shall also briefly touch upon the discussions of time in Henri Bergson and William James, insofar as they inform the interpretations of Stoicism under discussion. I shall conclude by offering an answer to my question, namely whether the concepts of *aiôn* and *chronos* are really Stoic concepts at all.

1. DELEUZE ON AIÔN AND CHRONOS

According to Deleuze the Stoics proposed two distinct readings of time.[6] Rather than conceive time as a continuum divided into the three parts of past, present, and future, Deleuze suggests that the Stoics separated the present from the past and future. On the one hand the Stoics conceived time as *chronos*, the extended, but limited, living present. On the other hand they conceived time as *aiôn*, the unlimited past and future:

> Thus time must be grasped twice, in two complementary though mutually exclusive fashions. First, it must be grasped entirely as the living present in bodies which act and are acted upon. Second, it must be grasped entirely as an entity infinitely

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[6] The conceptual distinction is introduced at *LS* 14/5 and elaborated in the 10th and 23rd series, with passing references throughout. For a general discussion see P. Mengue, 'Aiôn / Chronos', in R. Sasso and A. Villani, eds, *Le Vocabulaire de Gilles Deleuze*, Les Cahiers de Noesis 3 (Nice, 2003), 41-7.

> divisible into past and future […]. Only the present exists in time and gathers together or absorbs the past and future. But only the past and future inhere in time and divide each present infinitely. These are not three successive dimensions, but two simultaneous readings of time.[7]

Under *chronos*, the present moment has a certain extension or duration (*étendue ou durée*),[8] an extension that can expand or contract – the present discussion, the present day, the present year, for instance. It can even expand to encompass all of time, becoming what Deleuze calls the cosmic present.[9] From the perspective of *chronos* the past and future are merely parts of some larger present that subsumes the current present: 'the past and future indicate only the relative difference between two presents'.[10] The past and future of the present day – yesterday and tomorrow – are merely parts of the larger present that is the present week. Thus there exists a series of presents of differing extensions enveloping one another, all ultimately enveloped by the cosmic present.

Under *aiôn*, the relationship between the present on the one hand and the past and future on the other is reversed. Instead of a present that can expand and absorb the past and future, under *aiôn* the extended present evaporates in a process of subdivision into part of the past and part of the future.[11] The extended present is replaced by the instant, a mathematical limit without thickness or extension that stands between past and future.[12] If ever we think we have isolated a present moment with any extension in between past and future, it will always be possible to divide it once again into part of the past and part of the future. On this reading no event is ever truly present, having either just happened or being just about to happen: 'no one ever dies, but has always just died or is always going to die'.[13] With *aiôn*, then, we find an echo of Aristotle's discussion of time in *Physics* 4.10, where Aristotle wonders whether time really exists if some of it is in the past and so no longer exists and some of it is in the future and so does not yet exist. The 'now' (*nun*) for Aristotle is an instant without extension separating past and future, and so neither does this exist, for it does not refer to a period of time that is ever actually present.[14]

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[7] *LS* 14/5. See also *LS* 77/61 and 190/162, where Deleuze labels these two readings *chronos* and *aiôn* respectively.

[8] See *LS* 190/162.

[9] See *LS* 77-8/61; see also 190/162: 'God experiences as present that which for me is future or past, since I live inside more limited presents'.

[10] *LS* 78/62; see also 190/162.

[11] See *LS* 78/62.

It should be clear that these two conceptions of time attributed to the Stoics are radically opposed to one another.[15] The idea of an extended present with a certain temporal extension or duration is incompatible with the idea of a present defined as an abstract mathematical limit. Thus we have two diametrically opposed conceptions of time involving two different conceptions of the present moment (and in order to avoid confusion Deleuze labels the present without extension 'the instant').[16] For Deleuze, the Stoics do not conceive time as something composed of the three elements of past, present, and future. Rather, they read time in two distinct ways: as an expanding and contracting extended present on the one hand (*chronos*), and as an infinitely divisible line of past-future divided by an instant without thickness on the other (*aiôn*)

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[12] See *LS* 78/62, where he calls this a *pur instant mathématique*, and 193/164, where it is 'the instant without thickness and without extension' (*l'instant sans épaisseur et sans extension*).

[13] *LS* 80/63.

[14] See Aristotle, *Physics* 4.10, 217b29-218a8. For the 'now' being an instant without extension see *Physics* 4.13, 222a10-20. For the infinite divisibility of a continuum such as time see *Physics* 6.1, 231a21-b18. For discussion see R. Sorabji, *Time, Creation, and the Continuum* (London: Duckworth, 1983), esp. 7-16.

[15] We can also note that, for Deleuze, the extended present of *chronos* is intimately connected to the interactions of existing bodies, while the infinite and infinitely divisible past-future of *aiôn* is associated with the subsisting incorporeal effects of the event. These are the two sides of his pseudo-Stoic ontological surface.

(…(…(extended present)…)…)	← past …. | …. future →
	(instant)
finite present	infinite past and future
chronos	*aiôn*

Figure 1. Two Conceptions of Time

Deleuze straightforwardly presents this as an ancient Stoic theory and he cites as his source for this theory a book by the French scholar Victor Goldschmidt on the 'Stoic System and the Idea of Time'.[17] If one has any doubts about whether this really is an ancient Stoic theory then one must turn to Goldschmidt and assess his account and examine the ancient sources that he cites in its support. We shall do this shortly, but first let us turn directly to the ancient Stoics and some of their other modern interpreters.

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[16] See *e.g. LS* 78/62 and 193/164, noted above.

[17] See *LS* 78/340 ('Victor Goldschmidt in particular has analyzed the coexistence of these two conceptions of time'), with V. Goldschmidt, *Le système stoïcien et l'idée de temps* (Paris: Vrin, 1953, 4th edn 1979). Deleuze also cites É. Bréhier, *La théorie des incorporels dans l'ancien Stoïcisme* (Paris: Picard, 1908; 9th edn Vrin, 1997) as a source for his reading of Stoicism, although he relies on this mainly for his account of the Stoic theory of incorporeals rather than the theory of time.

2. The Early Stoics on Time

None of the works of the early Stoics survive and so in order to consider their theory of time it is necessary to rely upon quotations and doxographical reports of their views. These are inevitably partial, partisan, and sometimes contradictory. The task of determining what the early Stoics thought is by no means easy, then, and this is especially true when it comes of their thoughts about time. The matter is complicated further by the fact that the label 'early Stoics' covers a number of thinkers, each of whom may well have revised their position at some point. It is sometimes assumed by both modern readers and ancient doxographers that there exists just one early Stoic position on any given philosophical topic, but this is not necessarily the case. Moreover, ancient doxographers and modern scholars sometimes assume a philosophical identity between the early Stoa as such and the work of its most prominent figure, Chrysippus. In short, determining what the early Stoic theory of time actually was is a scholarly minefield. With that warning in place, let us turn to consider the evidence.

There are in fact just three texts that report what the early Stoics thought about time, and these are in Diogenes Laertius, Plutarch, and Stobaeus. The last two are longer and include reports relating to different early Stoics so I shall divide both of these in two, giving us five ancient texts to consider:

> (a) Diogenes Laertius 7.141: Time (*chronos*) too is incorporeal (*asômatos*), being the measure (*diastêma*) of the world's motion (kinêsis). And time past and time future are infinite (*apeiron*), but time present is finite.[18]

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[18] This text is *SVF* 2.520. It is not included in Long and Sedley.

(b) Stobaeus 1,106,5-23: Chrysippus said time (*chronos*) is the dimension (*diastêma*) of motion (*kinêsis*) according to which the measure of speed and slowness is spoken of; or the dimension accompanying the world's motion. And (he says) every single thing moves and exists in accordance with time […] Just as the void in its totality is infinite (*apeiron*) in every respect, so time (*chronos*) in its totality (*panta*) is infinite (*apeiron*) on either side (*eph' hekatera*). For both the past and the future are infinite (*apeiron*). He says most clearly that no time (*chronos*) is wholly present (*holôs enistatai*). For since continuous things are infinitely divisible (*tomê*), on the basis of this division every time (*chronos*) too is infinitely (*eis apeiron*) divisible (*tomê*). Consequently no time (*chronos*) is present exactly (*kat' apartismon enestanai*), but it is broadly (*kata platos*) said to be so. He also says that only the present belongs (*huparchein*); the past and future subsist (*huphestanai*), but belong (*huparchein*) in no way, just as only predicates which are [actual] attributes are said to belong (*huparchein*), for instance, walking around belongs to me when I am walking around, but it does not belong when I am lying down or sitting.[19]

(c) Plutarch, *On Common Conceptions* 1081c-1082a: The Stoics […] do not admit a minimal time (*elachiston chronon*) or wish the now (*nun*) to be partless (*ameres*) but claim that whatever one thinks one has grasped and is considering as present (*enestos*) is in part future and in part past. […] Chrysippus […] says in his book *On the Void* and elsewhere that the part of time (*chronos*) which is past and the part which is future subsist (*huphestêkenai*) but do not belong (*huparchein*) and only the present belongs. But in *On Parts* Books, 3, 4, and 5 he maintains that one part of the present time (*enestêkotos chronou*) is future and the other past. So it turns out that he divides the belonging constituent of time into non-belonging parts of what belongs, or rather that he leaves nothing at all of time belonging, if the present has no part which is not future or past.[20]

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[19] Cited according to volume, page, and line of C. Wachsmuth, *Ioannis Stobaei Anthologii Libri Duo Priores Qui Inscribi Solent Eclogae Physicae et Ethicae*, 2 vols (Berlin: Weidmann, 1884; repr. 1958). This text is Arius Didymus fr. 26 (in H. Diels, *Doxographi Graeci* (Berlin: De Gruyter, 1879; Editio Quarta 1965), 461,23-462,3), *SVF* 2.509, and Long and Sedley 51B.

(d) Plutarch, *On Common Conceptions* 1081e: Archedemus says that now (*nun*) is a kind of joining and meeting of the past and future […] now (*nun*) is not a time (*chronos*) but a limit (*peras*) of time (*chronos*).[21]

(e) Stobaeus 1,105,17-106,4: On Posidonius: Some things are infinite (*apeira*) in every respect like the whole of time. Others in a particular respect like the past and the future. For each of them is limited only by reference to the present (*paronta*). His definition of time (*chronos*) is as follows: dimension of motion or measure of speed and slowness. And he holds that that time which is thought of in terms of 'when' is partly past, partly future, and partly present. The last consists of a part (*meros*) of the past and a part of the future, encompassing the actual division (*diorismon*). But the division (*diorismon*) is point-like (*sêmeiôdê*). Now (*nun*) and the like are thought of broadly (*en platei*) and not exactly. But now (*nun*) is also spoken of with reference to the least perceptible time encompassing the division (*diorismon*) of the future and the past.[22]

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[20] This text is *SVF* 2.517-9 and Long and Sedley 51C. I have made use of the helpful text with translation in H. Cherniss, *Plutarch, Moralia: Volume XIII, Part II* (Cambridge, MA: Harvard University Press, 1976).

[21] This text is Archedemus fr. 14 (in *SVF* 3) and Long and Sedley 51C.

[22] This text is Arius Didymus fr. 26 (in Diels, *Doxographi Graeci*, 461,13-22), Posidonius fr. 98 (in L. Edelstein, and I. G. Kidd, *Posidonius, The Fragments* (Cambridge: Cambridge University Press, 1972; 2nd edn 1989)), and Long and Sedley 51E.

These texts are complex and in certain respects seemingly contradictory. The challenge of reconstructing the Stoic theory of time from these meagre remains has not surprisingly led to a number of conflicting interpretations. On the basis of text (a) some have suggested that the Stoics posited a finite present with a certain extension or duration sitting between the past and future each of which are limited by the present on one side but unlimited on the other.[23]

← infinite past … (extended finite present) … infinite future →

Figure 2. Tripartite Theory of Time

This is clearly the polar opposite of Deleuze's reading. Others have suggested that while there is a mathematical limit between past and future, there is also an extended present that overlaps with part of the past and part of the future,[24] in effect combining Deleuze's two opposed readings into one.

instant
← infinite past … | … infinite future →
(extended present)

Figure 3. Revised Tripartite Theory of Time

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[23] I. G. Kidd, *Posidonius II: The Commentary*, 2 vols (Cambridge: Cambridge University Press, 1988) suggests this was Zeno's position. Sorabji, *Time, Creation, and the Continuum*, 25, attributes this interpretation to G. E. L. Owen (although not citing this text).

[24] See *e.g.* Sorabji, *Time, Creation, and the Continuum*, 25, who considers (but does not endorse) this reading along with the previous reading as 'two rival interpretations of Chrysippus'.

The reading that has tended to dominate modern scholarly discussions rejects both of these possibilities. It argues that for the Stoics the present does not have any extension of its own and when we talk as if it does we are merely talking about a fictitious or specious present. This is the position adopted by Sorabji after considering and then rejecting the other two readings and it is also the position adopted by Long and Sedley in their influential sourcebook.[25] The latter note that according to the sources 'time is infinite in extension and infinitely divisible'.[26] While time as a whole is infinite, past and future are infinite on only one side, limited on the other side by the present. Long and Sedley take 'the present' and 'the now' to be synonymous, being an indivisible durationless point (*i.e.* Deleuze's 'instant'). 'But', they say, 'we are allowed to speak of the present as if it had a duration or existence of its own. That is acceptable at the level of perception, but under strict analysis the present is specious since it "consists of a part of the past and a part of the future"'.[27] In other words, the extended present is merely a popular but ultimately mistaken way of talking (and not a second theory of time). On this reading, there is no extended present of *chronos*, only the infinite past-future of *aiôn*.

There is one piece of ancient evidence that this reading does not take into account. It is the claim reported by Plutarch and Stobaeus that while the past and future 'subsist' (*huphestanai*), the present moment 'belongs' (*huparchein*).[28]

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[25] See Sorabji, *Time, Creation, and the Continuum*, 21-6; Long and Sedley, vol. 1, 307.

[26] Long and Sedley, *ibid*.

[27] Long and Sedley, *ibid*.

[28] On this distinction see A. A. Long, 'Language and Thought in Stoicism', in A. A. Long, ed., *Problems in Stoicism* (London: Athlone, 1971), 75-113, at 89-93; V.

This word translated as 'belong' (*huparchein*) has sometimes been translated as 'exist'.[29] The present moment belongs or exists in the same sense that the predicate 'I am walking' belongs to me when I am actually walking but not when I am sitting. The important point is that the present is said to have a greater ontological status than the past and future, and this seems at odds with the claim that the present is merely specious.

It has been suggested by Kidd that the Stoic Posidonius tried to overcome this problem by drawing a distinction between two senses of the now (*nun*).[30] According to Kidd, the first Stoic, Zeno, held a tripartite theory of time divided into past, present and future, positing a finite present with a certain extension sitting in between the past and future. Chrysippus rejected the idea of a finitely extended present due to the problem of its infinite divisibility (raised by Aristotle in *Physics* 6.3, 234a11-24), and so was left with only the past and future separated by a limit. However, this left Chrysippus with the paradox of claiming that the present 'belongs' even though it isn't really there. Posidonius overcame this paradox in Chrysippus' position (in which the present is reduced to nothing but still 'belongs') by distinguishing between two senses of now (*nun*), one conceptual and one temporal – the dividing limit and the specious present (these are Deleuze's 'instant' and 'extended present'). While the conceptual present is a mathematical

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Goldschmidt, '*Huparchein* et *huphistanai* dans la philosophie stoïcienne', *Revue des Études Grecques* 85 (1972), 331-44; F. H. Sandbach, *Aristotle and the Stoics*, Cambridge Philological Society Suppl. Vol. 10 (Cambridge: Cambridge: Philological Society, 1985), 79-80; Long and Sedley, vol. 1, 164.

[29] See *e.g.* Long, 'Language and Thought in Stoicism', 89; Sorabji, *Time, Creation, and the Continuum*, 22.

[30] See Kidd, *Posidonius II: The Commentary*, vol. 1, 395-403.

concept, the temporal present is an extension or interval between two limits where the extent of the interval is not fixed, and so the present can expand or contract, although it remains specious.

Zeno:

← infinite past … (extended finite present) … infinite future →

Chrysippus:

instant

← infinite past … | … infinite future →

Posidonius:

conceptual instant

← infinite past … | … infinite future →

(temporal extended present)

Figure 4. Kidd on Zeno, Chrysippus, and Posidonius

Kidd goes on to draw a parallel with William James,[31] suggesting that the philosophically correct use of the notion of the present is to refer to a durationless limit or instant. This is the conceptual present. However, the foundation for our conception of time is a pre-philosophical specious present of lived time, which is necessarily vague and imprecise. Again, like Sorabji and Long and Sedley, the extended present of *chronos* is rejected as specious and we are left with the infinite past-future and durationless instant of *aiôn*. More recent scholarship has continued with this line of interpretation. In the nine hundred pages of *The Cambridge History of Hellenistic Philosophy* we get just one paragraph on the Stoic theory of time: 'To the Stoics time is an incorporeal continuum which can be infinitely divided. For this reason no time is wholly present inasmuch as the present consists of a part of the past and a part of the future. Past and future are parts of time and stretch out infinitely on one side but are limited by the present, which acts as a kind of joining'.[32] This is again the Deleuzian time of *aiôn*. No attempt is made here to reconcile this with the ancient claim that, while the past and future subsist, the present 'exists' or 'belongs' (*huparchein*).

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[31] Kidd cites W. James, *The Principles of Psychology*, 2 vols (London: Macmillan, 1890), 1,631.

By way of summary thus far, we can see that according to the recent scholarly consensus the Stoics held a theory of time close to Deleuze's conception of *aiôn*. However, there remains a tension within the ancient sources that is uncomfortable. Indeed, most modern accounts fully acknowledge this and their readings are offered as the most plausible reconstruction of some messy and possibly contradictory doxography. The tension that remains is this: while on the one hand time infinitely extends into the past and future and the past and future are separated by a durationless instant, on the other hand the present moment is said to be extended and to 'belong', which accords it a greater ontological status than the past or future.

Plutarch, who is explicitly looking for contradictions within Stoic philosophy, sums this up best in text (c) above. There he says that while Chrysippus says in his book *On the Void* that 'part of time which is past and the part which is future subsist (*huphestêkenai*) but do not belong (*huparchein*) and only the present belongs (*huparchein*)', in his other book *On Parts* 'he maintains that one part of the present time is future and the other past'. Consequently Plutarch charges Chrysippus with dividing 'the belonging constituent of time into non-belonging parts of what belongs, or rather that he leaves nothing at all of time belonging'. This is the tension that modern scholars try to explain away. The fact that Plutarch cites from two different works by Chrysippus (*On the Void* and *On Parts*) should not be overlooked, and Kidd may well be right to try to sketch a development in Stoic thinking about time.[33] What we may have here are fragments of two different positions held by Chrysippus at two different stages in his philosophical development. But of course such a claim can be no more than speculation.

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[32] D. M. Schenkeveld, 'Language', in K. Algra *et al.*, eds, *The Cambridge History of Hellenistic Philosophy* (Cambridge: Cambridge University Press, 1999), 177-225, at 191.

There is also an issue of translation here. In the two passages from Stobaeus it is said that the present is *kata platos* and *en platei*.[34] Long and Sedley render these as saying that the present is 'broadly said to be' and is 'thought of broadly', implying imprecisely.[35] We say that the present moment exists but this is imprecise because strictly speaking the present is merely part of the past and part of the future. However, others translate these passages as saying that the present *is* broad or has a certain extension. (Goldschmidt has 'étendue'; Rist has 'extension'; Hadot has 'thickness' in Chase's translation; Brunschwig has 'extended'; Sorabji has 'broadly', to imply thickness, even though he rejects this reading.)[36] On this reading the present is real and is not specious. How we translate this phrase will affect how easily the tension within the doxography can be reconciled. However, one tension will not go away. For even if we dismiss the supposedly extended present as specious, we are still faced with the claim that only the present belongs. Yet it seems odd to say that the 'now' conceived as a durationless mathematical limit can 'belong' in a way analogous to the way in which walking 'belongs' to me when I am walking. On the contrary, walking sounds precisely like a present activity that takes place in an extended, albeit unspecified, duration of time.

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[33] The only other reference we have to *On the Void* is from Diogenes Laertius 7.140 (*SVF* 2.543) who helpfully tells us that in *On the Void* Chrysippus discusses the void. There are no other references to *On Parts*. See Appendix II in *SVF* 3, 200.

[34] See Wachsmuth, 1,106,18 and 1,105,26, in texts (b) and (e) above.

[35] See Long and Sedley, vol. 1, 304 and 305.

3. Marcus Aurelius on Time

As we have seen, usually the Stoic theory of time is read as a single theory of time, although one with a few loose ends not fully explained. However we can also see, especially in the testimony of Plutarch, that it might not be unreasonable to see two distinct conceptions of time in the ancient evidence, one with an extended present that belongs and another with a durationless instant separating past and future. But there is nothing to suggest that the Stoics held on to two distinct readings of time as part of one theory and nor is there any evidence to suggest that two such readings were referred to by the terms *aiôn* and *chronos*. Indeed, *chronos* is simply 'time', so what we have been examining thus far is simply the Stoic theory of *chronos*, although the philosophical position that we have uncovered is usually read as one that is close to what Deleuze calls *aiôn*.

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[36] See *e.g.* Goldschmidt, *Le système stoïcien et l'idée de temps*, 37; J. M. Rist, *Stoic Philosophy* (Cambridge: Cambridge University Press, 1969), 278; P. Hadot, *The Inner Citadel: The Meditations of Marcus Aurelius*, trans. M. Chase (Cambridge, MA: Harvard University Press, 1998), 136; J. Brunschwig, 'Stoic Metaphysics', in B. Inwood, ed., *The Cambridge Companion to The Stoics* (Cambridge: Cambridge University Press, 2003), 206-32, at 215; Sorabji, *Time, Creation, and the Continuum*, 22.

If *chronos* is simply 'time' then what about *aiôn*? This might be straightforwardly translated as 'eternity', although depending upon the context it is also sometimes rendered as 'time'. In the standard collection of the fragments of the early Stoics *aiôn* appears just once, in an obscure etymological observation reported by Varro, who says that Chrysippus defined *aiôn* ('eternity') as *aei on* ('always existing') – if something is eternal it exists always.[37] In short, there is no explicit early Stoic discussion of *aiôn* in the surviving evidence. If we want to find this term in Stoic texts we must move forward some four hundred years from Chrysippus to Marcus Aurelius.[38] In Marcus's *Meditations* there are 21 instances of *aiôn* and it is from Marcus that Victor Goldschmidt takes the term in his discussion of Stoic time, a discussion upon which Deleuze's account of the Stoic theory of time is based.

Goldschmidt argues that there are indeed two conceptions of time in Chrysippus, the extended present that belongs and the infinite past-future separated by the durationless instant, but Goldschmidt suggests that Chrysippus was negligent when it came to terminology. However, that failure was rectified much later by Marcus, who used the term *aiôn* to refer to the infinite time of past-future. In support of this claim Goldschmidt cites *Meditations* 4.3, in which *aiôn* is conjoined with *apeiros*:[39]

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[37] See Varro, *De Lingua Latina* 6.2 (*SVF* 2.163): 'Aevum ab aetate omnium annorum (hinc aeviternum, quod factum est aeternum): quod Graeci *aiona*, id ait Chrysippus esse *aei on*.'

[38] For Marcus Aurelius I have used the editions by C. R. Haines, *The Communings with Himself of Marcus Aurelius Antoninus* (London: Heinemann, 1916), A. S. L. Farquharson, *The Meditations of the Emperor Marcus Antoninus*, 2 vols (Oxford: Clarendon Press, 1944), and J. Dalfen, *Marci Aurelii Antonini Ad Se Ipsum Libri XII* (Leipzig: Teubner, 1987), the last of which contains a complete Index Verborum.

> Shall mere glory distract you? Look at the swiftness of the oblivion of all men; the gulf of infinite eternity (*apeirou aiônos*), behind and before; the hollowness of applause, the fickleness and folly of those who seem to speak well of you, and the narrow room in which it is confined. This should make you pause. For the entire earth is a point (*stigmê*) in space, and how small a corner thereof is this your dwelling place, and how few and paltry those who will sing your praises here.[40]

However, Goldschmidt fails to note *Meditations* 2.14 and 10.31, in which *apeiros* is conjoined with *chronos*:

> Always remember, then, these two things: one, that all things from everlasting are of the same kind, and are in rotation; and it matters nothing whether it be for a hundred years or for two hundred or for an infinite time (*en tôi apeirôi chronôi*) that a man shall behold the same spectacle; the other, that the longest-lived and the soonest to die have an equal loss; for it is the present alone of which either will be deprived, since (as we saw) this is all he has and a man does not lose what he has not got.[41]

> For in this way you will continually see that man's life is smoke and nothingness, especially if you remind yourself that what has once changed will be no more in infinite time (*en tôi apeirôi chronôi*).[42]

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[39] Goldschmidt, *Le système stoïcien et l'idée de temps*, 39. See also É. Alliez, 'Aiôn', in B. Cassin, ed., *Vocabulaire européen des Philosophies* (Paris: Le Robert / Seuil, 2004), 44-52, at 45, who cites the same text for the same thesis.

[40] *Meditations* 4.3; translation by Farquharson, modified. Farquharson translates *apeirou aiônos* as 'endless time'; Haines has 'infinite time'. Clearly neither thinks that a contrast between *aiôn* and *chronos* is implied here.

[41] *Meditations* 2.14; translation by Farquharson.

[42] *Meditations* 10.31; translation by Farquharson.

These other passages indicate that Marcus was not using *aiôn* as a technical term to refer to time conceived as infinitely extending into the past and future. Indeed, a careful reading of the 21 instances of *aiôn* and the 31 instances of *chronos* in the *Meditations* makes clear that Marcus uses neither term in any technical sense to refer to a specific conception of time.[43] As we can see from the passages above, Marcus is keen to stress how small a portion of time each of us is allotted compared with the infinite expanse of time, in order to highlight the paltry insignificance of human life, but there is no evidence to suggest a philosophical theory about the nature of time. In these passages Marcus uses the terms *aiôn* and *chronos* synonymously and interchangeably;[44] elsewhere he does use them to draw a contrast between the *chronos* of a human life and the *aiôn* of the cosmos, but again this is merely to draw a contrast between the limited amount of time allotted to each human life and the infinite time of which it is an insignificant part.[45] As we have seen, *chronos* is also used to refer to that same infinite time.[46]

At this point I want to turn to Pierre Hadot's reading of Marcus Aurelius, which involves one of the few explicit discussions of Goldschmidt's thesis.[47] In the *Meditations*,

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[43] For *aiôn* see *Meditations* 2.12, 4.3, 4.21, 4.43, 4.50, 5.24, 5.32, 6.15, 6.36, 6.59, 7.10, 7.19, 7.70, 9.28, 9.32, 9.35, 10.5, 10.17, 11.1, 12.7, 12.32; for *chronos* see 1.17, 2.4, 2.14, 2.17, 3.7, 3.11, 4.6, 4.32, 4.48, 5.10, 6.15, 6.18, 6.23, 6.25, 6.36, 6.49, 7.29, 7.35, 7.46, 8.5, 8.7, 8.11, 8.44, 9.14, 9.25, 10.1, 10.17, 10.31, 12.3, 12.18, 12.35.

[44] Compare *Meditations* 2.14, 4.3, and 10.31, cited above. See also 10.17 where they are used synonymously and where Farquharson translates both as 'Time'.

[45] For *chronos* as a finite human lifespan see *e.g.* *Meditations* 2.4, 2.17, 3.7, 4.48, 6.49, 7.46.

[46] For *chronos* as infinite time see *e.g.* *Meditations* 2.14, 10.17, 10.31.

[47] See Hadot, *The Inner Citadel*, esp. 131-7.

Hadot argues, there is a specific attitude towards the present, a concern with focusing one's attention on the present moment. Hadot relates this to the early Stoic theory of time, and quotes Stobaeus (text (b) above). What we find in this report are 'two diametrically opposed conceptions of the present',[48] Hadot suggests: on the one hand the present is merely a limit between past and future, without any extension; on the other hand the present does have a certain duration, reflecting the intention and attention of the individual subject. Rather than try to reconcile these two opposed conceptions of the present, Hadot draws a parallel with the philosophy of Henri Bergson who, in a lecture originally delivered in Oxford in 1911, drew a distinction between the present as a mathematical instant and the present as a certain duration or extension determined by one's attention.[49] For Bergson, the present conceived as a mathematical instant is a pure abstraction without any real existence, unable to constitute part of time for all the reasons outlined by Aristotle. The present that we experience, by contrast, has 'a certain interval of duration':

> Our consciousness tells us that when we speak of our present we are thinking of a certain interval of duration. What duration? It is impossible to fix it exactly, as it is something rather elusive. My present, at this moment, is the sentence I am pronouncing. But this is so because I want to limit the field of my attention to my sentence. This attention is something that

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[48] Hadot, *The Inner Citadel*, 135. Note also the summary in his *What is Ancient Philosophy?*, trans. M. Chase (Cambridge, MA: Harvard University Press, 2002), 192.

[49] See Hadot, *The Inner Citadel*, 136. Bergson's Oxford lecture was first published in *La Perception du Changement: Conférences faites a l'Université d'Oxford, les 26 et 27 mai 1911* (Oxford: Clarendon Press, 1911), reprinted in H. Bergson, *La Pensée et le mouvant* (Paris: Félix Alcan, 1934), 143-76, and translated in *The Creative Mind*, trans. M. L. Andison (New York: Philosophical Library, 1946), 153-86.

> can be made longer or shorter, like the interval between the two points of a compass.[50]

For Bergson this interval can be expanded or contracted by one's attention, and even expanded so far as to include a substantial portion of one's past. But as soon as we stop paying attention to a particular moment it falls into the past and no longer forms part of our present. Thus the distinction between past and present for Bergson is fluid and dependent upon one's level of attention. In the light of both Marcus's focus on the present moment and Bergson's prioritization of lived duration over mathematical abstraction, Hadot understands Chrysippus's extended present not as a specious pre-philosophical present that evaporates before our very eyes when submitted to philosophical analysis, but rather as a lived present that truly 'belongs' (*huparchein*) to us. When Marcus exhorts us to focus our attention on the present moment he is referring to this extended present, Hadot suggests, and by adjusting our attention we can also expand or contract this extended present along the lines outlined by Bergson.

According to Hadot, Goldschmidt claimed that, for Marcus, this extended present could contract right down to an instant without duration.[51] Hadot rejects this reading of Marcus. He also rejects the claim that, when discussing eternity (*aiôn*), Marcus is conceiving the present as a durationless limit. On the contrary, he is highlighting the limited extension of the present compared with the infinities of past and future. Although Marcus in places describes the present as a point,[52] the context makes clear that this is to emphasize its relative smallness rather than its non-existence. Marcus's term *stigma*, sometimes translated as 'point', is a pin-prick or a mark rather than a mathematical limit.[53] It has a size, albeit a small one. For Marcus, according to Hadot, the present is always the extended lived present. Goldschmidt's attribution of a durationless instant to Marcus reflects his attempt to find a theory of infinite past-future in the *Meditations* and connect it with the evidence for the early Stoa which, as we have seen, does not stand up to close scrutiny.

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[50] Bergson, *La Pensée et le mouvant*, 168-9; *The Creative Mind*, 178-9.

[51] See Hadot, *The Inner Citadel*, 137, and Goldschmidt, *Le système stoïcien et l'idée de temps*, 195.

According to Hadot's Bergsonian reading, then, there are indeed two distinct Stoic conceptions of the present moment: the first is the durationless mathematical limit or instant conceived by Chrysippus and the second is the extended (expandable and contractible) present meditated upon by Marcus.

Chrysippus:

instant

← infinite past … | … infinite future →

Marcus Aurelius:

(…(…(…(extended present)…)…)…)

Figure 5. Hadot on Chrysippus and Marcus Aurelius

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[52] See *e.g. Meditations* 4.3, cited above, and 6.36: *pan to enestôs tou chronou stigmê tou aiônos*, which Farquharson translates as 'every instant of time, a pin-prick of eternity'.

[53] However, Aristotle does use this term to refer to a mathematical limit; see *e.g. Physics* 4.13, 222a14-17.

Turning Goldschmidt's claim on its head, according to Hadot it is Chrysippus who is the theorist of unlimited *aiôn*, while Marcus is the theorist of the extended present of *chronos*.

4. TWO APPROACHES TO THE PRESENT MOMENT: BERGSON AND JAMES

So far we have seen Anglo-American scholars dismiss the extended present as specious and French scholars affirm the extended present as primary. While some of the former turn to William James for philosophical inspiration, some of the latter turn to Henri Bergson. As both Bergson and James have been brought into the discussion by these scholars of Stoicism, it may be instructive to consider briefly the relationship between their two positions.[54] This should help us to clarify the difference between Hadot's reading of the Stoic theory of time and the reading dominant in the English-language scholarship.

It is well known that Bergson and James corresponded, met, and had great respect for each other's work.[55] They developed their dual theories of time independently of one another but they do share a striking structural similarity.[56] James in particular often stressed his philosophical proximity to Bergson.[57] Proximity, however, is not identity. In fact, it would be more accurate to say that their two theories are diametrically opposed to one another, one being the reversal of the other. Bergson and James share a position involving two conceptions of the present moment: an extended present of duration on the one hand and a conceptual mathematical limit between past and future on the other. For Bergson, it is the extended present of duration that truly exists, while the conceptual instant between past and future is a mere confusion that cannot grasp the reality of time. For James, by contrast, the extended present is a specious present, a pre-philosophical everyday confusion that should be replaced with the scientific concept of the extensionless instant.[58] (These at least are their opening positions, as I understand them; James may well have amended his position later after discovering Bergson's philosophy.)[59] Both agree that the extended present is our primary experience, but – initially at least – they differ as to its value. James, for instance draws upon psychological studies that try to measure the extended present, and he suggests a maximum duration of 12 seconds. One suspects that Bergson would not have been impressed by such attempts. Indeed, Bergson would have rejected the very phrase 'extended present' to describe his concept of 'duration', for it involves an implicit spatialization of time which is precisely what his theory is trying to overcome. The thought of trying to measure duration simply misses his point.[60]

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[54] One should also note Sambursky's appeal to Whitehead in his account of the Stoic theory of time. In particular, he cites Whitehead's distinction between a moment and a duration. See S. Sambursky, *Physics of the Stoics* (London: Routledge & Kegan Paul, 1959), 105.

[55] See R. B. Perry, *The Thought and Character of William James*, 2 vols (London: Oxford University Press, 1935), 599-636, which also reproduces their correspondence.

[56] Bergson's position was first outlined in H. Bergson, *Essai sur les données immédiates de la conscience* (Paris: Félix Alcan, 1889), James's in his 1890 work *The Principles of Psychology*. For a rejection of the claim that there was any influence one way or the other see Perry *The Thought and Character of William James*, 599-600.

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[57] See in particular James's 'Bergson and his Critique of Intellectualism' in W. James, *A Pluralistic Universe* (London: Longmans, Green, and Co., 1909), 225-73. Bergson also wrote on James; see Bergson, *La Pensée et le mouvant*, 239-51 (translated in *The Creative Mind*, 248-60), first published as the preface to the French translation of James's *Pragmatism*.

[58] See James, *The Principles of Psychology*, esp. 608-10. James borrows the phrase 'specious present' from E. R. Clay.

[59] See *e.g.* James, *A Pluralistic Universe*, 235: 'all these abstract concepts are but as flowers gathered, they are only moments dipped out from the stream of time, snap-shots taken, as by a kinetoscopic camera, at a life that in its original coming is continuous'.

As one can see, an appeal to Bergson or to James when trying to reconstruct the Stoic theory of time will imply quite different attitudes towards the extended present, the conceptual instant, and the relationship between the two. It is precisely this relationship that is central to understanding Deleuze's account of *aiôn* and *chronos*. However, an appeal to either James or Bergson when trying to comprehend the Stoic position runs the risk of anachronism.

5. A Stoic Theory?

We should now be in a position to answer the question whether Deleuze's theory of *aiôn* and *chronos* is really an ancient Stoic theory of time. In the light of our discussion a number of points should be clear. Firstly, there is no explicit ancient Stoic theory of *aiôn* and *chronos* and the word *aiôn* is nowhere used in Stoic texts as a technical term within a philosophical theory of time, whether one looks at the doxography for the early Stoics or at a late Stoic text such as the *Meditations* of Marcus Aurelius. Secondly, although scholars have attempted to construct a single theory of time out of the evidence for the early Stoics, tensions remain, and it *is* possible to read within the evidence two distinct conceptions of time. However, the evidence is far too thin to attribute to the early Stoa a twofold theory of time, and the tensions may equally be explained in terms of a development of the Stoic position over a period of time. Thirdly, Marcus Aurelius is concerned with the notion of an extended present and this does contrast with the durationless instant attributed to Chrysippus by modern scholarship. However these two conceptions of the present moment, corresponding to Deleuze's *chronos* and *aiôn* respectively, come from philosophers separated by four hundred years and there is no evidence to suggest that they should be taken together as parts of an explicitly dual theory of time.

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[60] Later, James may well have agreed with this: the phrase 'specious present' appears in James's 1890 *Principles of Psychology* but it is absent from his 1909 essay on Bergson which contains nothing to suggest that James disagreed with Bergson on this point.

As we have also seen, Deleuze is dependent upon the work of Victor Goldschmidt. Notwithstanding Hadot's criticisms of Goldschmidt, which I think are well founded,[61] Goldschmidt and Hadot share a broadly Bergsonian reading of the ancient Stoics on time in which there are two distinct conceptions of the present moment. In contrast to the Jamesian readings of the English-language scholarship in which the extended present is dismissed as specious, both Goldschmidt and Hadot affirm the reality of the extended present. One can see why the Bergsonian Deleuze would be attracted to the Stoic theory of time when presented in such Bergsonian terms.[62] However, *contra* Goldschmidt, it is to Chrysippus (and not Marcus) that we must turn to find what Deleuze calls the Stoic theory of *aiôn* and it is with Marcus that we shall find the extended present of *chronos*. Whether any ancient Stoic actually held both of these conceptions at once, as a dual theory of time, is a matter about which we must ultimately suspend judgement. There is certainly no evidence to confirm that the theory of *aiôn* and *chronos* made famous by Deleuze was in fact a Stoic theory.

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[61] I agree with Hadot's criticism of Goldschmidt over the interpretation of Marcus Aurelius. However, do not accept all of Hadot's account of the Stoic theory of time, which, with regard to Chrysippus, does not do justice to the tensions in the surviving evidence. On the basis of the meagre evidence available to us, I would suggest that Plutarch's charge of inconsistency is well founded. But before we praise Plutarch too much we must also remember that our evidence has in part been shaped by Plutarch's own selective quotations from Chrysippus, no doubt informed by his own polemical agenda. On this final point see G. Boys-Stones, 'Plutarch on *koinos logos*: Towards an Architecture of the *de Stoicorum repugnantiis*', *Oxford Studies in Ancient Philosophy* 16 (1998), 299-329.

[62] It is worth noting that Deleuze uses very Bergsonain descriptions in his account of the Stoic theory of time, calling *chronos* the 'living present' and *aiôn* a 'being of reason' (see *e.g. LS* 80/63).

It should be borne in mind that Deleuze made no pretensions to be an expert in ancient philosophy, and this is equally clear from his account of Stoic incorporeals.[63] Nevertheless, it is necessary to be clear about the differences between the Deleuzian and Stoic theories of time if we are to grasp the significance of either of them.[64] The theory of *aiôn* and *chronos* is an interesting element in Deleuze's philosophy that takes its inspiration from a speculative reading of the ancient Stoics, but it is not an ancient Stoic theory.

As I acknowledged at the outset, this relatively minor scholarly point does not claim to raise any philosophical objections to the use that Deleuze makes of this dual theory of time. The same may be said about his confusions regarding the Stoic theory of incorporeals. But it is ironic that it is these aspects of Deleuze's engagement with the Stoics that have become best known. Deleuze's supposedly Stoic ontology in *The Logic of Sense* is not really Stoic at all. By contrast, his comments on Stoic ethics in the same book, although based upon an equally brief acquaintance, are much closer to the spirit of ancient Stoicism.[65] Both Marcus Aurelius and Epictetus would have welcomed Deleuze's statement that 'Stoic ethics […] consist of willing the event as such' and that the ultimate task of ethics is 'not to be unworthy of what happens to us'.[66] It is in the realm of ethics, and not ontology, that Deleuze comes closest to Stoicism.

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[63] On Deleuze's misreading of Stoic incorporeals see n.4 above. For a discussion of his methodological approach to the history of philosophy see J. Sellars, 'Gilles Deleuze and the History of Philosophy', *British Journal for the History of Philosophy* 15/3 (2007), 551-60.

[64] For a similar point see Mengue, 'Aiôn / Chronos', 45.

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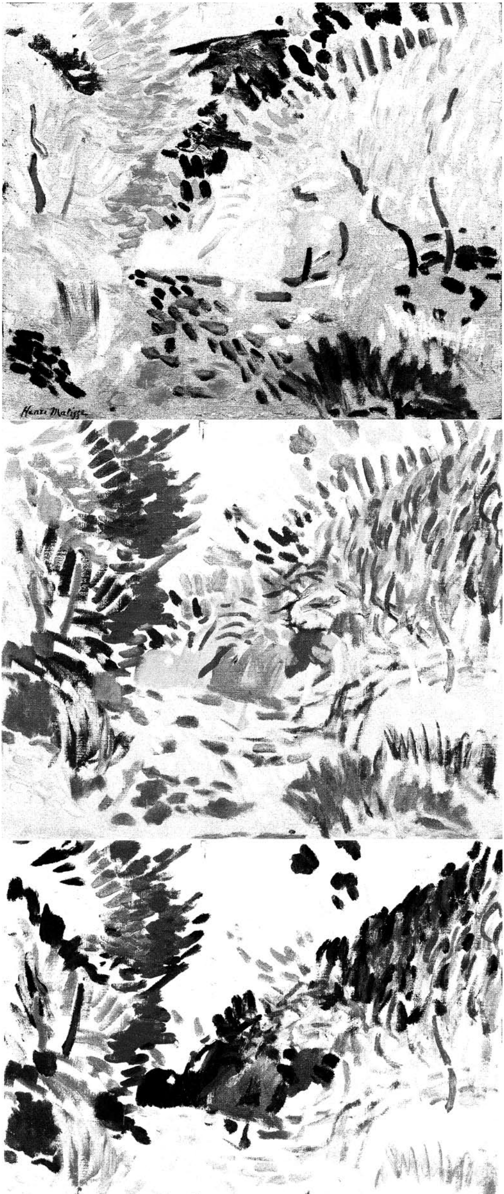
[65] This claim has been elaborated at greater length in Sellars 'An Ethics of the Event: Deleuze's Stoicism' (cited in n.1 above).

[66] *LS* 168/143 and 174/149.


Henri Matisse

Matisse-Thought and the Strict Quantitative Ordering of Fauvism[1]

Éric Alliez and Jean-Claude Bonne

The revolution inaugurated in painting by Matisse during his 'Fauvist' period of 1905-6 consisted in substituting for the traditional qualitative conception of painting, subordinated to the representation of (the forms of) things and/or the exposition of the medium, a rigorous, intensive conception for which the reciprocal differential quantities of colours are *their qualities, no longer being covered or mediated by phenomenal qualities in whose service their creative power had hitherto been placed. The intensity of colours, which Matisse pushed to its full extent, will fuel the expansiveness of the canvas, energising it from within, ultimately taking it beyond its limits, in other words beyond the Canvas-Form of painting. But this could only be achieved through a 'strict quantitative ordering' at odds with any post-romantic understanding of Fauvism, and implying a rigorous new constructivist conception of expression. An appreciation of Matisse's experimental practice during this period allows a new understanding of the significance of Fauvism for his later work; whilst also reaffirming the philosophical pertinence of a Nietzschean-Deleuzian thinking of intensity and extensity, the qualitative and the quantitative.*

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[1] Translated extract from E. Alliez & J-C. Bonne, *La Pensée-Matisse: portrait de l'artiste en hyperfauve* (Paris: Le Passage, 2005), 75-84.

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THE QUANTITATIVE FOUNDATION OF THE QUALITATIVE

For Matisse, decorativity implies that *colour only exists qua constructive expression of the relation of forces* between colours. Furthermore, the *relation of quantity* between coloured surfaces would then constitute the *quality* of colour. In the case of a painting which, like his, employs pure (unmixed) pigments, Matisse's formula – '[…] even colour can only be a creation' – only makes sense in envisaging the quantitative determination of the quality of colours[2] – A quantitative creation which seizes hold of the totality of the construction of the painting through the '*all-over*' *organisation of colour* ('this *whole* [*ensemble*] the painting constitutes').[3] 'Organisation of forces – colours are forces'; 'to organise sensations'; 'organisation of his brain' … Matisse comes back continually to this: 'painting requires organisation'.[4] *Organisation is the Matissean name for composition*, for the *global composition* which 'is modified along with the surface to be covered'[5] and consequently is no longer, qua creation in the making, that *classical design* (*disegno*) that would project an *idea* onto an inert matter. Idealist (Italian, Latin) ideation is replaced by the announcement of the materialist idea of the medium, an idea excluding 'preconceived forms' (Derain); an idea whose proper logic is that of the quantitative working of the surface by its freed forces, freely organised in the *all-over conception.* But it is the same Matisse who writes, in his 'Notes of a Painter': 'For me, all is in the conception. It is thus necessary to have, from the very start, a clear vision of the whole [*l'ensemble*].'[6] For, as opposed to the pre-visionary idea of the *study*, this envisaging of the whole is none other than the 'consciousness of the forces that one employs', as one proceeds, 'driven by an idea that one does not truly know except in so far as it develops with the growth [*la marche*] of the painting.'[7] Far from being any sort of 'reportage' of a mental image, its necessity is a *function* of the impossibility of a difference/différance of the conception from its *realisation* (a Cézannian term if ever there was one, to which the painter of Aix opposed the *esprit littérateur*). Or once again: in the absence 'of rupture between thought and the creative act',[8] conception is of importance only inasmuch as it *surfaces* in a continuous becoming. This processual materialism is antipodeal to the post-romantic exasperation to which the Fauvist 'movement' has been reduced. Matisse does not even balk at evoking a *strict quantitative ordering* in a formula which constitutes, in our view, his most technical definition of Fauvism: 'At the time of the "Fauves", what constituted the *strict ordering of our paintings was that the quantity of colour was its quality*.'[9] In what Matisse calls 'expression', a Nietzschean intuition of the greatest purity will always animate Fauvism: The intuition that *quality is nothing other than the difference of quantity which corresponds to it in each force in relation to all other forces*;[10] the intuition that unity can only make sense in the relational domain of the multiplicity of forces in terms of *the organisation of their mutual play*; the intuition of the liberatory function of art qua *destruction* of every type of ulterior world (the artist as 'spokesman for the "essence" of things', the 'telephone to the beyond');[11] and the *construction of a physiology of aesthetics,*[12] grounding itself *quantitatively* upon the forces of the universe, so as to extract from chaos the *varieties of a composition.* It is this *principle of immanence* which continually refers the 'Fauves' back to Nietzsche, offering his philosophy an alternative to the antagonism between romanticism and classicism which the thinker of the Great Midday sought to redefine by recusing 'most resolutely the classical method'.[13] To borrow from Deleuze and Guattari: Fauvism 'is not chaos but a *composition of chaos* that yields the vision or sensation, so that it constitutes, as Joyce says, a chaosmos, a composed chaos – *neither foreseen nor preconceived*'. If it 'takes up arms against chaos, it is in order to *borrow weapons from it that it turns against opinion*, the better to defeat it with tried and tested arms'.[14] (This 'composition of chaos' echoing the *organisation of chaos* put forward by Nietzsche at the end of the second *Untimely Meditation* – '*das Chaos* […] *zu organizieren*'.) In the 1907 interview which Appollinaire, persuaded by Goldberg, succeeded in obtaining with Matisse despite the reticence of the latter, who held the poet for a poor art-critic, we find the formula: 'To order a chaos, that is creation'.[15] Directed against that 'opinion' which had begun by sealing the marriage between romanticism and impressionism, and then that of symbolism with a purportedly 'natural' classicism,[16] the strictness of the ordering indicated by Matisse also implies a rupture with every type of

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[2] 'Rôle et modalités de la couleur' in H. Matisse, *Écrits et propos sur l'art*, ed. D. Fourcade (Paris: Hermann, 1972 [Henceforth EPA]), 201; the complete formula is: 'Everything, even colour, can only be a creation'.

[3] Yve-Alain Bois was the first to insist, quite rightly, on the importance of the quantitative in the all-over conception of colour in Matisse (see 'Matisse and "Arche-Drawing"' in *Painting as Model*, Cambridge, MA: The MIT Press, 1998).

[4] See H. Matisse, 'Entretien avec Léon Degand', in 'Matisse à Paris' EPA 301-3; 'Notes d'un peintre' EPA 51 ('to organise sensations'). Matisse declares of Cézanne: 'There were such possibilities in him that he needed, more than any other person, to put some order into his brain', Jacques Guenne, 'Entretien avec Henri Matisse', *L'Art Vivant*, no. 18, September 1925; EPA 84.

[5] H. Matisse, 'Notes d'un peintre', EPA 43.

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[6] *Ibid.*

[7] H. Matisse, 'Notes d'un peintre sur son dessin', EPA 163. One thinks here of the passage in Bergson's *Creative Evolution* where he speaks of the portrait which one cannot predict in advance, 'for to predict it would have been to produce it before it was produced' (H. Bergson, *Creative Evolution,* trans. A. Mitchell, NY: Dover, 1998, 6).

[8] H. Matisse, remark reported by André Verdet, *Prestiges de Matisse*; EPA 47 n11. It is necessary to have a vision of the global state at each moment: 'everything must be envisaged correlatively in the course of the work.' ('Notes de Sarah Stein', 1908, EPA 71). 'I never know in advance what I'm doing' (correspondence with Jean and Henri Dauberville, EPA 47 n11). On the absence of rupture between conception and realisation, see Yve-Alain Bois, 'Matisse and "Arche-Drawing"', *op. cit.* 28*sq*.

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[9] H. Matisse 'Visite à Henri Matisse', interview with Tériade, EPA 98 (italics ours).

[10] See *Nietzsche and Philosophy*, 42-4 ('Quantity and Quality'), along with the fragments from *Will to Power* upon which Deleuze's argument rests.

[11] See F. Nietzsche, *On the Genealogy of Morals* (trans. K. Ansell-Pearson, Cambridge:Cambridge University Press, 1994), 78 (Third Essay, §5).

[12] The 'hitherto untouched and unexplored *physiology of aesthetics*' appears in *On the Genealogy of Morals*, 85 (Third Essay, §8).

[13] See M. Kessler, *L'Esthétique de Nietzsche* Paris:PUF, 1998, 156 (along with the

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whole of the second part, 'The genesis of classical formalism'). In the introduction, the author quite rightly posits that 'Far […] from representing a brutal and massive force, the greatest will to power is a power of organisation and thus of the simplification of the original chaos of the universe. Beyond this minimal definition aimed at serving his own philosophical and aesthetic categories, classicism thus means nothing to Nietzsche'.

[14] *What is Philosophy?*, 204 (emphasis ours).

[15] *La Phalange* no. 2, December 1907, reprinted in EPA, 56; unlike other formulas, this is not given in inverted commas, as a citation of a remark of Matisse's but it does seem to correspond to his thought. On the circumstances of this interview, see H. Spurling, *The Unknown Matisse: Volume 1 - A Life of Henri Matisse 1869-1908* (London:Hamish Hamilton, 1998), 415-7.

[16] Nietzsche already noted, in this fragment republished in *The Will to Power* (Trans. W. Kaufman and R.J. Hollingdale, ed. W. Kaufman, New York:Vintage, 1968), 447-8 (§849): 'One believed that classicism was a kind of naturalness! […] The romantics in Germany do *not* protest against classicism, but against reason, enlightenment, taste, the eighteenth century'.

transcendental or spiritualist psychology wedded to the 'language of forms and colours'.

It will be objected that Matisse, in his interview with Tériade, says 'at the time of the "Fauves"' – to which we will answer: Yes, because the quantitative equation crystallises the *trans-historical* dimension of this continued revolution which, in Matisse's words, sees Fauvism at the 'base of everything'. With the principle '*1cm^2 of blue is not as blue as a square metre of the same blue*',[17] Fauvism is inscribed at the base, as the fundament of a *scienza nova* of colour, composing through its differences of quantity a rigorous processual machine of 'requalification' of the world that *exceeds the art-world.* For it does not announce the same thing as Gauguin did when he said to Cézanne: '*A kilo of green is more green than half a kilo*.'[18] For Matisse, the substitution of surface for weight implies a radical rejection of all metaphorisation of quantity, as a result of the severance of all ties with the symbolism of colour: the intensity of colour depends upon a regime *at once superficial and relative* from which every 'in-itself' has been banished – even one *weightily* carried to saturation-point. From this point of view, despite the debt owing to Gauguin, the painter of flat colour planes, for escaping 'the tyranny of Divisionism',[19] Matisse will affirm that 'the basis of Gauguin's work and that of my own, are not the same', discerning the essential point: 'Gauguin cannot be counted among the Fauves, for he lacks a construction of space by means of colour, which latter he employs as an expression of feeling.'[20] Matisse is rather hard on Gauguin – for the latter had indeed also *constructed* space by means of colour. But it must be admitted that this construction plays more upon a qualitative sentiment of colour than upon the quantitative – in other words upon the sentiment of the vital force immanent to colour. This judgment clearly confirms, then, that for Matisse there is a clear difference between vital expressivity and psychological expressionism, since he explicitly opposes himself to the idea of colour as 'expressive of feeling', even though he sometimes formulates his own conception of colour in precisely these terms![21] Thus Matisse sets himself up against a sentimentalism of colour to which is attributed a shared but internally-conflictual symbolism running 'from Eugène Delacroix to neo-impressionism', up to Kandinsky's 'spiritual turn' – a sentimentalism which takes on the cast of a regression or counter-revolution. As Nietzsche wrote: 'We are enemies of *sentimental emotions*.'[22]

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[17] Remark by Matisse, reported by Aragon in *Henri Matisse, roman* (Paris: Gallimard, 1998), 830; EPA 129 n95 (emphasis ours).

[18] 'In a golden book I have seen at the house of Marie Gloannec, at Pont-Aven,' specifies Matisse (EPA 129 n95). On this problematic attribution, see Yve-Alain Bois' scrupulous analysis, in 'Matisse and "Arche-Drawing"', *op cit.* 36-9.

[19] Matisse will confide: '[…] fundamentally Gauguin was more answerable than the neo-impressionists for making me take a step in my own direction' (EPA 95 n43).

The summer of 1905 spent in Collioure (in the Eastern

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[20] H. Matisse, remark collected respectively by G. Duthuit, *Les Fauves* (Paris:Michelon 2006), and Russell Warren Howe, 'Half an hour with H.M.', *Apollo*, February 1949 (EPA 95 and 94 n43). We cite once more Matisse's phrase concerning Gauguin, reported by Escholier, where it is difficult not to hear the echo of symbolism: "I instinctively fled his *already fixed* theory' (EPA 95).

[21] For example, in 'Notes of a Painter', 1908, he writes: 'My choice of colours does not rest upon any scientific theory: it is based on observation, on feeling, on the experience of my sensibility', EPA, 48 *sq*. (but this passage is significantly followed by a first formulation of the quantitative principle, *cf*. *infra*.)

[22] Nietzsche, *Will to Power*, 448 (§850 'The nihilism of artists').

Pyrenees) in the company of Derain, is a period of disquiet and feverish research, leading in diverse and sometimes contradictory directions, very much in Matisse's manner.[23] But Collioure is also the moment when Matisse will begin to experiment with the new, and no longer with the contemporary. The exploratory character of this period translates into products of very heterogeneous appearance, as can be seen by a superficial comparison of *Paysage à Collioure* and *La Moulade*, *Collioure*, both dating from that summer. The first painting is highly vibratory and effervescent, with explosive coloured patches, hatched brushstrokes, large coloured spots [*pastilles*]: it has a more animated and disruptive character than the other. The second has an entirely different texture, produced through the assemblage of taut surfaces, better circumscribed and more homogeneous, even if we also find here discontinuous brushstrokes, in short strips. These two aspects might be considered as symptomatic of two components – one destructive, the other constructive – traditionally associated with Fauvism. But we will see that these components come as a pair and in fact are both to be found in each of the two paintings, as indeed in all his Fauve paintings.

It is true that during the period in question, the liberation in colour of its (vital) energy sometimes takes on an appearance that was deemed disorderly and violent. To face this violence of colour that he had already tested and exploited before the Fauve summer (for example during his 1898 sojourn in Corsica) and to try to control it without renouncing its intensity, Matisse had sought in 1904 (but this was not the first time) a solution by way of neo-impressionism, and certain paintings from Collioure still bear the mark of this solution. But he was soon to discover that Divisionism, by parcelling out colour, destroyed its force. To shake off the yoke of the past and the present alike was indeed to imply a 'destructive' effect, one that would even be qualified as 'chaotic'.[24] It is true that, in certain works, Matisse goes further than all who came before him in challenging the representational conception of colour and of line. The various impressionisms did not go so far as to question radically an optical or symbolic *finality* of the image internal to their paintings, even if they displayed a strong pictoriality quite free from illusionism. But alongside, and intertwined with, this 'destructive' aspect, what also came to light at Collioure was a 'constructive' aspect founding the *maximum* expressive power of colours upon the global quantitative organisation of their relations of forces in such a way that they did not mutually diminish each other. ('An avalanche of colours remains without force. Colour only attains its full expression when it is organised.')[25] Certainly, the constructive stakes of the quantitative are not yet formulated as such at Collioure, but certain canvases are already distinguished by its being (experimentally) taken seriously into account. This must, in any case, have been clear enough to Matisse for him to maintain, retrospectively, that 'at the time of the "Fauves", what constituted the strict ordering of our works, was that the quantity of colour was its quality', a formula already cited, but which must be linked to what follows it, because here Matisse adds a further important specification: 'It had to be right [*juste*] from all points of view. That was what was opportune at the time.'[26] To speak of paintings from the period of historical Fauvism (1905-1906) in terms of a *strict quantitative ordering* will seem surprising to many. Yve-Alain Bois, who so rightly brought into strong relief the importance of the quantitative in Matisse, does not recognise its true employment in painting (after its discovery in the line of the woodcuts of 1906) until after this period, from *Bonheur de vivre* in winter 1905-1906.[27] But he agrees that, despite the *eclecticism* of the Fauve summer and even of the beginning of 1906, 'the most important canvases [of that period] are […] those in which the equation quantity = quality was being sought, before being isolated in the woodcuts', even if this equation as yet only concerned limited parts of the paintings and not their overall construction.[28] Rather than suggest that Matisse is researching something but that he does not know what, we prefer to say that Matisse utilises

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[23] Indeed, as Phillipe Dagen says: 'Between 1895 and 1905, from twenty-five to thirty-five years old, he dedicated ten years to recapitulating in an exhaustive and methodical manner the modern pictorial styles that had appeared between 1874 and the moment when he set to work.' And, having enumerated them (impressionism, Gauguinism, neo-impressionism, Cézannism, japonism …), the author concludes: 'With subjects chosen with regard to the effects they allow him to experiment with, Matisse reviews references and models, sometimes taking literal inspiration from them, sometimes combining them into strange, mixed forms of painting.' P. Dagen, *Le Peintre, le poète, le sauvage. Les voies du primitivisme dans l'art français*, (Paris:Flammarion 1998), 8.

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[24] One finds this adjective used by Matisse historians precisely with regard to *Paysage à Collioure*.

[25] H. Matisse, 'Rôle et modalités de la couleur', remark collected by Gaston Diehl in *Problèmes de la peinture*, EPA 200.

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[26] 'Visite à Henri Matisse', interview with Tériade, EPA 98-9, emphasis ours (Matisse then explains that this leads to a simplification of forms).

[27] This is the thesis first formulated by Yve-Alain Bois in 'Matisse and "Arche-Drawing"', *op.cit.*, 53: 'According to my hypothesis, *Le Bonheur de vivre* marks at once the end of Fauvism and the birth of the 'Matisse system'; a thesis reprised in 'L'aveuglement', in *Henri Matisse 1904-1917*, exhibition catalogue, 42.

[28] Bois, 'Matisse and "Arche-Drawing"', *op.cit.*, 52.

practically and deliberately (but without yet formulating it) the equation quantity = quality as a *research programme*, and that the object of his experimentation is the possible ways in which this equation might be applied. It is not the object of an exclusive choice, because it is still competing with other solutions. It is therefore not stabilised: all of which results in an eclecticism which, for our part, we would qualify as quite methodical. But it is in this equation that Matisse was to recognise, in the aftermath of a lengthy period of practice, the positive contribution of Fauvism, once its fecundity had been verified and recognised through effects that would have been impossible to anticipate. Such is our hypothesis, but there can be no *a priori* decision on this debate. It is through a 'strict' analysis of the complete 'ordering' of certain paintings that we can put to the test the exactitude of Matisse's assertion *as regards Fauvism itself*. Unless this can be demonstrated, we would have to maintain that Matisse misunderstood himself completely with regard to the nature of his own paintings from the time of the Fauves, and that he is the victim of a very curious retrospective illusion with regard to a crucial aspect of his work. It remains to discover the precise meaning of this equation.

THE INTENSIVE AND THE EXTENSIVE

We will start from the first explicit presentation. A first concern with the *general quantitative adjustment* of at least certain of the qualities of colours appears in 'Notes of a Painter', written in 1907-8. The passage is interesting in that Matisse opposes himself on this point to neo-impressionism, with which he had had to break after having experimented with it. 'Inspired by certain pages of Delacroix's, an artist like Signac becomes preoccupied with complementary colours, and a theoretical knowledge of them leads him to employ, here or there, this or that tone.'[29] That is, Signac makes simple local applications of a general principle that is purely qualitative because thought, and applied, from an exclusively theoretical point of view (as established by Chevreul). For example, the contrast in itself between red and green – naturally, of one particular green and one particular red, but as if their coupling had a purely qualitative identity independently of their quantity.[30] Signac does indeed think (complementary) colours in terms of relations, but simply qualitative relations, quantity – for example the division (the 'mechanical' division, Matisse says) of brushstrokes into regular units – intervening only as one of the several optical qualities of colour. To which Matisse opposes *his practice* of colour: 'For myself, I seek simply to use colours that render my sensation.' Matisse therefore does not start from principle ('we have nothing to do with laws');[31] he observes and follows the singular expressive-vital 'growth' [*«la marche»*] of colours within his painting. The setting of colours is internally governed, without being (tightly) subordinated to a form (which would give it a qualitative identity as colour *of* that form or that figure) or to a symbolism (which would act upon it in the same way). Because – and this is stated directly – 'there is *a necessary proportion of tones* [whose pursuit] can lead me to modify the form of a figure [which latter tends to impose 'its' form on the colour] or to transform my composition. As long as I have not obtained [this proportion] *for all the parts, I seek it, and I continue my*

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[29] H. Matisse, 'Notes', EPA 49.

[30] Matisse will say of the neo-impressionist conception, in an interview with Rayssiguier on 5 February 1949: 'it is too narrow: blue, red, green, yellow, *according to the quality between them*'. In H. Matisse, M.-A. Couturier, L.-B. Rayssiuguier, *La Chappelle de Vence. Journal d'une création* (ed. M. Billot, Paris: Cerf, 1993), 141: italics ours.

[31] In response to a question from Russell Warren Howe on complementaries ('Half an hour with Matisse', EPA 49 n14).

work. Then, there comes a moment when *all parts have found their definitive relations*, and from then on, it would be impossible for me to retouch anything in the painting without entirely remaking it' (italics ours). What exactly is to be understood by the 'proportion of tones'? Signac, in his manifesto, means 'by *hue* the quality of a colour [in other words its chromaticity] and by *tone* the degree of saturation and luminosity of a hue', whilst recognising that the two words are often employed the other way around.[32] So perhaps the word 'tone' here captures for Matisse these two *intensive* qualities of colours – unless it is simply a synonym for colour, as might be suggested by the way the word is used in the preceding phrase and by the context more generally.[33] Nonetheless, the notion of proportion implies, in any case, the idea of *quantitative relations* (which takes us beyond the pure quality of Signac's 'hue').

But what precisely is the 'quantity' of colour? One could, indeed one must, understand it in two senses, as both extensive – quantity of surface (of 'hue', if you like) – and as intensive – the force of saturation and luminosity (of 'tone'). Thus a double process is put into play here, or rather a double dimension of the process which Matisse does not make explicit, doubtless because the two aspects are indissociable, thus lending a certain ambiguity to his formulae. It is fitting to remove this ambiguity. For Matisse sometimes says that quantity *is* quality, and sometimes that it is what *gives* quality – which is not the same thing. Could it be that these two different ways of formulating the quantitative principle correspond to these two different ways of understanding quantity?

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[32] P. Signac, *D'Eugène Delacroix au néo-impressionisme* [1899] (republished Paris: Hermann, 1978), 35n.; note that Signac's 'tone' conflates saturation and what we call luminosity.

[33] In favour of this identity, this formula: 'A mere tone is just a colour; two tones together is an accord, it is life. A colour counts for nothing apart from its accord with its neighbour' (cited by Gaston Diehl in *Henri Matisse* (Paris: NEF, 1970) EPA 67 n41.

In first place, the intensive quantity – the force – of colours varies for Matisse with their reciprocal extensive quantity. The most famous statement of this principle – the statement that '1cm^2 of blue is not as blue as a square metre of the same blue' – is wholly theoretical in so far as it abstracts from the relations between a colour and its 'neighbours'; now, since the latter can change, a colour is able to change in intensity and thus in quality (as the result of a change of contrast, for example) without its 'surface quantity' being modified. (To re-establish an equivalent intensive relation one or other, or both, of the quantities would have, in turn, to be modified). It is intensive quantity alone, but qua differential, that must be said to *be the quality* of the colour, according to the most radical formula of the equation quantity = quality which Matisse formulates *precisely* with regard to Fauvism. The intensive, or difference of force of colour, constitutes its entire quality for Matisse (following the Deleuzian argument: 'each intensity [...] reveal[s] the properly qualitative content of quality' in expressing the difference in quantity).[34] The intensive is *ontologically* and *operationally* primary in that the extensive results from the relations of forces with each another (Deleuze again: 'Everywhere intensity is primary in relation to organic extensions').[35] This is what Matisse's *oeuvre* demonstrates, in so far as extension (figures) and space (where they take place) appear in it not as given in and through forms, but as *resultants* (to use a word of Derain's) of a moment of *the equilibrium of the forces of colours*. What Matisse seeks are ‘energetic and harmonious relations’[36] – *harmony* (that commonplace in art discourse, whose sense he also displaces) must be understood in Matisse as that decorative or *all-over* character which, precisely, gives a work its *equilibrium,* which must be made through, and with, the ‘mutual impact’ of colours.[37] Thus, extensive differences must be regulated as a function of the intensive differential: the painter who ‘wants to give an *expressive* character *to the uniting of many colour surfaces*’ must take into account ‘pure colour, *with its intensity, its reactions on neighbouring quantities*’ – this is the ‘difficult task’ of the painter. Even if the intensive has naturally always been in play in painting to some degree or other, it is Matisse’s Fauvism which operated a systematic and thus wholly affirmative laying-bare of *chromatic energy* (in so far as it is no longer mediated) – an expressivity which is the sensible reason of vitalism, and without which Fauvism would lose its principle of immanence. Or, once more: colours *are not* identitarian qualities, as in a ‘representative’ system which necessarily cuts off forms from the *differential of forces* constituting the material basis of their production, in order to make appear the identity which stabilises them and allows them to be recognised in their *formal, and thus structural, differences* (resemblance is the law of quality as *form of representation*). When intensive difference is submitted to representation and thus to identity, 'quality then comes to cover over intensity', as Deleuze concludes in the pages where he takes colour as his example.[38] When, on the other hand, representation is submitted to the differential of forces, the field of their confrontation overwhelms formal differences, *bearing and sweeping them away* into its chaosmosis. See *Paysage à Collioure*: Non-identitarian, the colours are nonetheless energetic individuating differentiations whose singularities always enter into relations of forces amongst themselves; relations of forces which assure their resonance and/or their internal/external expansivity in this intense field of individuation which the canvas *is*, which it *becomes*. Every individuating force thus affirms itself in communicating immediately with others in an 'aesthetic of intensities' whose processual, *chaosmic* immanence might be called the 'implicated art of intensive quantities' in so far as it ex-plicates the 'fluent world of Dionysus' in restoring the difference of intensity as vital being of the sensible.[39]

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[34] *Difference and Repetition*, 222.

[35] *Ibid*, 251.

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[36] This expression is found in a letter from Matisse to Pierre Gaut, director of Établissements Linel, 25 March 1946, reproduced by Antoinette Rezé-Huré, ‘Une lettre de Matisse à Pierre Gaut’ (*Cahiers du Musée national d’art moderne* 84, 13 July 1984), 28 (Établissements Linel were responsible for finding the typographical inks for the reproduction of the plates of *Jazz*).

[37] ‘For me, colour is a force. My paintings are composed of four or five colours which collide with each other, giving sensations of energy.’ – A statement, around 1942, by the ever-‘Fauvist’ Matisse to Pierre Courthion (reported in P. Courthion, ‘Avec Matisse et Bonnard’, in *D’une palette à l’autre. Mémoires d’un critique d’art* [Geneva: La Baconnière Arts, 2004] 173).

We will not say of *extensive quantity* that it *is*, properly speaking, the quality of colour, but only that it actualises it and, in this sense, produces its *intensive quantity* (in other words its differential quality). This is what can be surmised from formulas such as: 'The quantities being different, their quality changes: when colours are employed quite overtly, it is their relations of quantity which *make* their quality'; or again: 'it is the proportion of colour which *gives* [the stained-glass windows of Chartres Cathedral] their quality'[40] – remember that the 'Notes of a Painter' spoke of 'a necessary proportion of tones'. Given that *to make* and *to give* do not mean *to be*, these formulas are probably better understood as alluding to extension, or 'quantity of surface', but one might also suppose them to refer to quantity in general, in so far as it always implies the intensive and the extensive.[41] As far as the extension of colours is concerned, above all the point must be made that, apart from the quantity of surface properly speaking (its area), this extension also refers to *spatial qualities* capable of affecting the intensity of colours, and so these must be taken into account in regulating their reciprocal extension. It is probably this aspect of the quantitative that Matisse is addressing when, after having declared that 'at the time of the "Fauves", what constituted the strict ordering of our works, was that the quantity of colour was its quality', he adds, as will be remembered, this crucial specification: 'It must be *right from all points of view*', and insists: 'That was what was opportune at the time' (emphasis ours). Matisse does not enumerate 'all the points of view' according to which the intensive quantity of colour (and necessarily the extensive also) must 'be right' – that is to say strictly ordered/arranged – because, since they are innumerable, an exhaustive inventory cannot be made of them. We must be content with suggesting the principal ones. Intensive quantities are to be adjusted not only as a function of the proportions of their sizes (brushstrokes, colour-patches, masses of colour, larger surfaces …) but also of their forms (precise or indeterminate, figurative or not, with clear or degraded borders, compacted or explosive …); of their placement in the field (peripheral, central, high, low …); of their density (thick or transparent …); of their texture (smooth flatness, worked matter, homogeneous, fluid or taut …); of their orientation (uni- or multidirectional, centrifugal, centripetal …); of the frequency and modes of distribution of these different surfaces (unicity, multiplicity, aleatory or ordered rhythmicity …), not forgetting the chromatic interactions (complementarity, simultaneous contrasts …). Thus, to take this last case, the theoretical quality of contrasting complementary colours varies practically, for Matisse, with the reciprocal quantities of these colours.[42] The (intensive) quality of colours is thus not only a function of their 'surface quantity',[43] as certain formulae suggest,[44] it must also be *quantitatively adjusted* as a function of other spatial properties of the surfaces. It is in these conditions that the *quantitative ordering* of *all* of the painting imposes itself as the discovery of Fauvism. The question of the quantitative is thus complex and cannot be the object of a finite calculation but only of an open evaluation on the part of a spectator who must, as far as possible, estimate it according to the 'points of view' implicated in the construction of the painting (as so many *factors forcibly entering, entering into force*). All the forms of the quantitative being, practically, mutually intricated and indissociable, we can speak globally of the quantitative (as does Matisse), leaving implicit what it comprises of the extensive and the intensive.

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[38] *See Difference and Repetition*, 245: '[A] multiplicity such as that of colour is constituted by the virtual coexistence of relations between genetic or differential elements of a particular order. These relations are actualised in qualitatively distinct colours, while their distinctive points are incarnated in distinct extensities which correspond to these qualities'.

[39] *Ibid*. See also in *Difference and Repetition* the Nietzschean conclusion of the chapter 'Asymmetrical Synthesis of the Sensible'.

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[40] Respectively, H. Matisse, letter to Alexandre Romm, January 1934 (correspondence published in the catalogue of the exhibition *Henri Matisse*, Moscow, Musée des Beaux-Arts Pouchkine, and Leningrad, Musée de l'Ermitage, 1969), EPA 146, and 'Notes on colour', EPA 206.

[41] The formula concerning the stained-glass of Chartres is immediately preceded in 'Notes on Colour' by a formula that we have cited above on 'pure colour with its intensity, its reactions on neighbouring quantities'.

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[42] In 'Notes of a Painter' Matisse writes, after the declaration on the proportion of tones: 'In reality, I hold that the very theory of complementaries is not absolute' because 'one could […] push back the frontiers of the theory of colours as currently accepted', EPA 49.

[43] EPA 149.

[44] This is also, if we understand correctly, what is suggested in Yve-Alain Bois' 'Matisse and "Arche-Drawing"', *op.cit.*

No longer being directly mediated by an external finality (which, on the contrary, is now but a medium in the service of energetic vitalism), the qualities of colours no longer depend on anything but their relations of quantity (intensive and extensive). It is true that the relatively large and homogeneous flat colour plane renders particularly sensible the importance of the quantity of surface in the force of colour. This is what Matisse will practice in the compositions of large coloured surfaces *after* the epoch of historical Fauvism. He will indeed declare with regard to the works of 1909-10 that put into play only a few colours, in large surfaces: 'When I undertook *La Danse* and the Moscow *Musique* – I was determined to put the colours into surfaces, without nuances […] What seemed to me *essential was the surface quantity of colours*.'[45] That this was what *then* appeared essential to him does not at all mean that he was indifferent to the other 'points of view' (to realise this one need only look at a reproduction of his paintings in inverse: 'the surface quantity' being unchanged, all the relations of colours are completely upset). This point, naturally, is decisive for the treatment of the question of the quantitative in the Fauve period, during which Matisse does not yet resort, or very little (in any case not systematically) to significantly large flat colour planes, because he has not yet come fully to realise the importance of the extensive. Still, the accumulation of enlarged brushstrokes coming together as a mass through an identity of colour, the coloured patches and, *a fortiori*, the more considerable applications of colour, already function as (quantities of) *surfaces*, in the twofold sense of marks which are given as literally applied to (the surface of) the canvas, and which maintain a certain surface area there (*qua* isolated elements or multiplicities of variable density).[46] The spacing of brushstrokes is certainly not the best way to *intensify* colour *to the maximum*, but it is already a way to *quantify it differentially*. If one refuses to recognise the (intensive) quantification of colours in a 'strict ordering' (necessarily including the extensive) as the contribution of Fauvism, on the pretext that the colours do not yet occupy a sufficient 'surface quantity' (a 'large' flat colour plane), it is because one wrongly identifies intensive quantity and *maximal* intensification. Furthermore, a response must be given to this rather absurd question: 'at what level of "surface quantity" does/will a surface begin to function quantitatively (= qualitatively)?' It appears to us decidedly problematic to say that the Matisse-system does not begin until *Le Bonheur de vivre*. The quantitative equation functions already in Fauvism, and from Fauvism onward, because colour has no other finality in principle apart from its immanent vital expressivity; it is this alone that *imposes* this equation, not the extensive as such. Will not Matisse-Thought have demonstrated anew a tremendous historical *and* theoretical pertinence, in its formulation of the quantitative principle 'at the time of the "Fauves"'? For this formulation implies that it can only be a question of intensive quantity – as that which *is* the quality of colour – and not particularly of its (large) extensive quantity, whose importance had not yet been either truly recognised or isolated, and which was thus *implicitly* numbered amongst 'all the points of view' according to which 'quantity' must be adjusted. To *intensify* intensity, thereby to assure a greater grasp of the quantitative on the qualitative, Matisse was to be led, *at the end of the Fauve experimentation and as one of its direct developments*, to simplify and to augment the dimensions of the colour surfaces, and thus to *make explicit* the importance of extensive quantity. This will certainly be an important evolution in the conception of the quantitative equation, but not at all a rupture marking its appearance.

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[45] H. Matisse, letter to Alexandre Romm, October 1934, EPA 149 (emphasis ours).

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[46] Even though in 1912, the following remark of Matisse's already makes sense for the epoch of historical Fauvism: 'Do not apply different little brushstrokes, but masses, because it is through quantity, through mass, that your tone acts in your painting.' Reported by Marcel Sembat in his 'Cahiers noirs', date of 29 April 1912. Taken up again in *Matisse-Sembat, Correspondence. Une Amitié artistique et politique, 1904-1922*, ed. C. Phéline and M. Baréty (Lausanne:La Bibliothèque des Arts, 2004), 170.

With regard to the epistemological importance of the quantitative factor in the interpretation of human phenomena at the end of the nineteenth century and the beginning of the twentieth, one cannot but bring together the name of Nietzsche with that of Freud who, very early on, will aim to 'discover what form the theory of mental functioning assumes when one introduces the notion of quantity into it, a sort of economy of nervous forces'. In developing this economy, the psychic processes will be linked to displacements, investments and discharges of a 'quantum of affect', which 'corresponds to the drive in so far as the latter is detached from representation and finds an expression adequate to its quantity in processes which become sensible to us as affects';[47] with the result that the affect will be defined as 'the qualitative expression of the quantity of drive energy and of its variations'.[48] The quantitative principle which thus brings together Matisse and Freud is all the more striking in that the latter has no affiliation with the intellectual references of the former.

Let us return to the question(ing) of form, to which our reflection here belongs. It can easily be seen that the quantitative principle which founds the Matissean aesthetic as an energetics of colour implies that form should be thought in terms of active, not static, surface, and still less in a purely linear fashion. If a painting really obeys a system of *all-over* construction in which the forms do not isolate themselves one from another by detaching themselves from the ground, their qualities do not belong to intrinsic properties of contours, but are rather relative to the relations of (intensive and extensive) quantities of coloured surfaces, relations within which the line that reciprocally delimits these surfaces is itself also held. Naturally, the colours present qualities that are not directly quantitative, in other words not intrinsically vital – representational, expressionist, pictorial qualities … Matisse always strives to treat them also in terms of relations of force, so that they might participate in a constructive fashion in his vitalism. Which necessarily implies treating them quantitatively, since the quality of a force lies in its quantity relative to another. ‘The essence of force is its quantitative difference from other forces, and […] this difference is expressed as the force’s quality’.[49] By bringing together this Nietzschean formula of Deleuze’s with Nietzsche’s own question – ‘To what extent is art immersed in the essence of force?’ – one might measure the proximity of Matisse-Thought to Nietzsche, and risk a (possible) response.

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[47] Respectively, a letter from Sigmund Freud to Wilhelm Fliess, 25 May 1895 (see *The Complete Letters of Sigmund Freud to Wilhelm Fliess, 1887-1904*, ed., trans. J.M.Mason. Cambridge, MA: Harvard University Press, 1985) and 'Repression' (in *On Metapsychology – The Theory of Psychoanalysis*, London: Penguin, 1991; cited after J. Laplanche and J.-B. Pontalis, *The Language of Psychoanalysis*, trans. D. N. Smith, London: Karnak, 1996, 390).

[48] Definition of the term 'Affect' in *The Language of Psychoanalysis, op cit,* 13.

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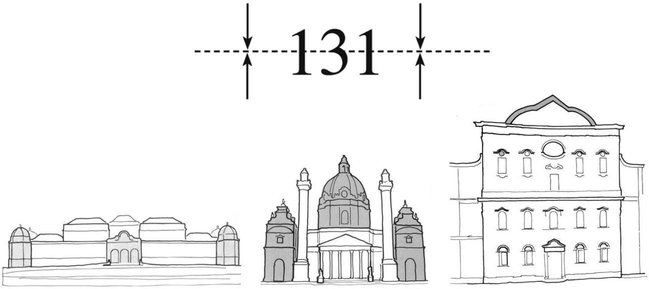
[49] *Nietzsche and Philosophy*, 50.

infinitely tiny things differential relations that will make possible an integration of the sum—in other words, a clear and distinguished perception. It is a filter, a selection. Now, on the one hand, I am not always capable of doing so at all times, but only in a particular zone that varies with each monad, and such that, for each monad, the greatest part remains in a state of detached dizziness, undifferentiated, unintegrated, in an absence of accord. All that can be said, to the contrary, is that no part of the world can be taken in the zone of *a* determinable monad, and that does not carry accords produced by this monad. But on the other hand especially, the linkages produced by a monad can be very different. Leibniz's writings clearly guarantee a classification of accords.

It would be wrong to seek a direct transposition of musical chords in the way they are developed in the Baroque; and yet it would also be erroneous to conclude with Leibniz's indifference in respect to the musical model: the question, rather, involves analogy. And we know that Leibniz was always trying to bring it to a new rigor. At its highest degree, a monad produces *major and perfect accords*: these occur where the small solicitations of anxiety, far from disappearing, are integrated in a pleasure that can be continued, prolonged, renewed, multiplied; that can proliferate, be reflexive and attractive for other accords, that give us the force to go further and further. This pleasure is a "felicity" specific to the soul; it is harmonic par excellence, and can even be felt in the midst of the worst sufferings, such as in the joy of martyrs. In this sense the perfect accords are not pauses, but, on the contrary, dynamisms, which can pass into other accords, which can attract them, which can reappear, and which can be infinitely combined.[23] In the second place, we speak of minor accords when the differential relations among the infinitely small parts only allow integrations or instable combinations, simple pleasures that are inverted into their contrary, unless they are attracted by a perfect accord. For, in the third place, integration can be made in pain. That is the specific character of *dissonant accords*, the accord here consisting in preparing and resolving dissonance, as in the double operation of Baroque music. The preparation of dissonance means integrating the half-pains that have been accompanying pleasure, in such ways that the next pain will not occur "contrary to all expectations." Thus the dog was musical when it knew how to integrate the almost imperceptible approach of the enemy, the faint hostile odor and the silent raising of the stick just prior to its receiving the blow.[24] The resolution of dissonance is tantamount to displacing pain, to searching for the major accord with which it is consonant, just as the martyr knows how to do it at the highest point and, in that way, not suppress pain itself, but suppress resonance or resentment, by avoiding passivity, by pursuing the effort to suppress causes, even if the martyr's force of opposition is not attained.[25] All of Leibniz's theory of evil is a method to prepare for and to resolve dissonances in a "universal harmony." A counterexample would be furnished by the damned, whose souls produce a dissonance on a unique note, a breath of vengeance or

Unknown Deleuze

Mehrdad Iravanian



Two ‘unknown Deleuze’*s and one* ‘un’*: an approach to deciphering the collective symmetrical manner of the central page* (*page* 131) *of* The Fold (518 *words*) *– carrying out a logical cartographical composition of abstract topological elements* (*monads, words, etc.*)*. The baroque nature of* 131 *can be distinguished through two references*: *firstly, the central piece* (3) *has an identical architectural form to baroque facades* (*Santa Maria della Pace, Saint Ivo della Sapienza, Sant’Andrea al Quirinale*)*; secondly, the same central piece* (3)*, as surrounded by symmetrical pieces* (1-1)*, manifests the voluptuousness of a curvilinear, growing, unfolding form, immanently symmetrical. As a form,* 131 *presents the elements of symmetrical order of the early baroque.*

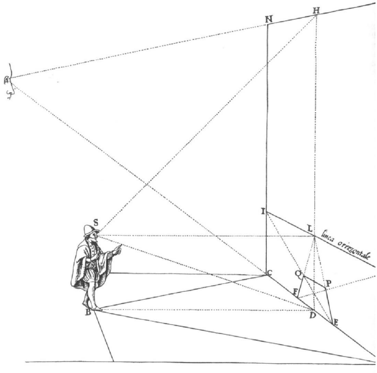
COLLAPSE III, ed. R. Mackay (Falmouth: Urbanomic, November 2007)
ISBN 978-0-9553087-2-0
http://www.urbanomic.com

‘An expression of states and relations which are inflected, which evolves a process shaped by different types of information before, during and after a building is materialized.’ This is how a boogazine – a hybrid type of publication, often employed by architects and combining the heterogeneity and topicality of a magazine with the referential and comprehensive approach of a book – describes the comic-book-like format through which it re-edits an event (*viz.,* any product: building, piece of writing, art object), usually after the event has found the solid ground necessary in order for it to be instituted as an object.

The proper place to seek the unfolded Deleuze is within the collective information that he has processed, not outside the content: the unknown is within.

More precisely, in relation to the subject at issue:
With regard to its sources, *The Fold* diagrams the
unpleating function.

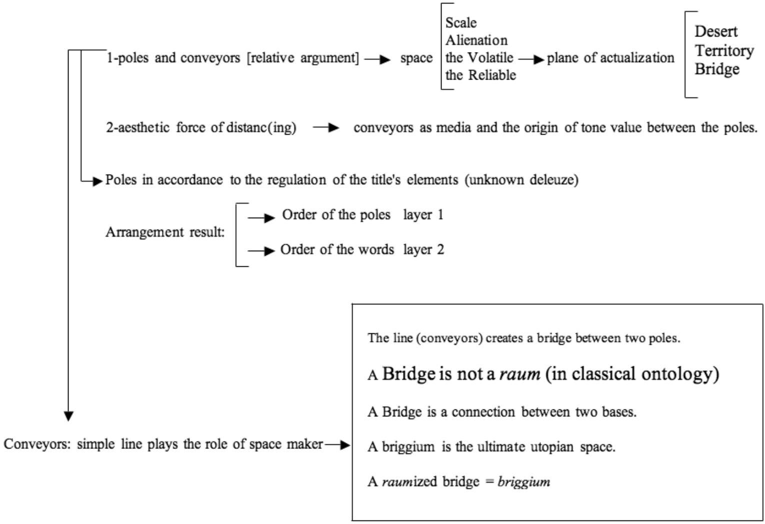
Chapter title: *The New Harmony* – a most appropriate title
for this new arrangement of unread characters.



Apprehension

The following graphitext critically examines this type of processing whilst (1) avoiding the vulgar comic-book tendency toward collage (instead invoking the baroque sense of perpetual development of a term); (2) receding to a lower profile of difference: The dominant modes and techniques of visual literacy are based on creating a relation between (graphical) elements in a grammatical manner – puzzle-solving on a monodimensional surface. It ought to be understood, however, that their effects (the perceived visual production) ultimately take place in the distance between the observer and the work (as related to the monodimension). Control of this space (the inderdimensionality between the observer and the work) can be achieved by influencing the networks of a series of focal points, the difference between the members of which is only a matter of distance (either as color or shape: hue, gradient, saturation, etc.). So that this management of distances between focal points from the observer is another way of creating 'work' – a lesser-known type of visual literacy amongst graphic artists.

EXAMINATION OF TEXT: SEARCH FOR HIDDEN SUBJECTS


1-poles and conveyors [relative argument]
space
Scale
Alienation
the Volatile
the Reliable
plane of actualization
Desert
Territory
Bridge
2-aesthetic force of distanc(ing)
conveyors as media and the origin of tone value between the poles.
Poles in accordance to the regulation of the title's elements (unknown deleuze)
Arrangement result:
Order of the poles layer 1
Order of the words layer 2
Conveyors: simple line plays the role of space maker

The line (conveyors) creates a bridge between two poles.

A Bridge is not a *raum* (in classical ontology)

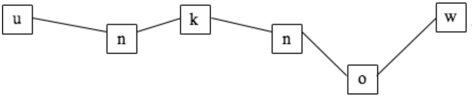
A Bridge is a connection between two bases.

A briggium is the ultimate utopian space.

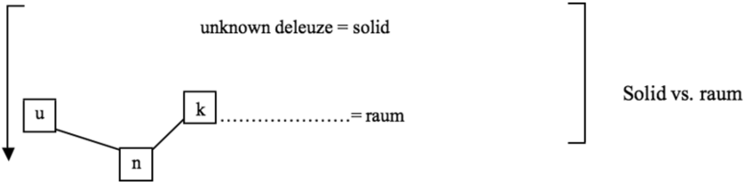
A *raum*ized bridge = *briggium*

LETTERS FIND DIRECTION

‘Unknown Deleuze’, as semantic unit, is non-directional, whereas:

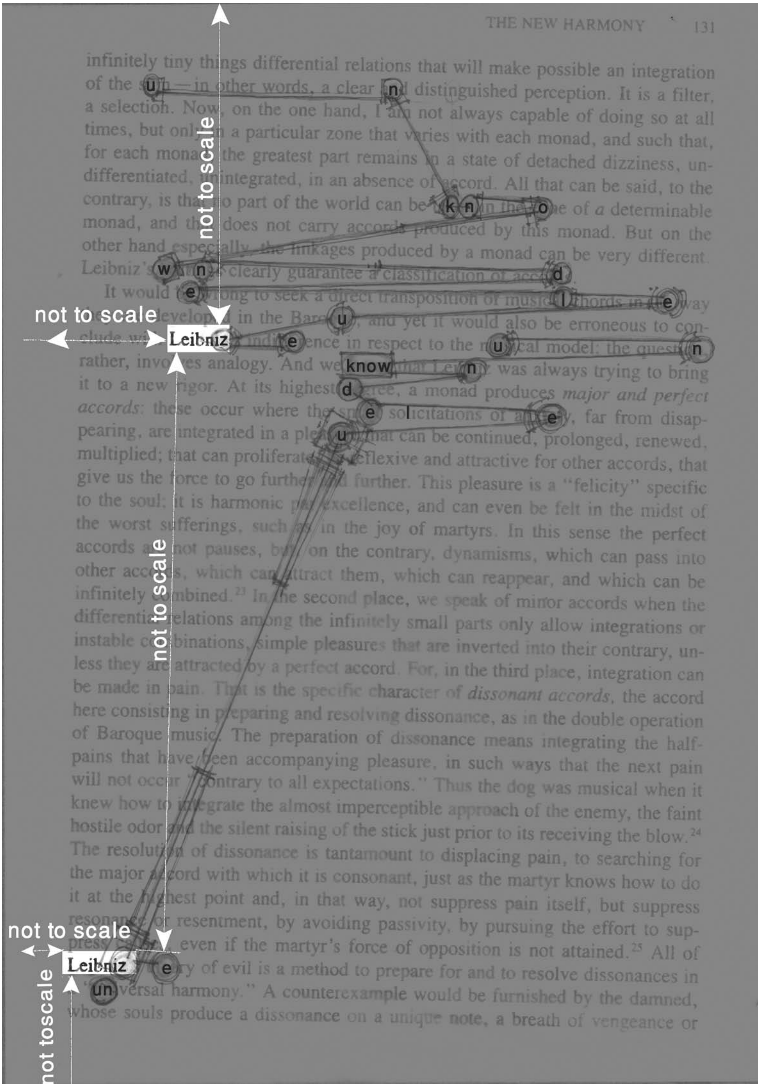


– is directional.


unknown deleuze = solid
u
n
k
= raum
Solid vs. raum

Separation and re-connection create a spatial, multidirectional statement. This process evolves the original statement into an unpleated state.

Importance of Leibniz (p.236); Briggium (p.237); Concentration of Memory (p.238); Poles cast Shadows (p.239); Soft Relation (p.240); Tendencies of Poles (p241);Volatile Boundary (p.242).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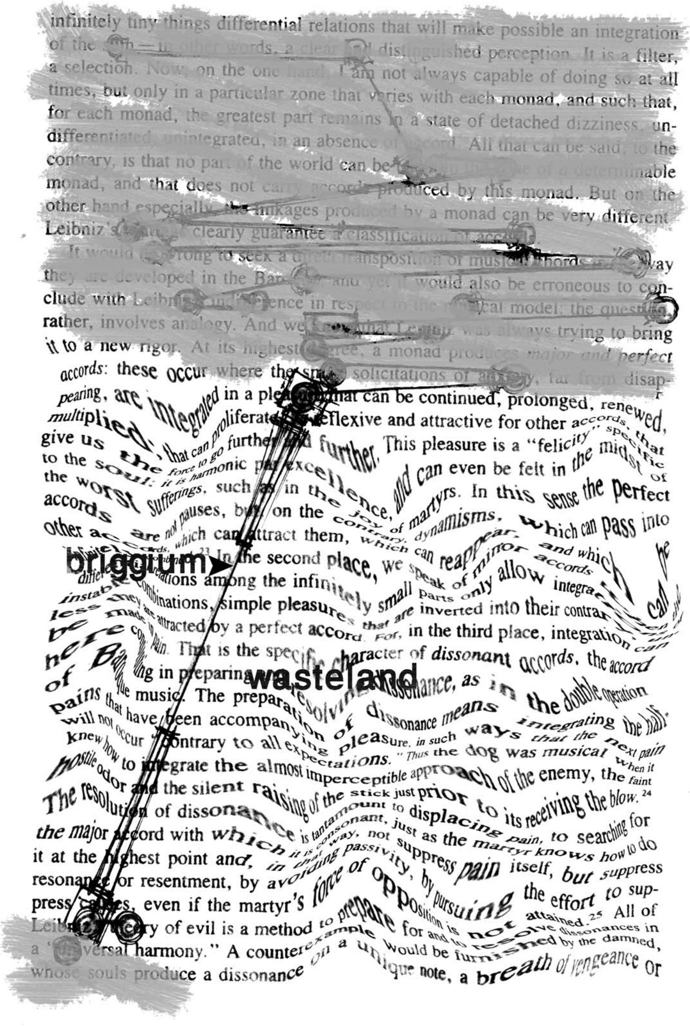
THE NEW HARMONY 131

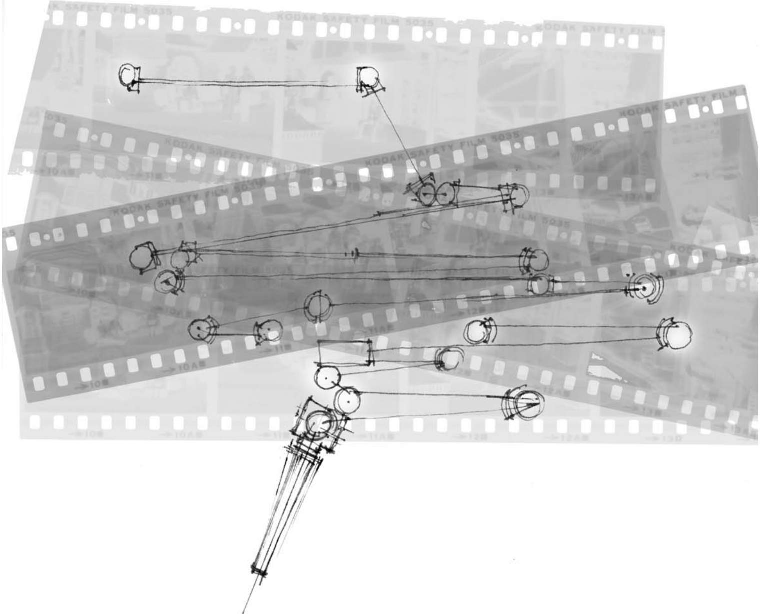
infinitely tiny things differential relations that will make possible an integration of the sum—in other words, a clear and distinguished perception. It is a filter, a selection. Now, on the one hand, I am not always capable of doing so at all times, but only in a particular zone that varies with each monad, and such that, for each monad, the greatest part remains in a state of detached dizziness, undifferentiated, unintegrated, in an absence of accord. All that can be said, to the contrary, is that no part of the world can be known in the zone of *a* determinable monad, and that does not carry accords produced by this monad. But on the other hand especially, the linkages produced by a monad can be very different. Leibniz's texts clearly guarantee a classification of accords.

It would be wrong to seek a direct transposition of musical chords in the way they developed in the Baroque, and yet it would also be erroneous to conclude with indifference in respect to the musical model: the question, rather, involves analogy. And we know that Leibniz was always trying to bring it to a new rigor. At its highest degree, a monad produces *major and perfect accords*: these occur where the small solicitations of anxiety, far from disappearing, are integrated in a pleasure that can be continued, prolonged, renewed, multiplied; that can proliferate, reflexive and attractive for other accords, that give us the force to go further and further. This pleasure is a "felicity" specific to the soul; it is harmonic par excellence, and can even be felt in the midst of the worst sufferings, such as in the joy of martyrs. In this sense the perfect accords are not pauses, but, on the contrary, dynamisms, which can pass into other accords, which can attract them, which can reappear, and which can be infinitely combined.[23] In the second place, we speak of minor accords when the differential relations among the infinitely small parts only allow integrations or instable combinations, simple pleasures that are inverted into their contrary, unless they are attracted by a perfect accord. For, in the third place, integration can be made in pain. That is the specific character of *dissonant accords*, the accord here consisting in preparing and resolving dissonance, as in the double operation of Baroque music. The preparation of dissonance means integrating the half-pains that have been accompanying pleasure, in such ways that the next pain will not occur "contrary to all expectations." Thus the dog was musical when it knew how to integrate the almost imperceptible approach of the enemy, the faint hostile odor and the silent raising of the stick just prior to its receiving the blow.[24] The resolution of dissonance is tantamount to displacing pain, to searching for the major accord with which it is consonant, just as the martyr knows how to do it at the highest point and, in that way, not suppress pain itself, but suppress resonance or resentment, by avoiding passivity, by pursuing the effort to suppress cause, even if the martyr's force of opposition is not attained.[25] All of Leibniz's theory of evil is a method to prepare for and to resolve dissonances in "universal harmony." A counterexample would be furnished by the damned, whose souls produce a dissonance on a unique note, a breath of vengeance or



infinitely tiny things differential relations that will make possible an integration of the [illegible] — in other words, a clear and distinguished perception. It is a filter, a selection. Now, on the one hand, I am not always capable of doing so at all times, but only in a particular zone that varies with each monad, and such that, for each monad, the greatest part remains in a state of detached dizziness, undifferentiated, unintegrated, in an absence of accord. All that can be said, to the contrary, is that no part of the world can be [illegible] of a determinable monad, and that does not carry accords produced by this monad. But on the other hand especially, the linkages produced by a monad can be very different. Leibniz's [illegible] clearly guarantee a classification of accords.

It would be wrong to seek a direct transposition of musical chords in the way they are developed in the Baroque, and yet it would also be erroneous to conclude with Leibniz's indifference in respect to the musical model: the question, rather, involves analogy. And we know that Leibniz was always trying to bring it to a new rigor. At its highest degree, a monad produces *major and perfect accords*: these occur where the small solicitations of anxiety, far from disappearing, are integrated in a pleasure that can be continued, prolonged, renewed, multiplied, that can proliferate, reflexive and attractive for other accords, that give us the force to go further and further. This pleasure is a "felicity" specific to the soul: it is harmonic par excellence, and can even be felt in the midst of the worst sufferings, such as in the joy of martyrs. In this sense the perfect accords are not pauses, but, on the contrary, dynamisms, which can pass into other accords, which can attract them, which can reappear, and which can be infinitely combined.[23] In the second place, we speak of minor accords when the differentiations among the infinitely small parts only allow integrations in instable combinations, simple pleasures that are inverted into their contrary unless they are attracted by a perfect accord. For, in the third place, integration can be made in pain. That is the specific character of *dissonant accords*, the accord here of Baroque music, falling in preparing and resolving dissonance, as in the double operation of Baroque music. The preparation of dissonance means integrating the half-pains that have been accompanying pleasure, in such ways that the next pain will not occur "contrary to all expectations." Thus the dog was musical when it knew how to integrate the almost imperceptible approach of the enemy, the faint hostile odor and the silent raising of the stick just prior to its receiving the blow.[24] The resolution of dissonance is tantamount to displacing pain, to searching for the major accord with which it is consonant, just as the martyr knows how to do it at the highest point and, in that way, not suppress pain itself, but suppress resonance or resentment, by avoiding passivity, by pursuing the effort to suppress causes, even if the martyr's force of opposition is not attained.[25] All of Leibniz's theory of evil is a method to prepare for and to resolve dissonances in a "universal harmony." A counterexample would be furnished by the damned, whose souls produce a dissonance on a unique note, a breath of vengeance or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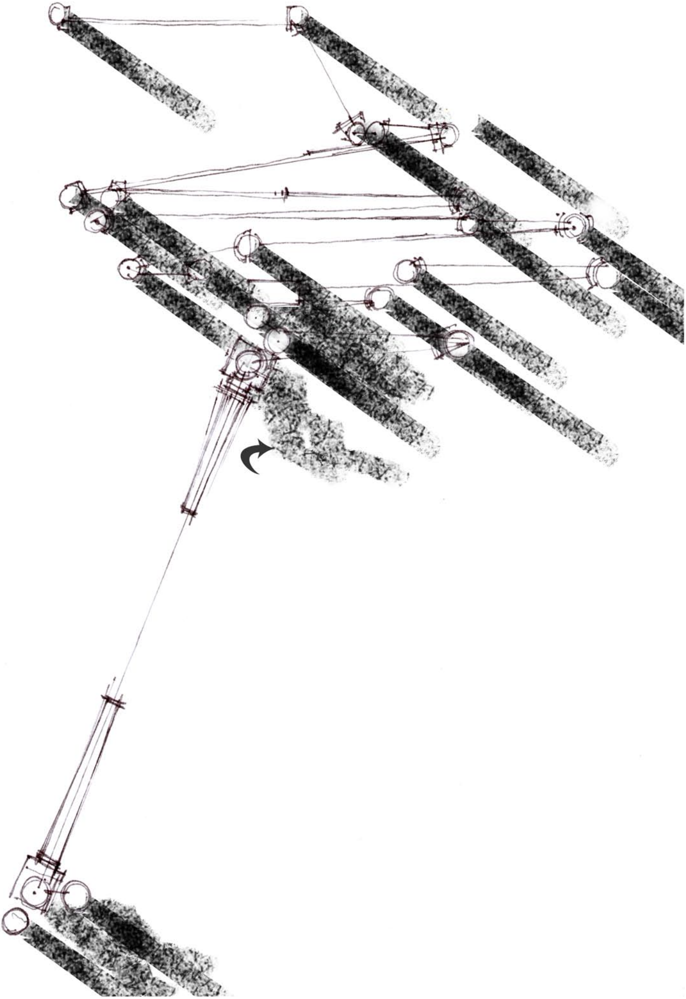

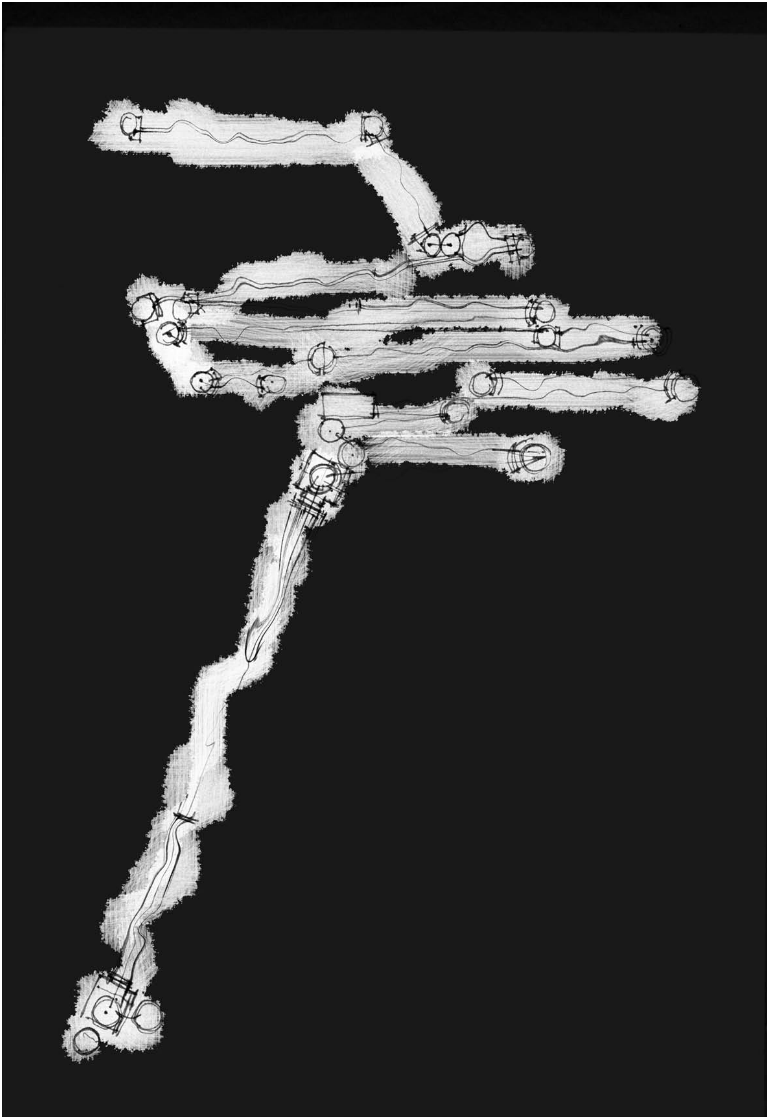

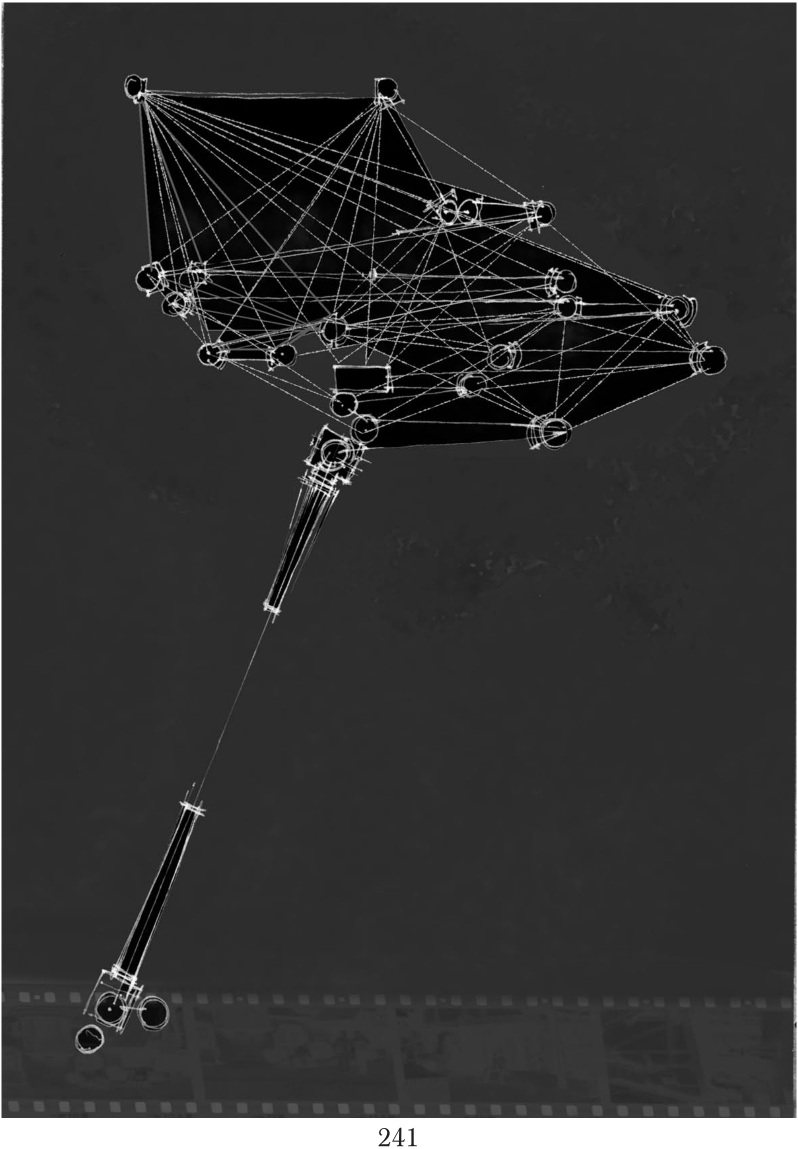

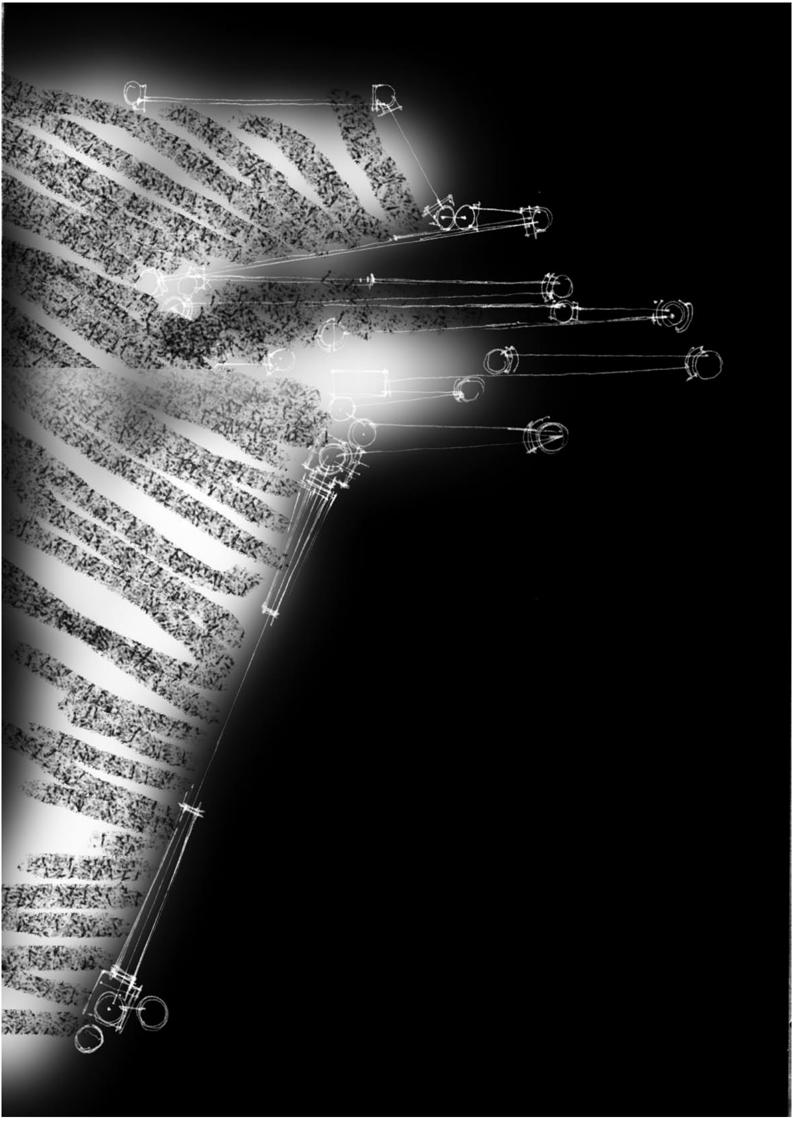

Another World

J.-H. Rosny the Elder

ROSNY AND THE SCIENTIFIC FANTASTIC[1]

The pseudonymous J.-H. Rosny (1856-1940) was 'already multiple', even before Belgian brothers Justin and Joseph-Henri Böex subjected him to a belated fissure, thus giving birth to Rosny 'the Younger' and Rosny 'the Elder'. It was Joseph-Henri, 'Rosny the Elder', who would achieve notoriety in the late nineteenth century as one of the group of writers whose 1887 *manifeste du cinq* broke acrimoniously with Zola's naturalism, declaring it a pandering and sterile form.[2] J.-H. Rosny the elder became a prominent literary figure, later presiding over the *Academie Goncourt*

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[1] Introduction by Robin Mackay,

[2] See http://www.berlol.net/chrono/des5.htm.

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http://www.urbanomic.com

and publishing over 150 books in almost every genre, from historical romance to what he dubbed *le merveilleux scientifique*, in virtue of which he is now recognised as a pioneer of Science Fiction. A minor 'rediscovery' in the 1970s saw his SF stories republished in the original French,[3] with a few being translated for US paperback editions, and a 1981 film of his prehistoric tale *Quest for Fire*, but to this day Rosny's legacy remains undeservedly overshadowed by those of Verne and Wells.

Only Deleuze's patronage saves Rosny from equal obscurity as a philosopher, even though a contemporary placed him in the most exalted company, dedicating a volume saluting a 'philosophical revolution' to 'Bergson, Einstein, le Dantec and Rosny the Elder'.[4] Deleuze was familiar with Rosny's fantastic fiction (a 'naturalism in intensity'),[5] but it is the reference to two key theses of the philosophical work *Les sciences et le pluralisme*[6] that confirm

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[3] The most complete collection is *Rosny: récits de science-fiction*, ed. J.-B. Baronian (Verviers: Marabout, 1975).

[4] J. Sageret, *La Révolution Philosophique et la Science*: *Bergson, Einstein, Le Dantec, J.H.Rosny aîné* (Paris: Alcan, 1924).

[5] See *Difference and Repetition* 326-7n. 2.

[6] *Les sciences et le pluralisme* was published in 1922 by Félix Alcan, a publisher who, in the first decades of the twentieth century, assembled a remarkable stable of philosophers of science (Lachelier, Renouvier, Brunschvicg, Bergson, not to mention Gabriel Tarde, Jean Wahl and Michel Souriau, to name only those cited in *Difference and Repetition*) who would exert a profound, if subterranean, influence upon French philosophy for the rest of the century. Alcan's name is attached to a group of authors who, rather than embodying a common ethos, saturated, through a sort of philosophical chromaticism, every philosophical possibility the epoch offered to the field.

The philosophical programme of philosophy of science inaugurated by Lachelier and Boutroux, and later renewed by Cavaillès and Bachelard, was, of course, finally interrupted by the Occupation, subsequently to be obscured by the 'return to the that Rosny's contribution to *Difference and Repetition* was far from marginal:

> (1) Resemblance presupposes difference; it is differences that resemble one another;
>
> (2) Difference alone allows us to conceive of being.[7]

Rosny's book attacks the 'monist' presupposition that science proceeds by annulling differences through a reduction of the heterogeneous and complex to the homogeneous and elementary;[8] and that any dissenting, pluralist position must lead to nothing more than a 'confusionism'.[9] In so far as scientific thought implies simplifications and abstractions, like Bergson, Rosny regards it as continuous with cognition *per se*, and with life as such: Noting that 'each of our senses is constructed so as to

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concrete' – but continued to operate beneath the surface, as is evident equally from the work of Badiou and Deleuze. See present volume, 35-6n. 90. A particularly clear account of the origins and mutations of this tradition is given by C. Imbert 'La fin d'une période : de Lachelier à Cavaillès et de Boutroux à Bachelard', at http://tlrdoc.free.fr/pages/philosciences.htm.

Alcan was one of the first French publishers to cede editorial control of scholarly journals to the scholars themselves, privileging innovation over tradition. This made Alcan the focal point of a new social network which would later lead to the formation of the *Quadrige* alliance of academic publishers, later PUF. For a detailed analysis of the role of *alcanisme* in the formation of the allied *Presses Universitaire de France* (PUF), and Alcan's impact in French publishing culture and the nascent figure of the intellectual, see V. Tesnière, *Le Quadrige: un siècle d'Édition universitaire, 1860-1968*. (Paris: PUF, 2001).

[7] *Difference and Repetition* 327n. 2.

[8] The most prominent advocate of such a thesis was Emile Meyerson, according to whose anti-positivist nihilistic ontology the underlying principle of science is an elimination leading to a uniform 'void' of absolute identity lacking all qualities. See E. Meyerson, *Identity and Reality* trans. K. Loewenberg (NY: Dover, 1962 – first published in French by Alcan in 1908).

[9] J.-H. Rosny Ainé, *Les sciences et le pluralisme* (Paris: Alcan, 1922), 1.

"neglect" what does not interest it',[10] he takes up Bergson's example of the 'contraction' of light, suggesting that '[i]n the same way' that we 'contract' trillions of vibrations into a single qualitative sensation, 'science continually neglects, totalizes, symbolizes.'[11] But for Rosny this abstraction always exists and acts alongside *experimentation*,[12] which continually puts thought back in touch with the infinite complexity of the real, there to discover new differences, the disequilibria that drive scientific revolutions and refoundations.

Like the process of evolution, the progress of scientific thought constantly wards off a passage to the limit in either direction, to monism or 'confusionism'. But although we cannot therefore do without either the concept of difference or that of resemblance, Rosny claims that the former encompasses the latter: 'the concept of difference, since it is irreducible, radically suppresses the concept of resemblance, whilst the latter does not at all suppress that of plurality.'[13] The pluralist conception subtends the monist one, which tacitly presupposes it, and this, for Rosny, in so far as pluralism, 'the only possible method, the only one that has been implicitly practiced, the only one conforming to intellectual activity issued from instinctive activity'[14] necessarily implies a theory of difference: 'There can be no unity if difference is essential to the constitution of things; but there can be any number of resemblances, resemblances of every order,

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[10] *Ibid.*, 2.

[11] *Ibid.*, 3

[12] *Ibid.*

[13] *Ibid.*, 5.

[14] *Ibid.*, 7

"different" resemblances, so to speak, in an indefinitely varied and variable universe';[15] 'we perceive more and more clearly summations of differences, where before we thought we saw resemblances.'[16] Like his contemporary Gabriel Tarde, whose 'differential epistemology' proposed that the infinitesimal and its integration were 'the key to the entire universe',[17] Rosny discovers the magical equivalence 'PLURALISM=MONISM'[18] through the promotion of difference as primary and fathomless; whence the formula repeated in *Difference and Repetition* to illustrate that there is nothing behind difference but difference:

> All (calculable) energy implies factors of the form E – E', in which E and E' themselves conceal factors of the form e – e', and so on indefinitely.[19]

This differential pluralism extends from Rosny's philosophy of science into his science fictions, for if 'experimentation indefinitely dominates speculation' this implies the tantalising fact that 'we only ever know a tiny portion of things in relation to the immensity and diversity of the universe. It makes us see that there exist innumerable series whose existence will never be revealed to our feeble powers of discrimination'.[20] In the final chapter, where Rosny makes this connection explicit, *Les sciences* begins to answer to Deleuze's ideal definition: philosophy becomes truly 'a kind of science fiction', written 'at the frontiers of knowledge',[21] and invoking the central theme of Rosny's fantastic tales: strange alien beings just beyond the reach of our limited knowledge:

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[15] *Ibid.*, 5.

[16] *Ibid.*, 6.

[17] See J. Milet, *Gabriel Tarde et la philosophie de l'histoire* (Paris:Vrin, 1970).

[18] *A Thousand Plateaus*, 20.

[19] Rosny, *Les sciences*, 6; *Cf. Difference and Repetition*, 117, 222.

[20] Rosny, *Les sciences*, 8.

> [T]here is no reason why the terrestrial surface, since it is traversed by immense energies, should not have produced organic systems equal in complexity to our own. No more than there is any reason that it might not produce another organic realm once ours has disappeared. My *Xipehuz*, *Moedigen* and *Ferro-Magnetics* are perhaps pale symbols of anterior and future realities.[22]

Indeed, these were already the stakes of Rosny's first SF tale, 1887's *Les Xipehuz*, whose nonorganic aliens announced, as surely as do the 'Moedigen' of 'Another World', the arrival of a non-anthropomorphic SF.

Along with this obsession with radically different orders of living beings, Rosny's rejection of the hubristic aspiration to a unification of knowledge unites him with another writer favoured by Deleuze: The following is Rosny, but it could easily have been written by the American weaver of weird tales H.P. Lovecraft (1890-1937):

> Revolting against our infirmity, if we cannot traverse and dominate the universe, at least we might conceive it. Vain dream of ephemeral beings, whose race will last but an instant in the innumerable succession of phenomena [...] [23]

Both Rosny and Lovecraft drew on contemporary scientific advances, and did not hesitate to extrapolate wildly from them. Both created weird tales in which 'the world of normality hardly ever appears',[24] even as a dramatic foil for preternatural occurrences. Both had a taste for materialism, scientific rationality, and precision that showed through in the meticulous construction of their alien worlds and creatures; both showed a will to estrange the reader with scientifically-plausible abstract-cosmic theses, with creatures that went beyond any biological comprehension but exemplified the most outlandish findings of physics (in Rosny we find creatures that are geometrical constructs of pure energy, helicoidal ferromagnetic forms, fluid, spiral, cones of magnetically-charged matter – all in perfect keeping with Lovecraft's bizarre hexagonal barrels, four-dimensional protoplasms and ineffable yet material presences). Both authors seal this alienation with their weird creatures' unpronounceable names – Rosny's 'Wanawnanabm' and 'Kzamms' for Lovecraft's 'Nyarlathotep' and 'Cthulhu' – and by overegging their tales with weighty adjectival invocations of the noumenal.[25]

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[21] *Difference and Repetition* xx-xxi.

[22] Rosny, *Les sciences*, 215.

[23] Rosny, *Les sciences*, 8.

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[24] J.P. Vernier 'The SF of J.H. Rosny the Elder', *Science Fiction Studies*, #6, 2:2, 1975.

[25] 'First of all there are certain words – always the same, always identical, almost piercing, like incantatory fomulae: fearful, formidable, terrible, prodigious, savage, gigantic! […] As if the author had deliberately wanted to define his literary universe, as if he had sought, by resorting to a singular vocabulary, the most accurate adumbration of his real and precise ambitions […]' – Jean-Baptiste Baronian, 'Les Fins et les Manieres', preface to Rosny, *Récits*, 5.

'In this register Lovecraft has never been equalled. One may copy his manner [...] but one can never imagine oneself emulating those passages where he loses all stylistic reserve, where adjectives and adverbs accumulate to the point of exasperation, where he lets loose exclamations of pure delirium [...] [T]his is the true goal of his work. One could even say that the often subtle and elaborate structures of the "major works" have no other purpose apart from preparing the way for passages of stylistic explosion [...] The adjectives and the exclamation marks multiply, the fragments of incantation spring to his mind, his heart is lifted with enthusiasm; he plunges into a true ecstatic delirium [...]' – M. Houellebecq, *H.P.Lovecraft: Against the World, Against Life*, trans. D. Khazeni (NY: Believer Books, 2005). Translation modified).

But as well as the difference in their scientific expertise (Lovecraft, though invariably well-researched, was ever the gentleman-amateur, whereas Rosny was something of a polymath and was in direct contact with the scientific luminaries of his day, including – as Deleuze notes – Marie Curie) the two authors display a marked difference in moral outlook. Although both perceived with utmost clarity the extent to which modern science had dislodged man from the centre of the universe, whilst Lovecraft revelled in repeatedly hammering home man's powerlessness in the face of impersonal cosmic forces (see Houellebecq's suberb account),[26] Rosny maintained a faith in man which survived the ravages of darwinism, atomic physics and relativity.

Both invoke weird and frightening creatures beyond our ken; but whereas in Lovecraft's quasi-Faustian tales an unhealthy taste for science is often to blame for bringing unhappy protagonists into contact with beings they ought to have left well alone, for Rosny these beings can, through the power of scientific thought, be brought within the purview of a positive scientific knowledge, in the process altering our own perception of the universe – a cognitive evolutionism, then, inspired no doubt by the enthusiasm for the mechanisms of adaptation and mutation in Bergson and his contemporaries.

Although Lovecraft and Rosny share a fascination for the seething world of particles and energy and for the apparent impossibility of defining what constitutes a living being, by constantly emphasising man's biological kinship with 'lower' and 'higher' forms of life alike and his consequent interconnectedness with the universe, Rosny finds a paradoxical sort of comfort wholly lacking in Lovecraft's visions of cosmic desolation. This theme of a sort of abstract community is keenly argued throughout Rosny's work: he believes in a sort of primacy of a *structure of life*; and inversely the 'meaning of life', in the higher form of advanced scientific thought, is the search for structure. Rosny's hymns to experimental research – including 'Another World' – are in some sense the inverse of Lovecraft's grim counsel against meddling with the hostile indifference of the physical universe. Perhaps this can be attributed to Rosny's personal involvement with the science that rendered Lovecraft awestruck from afar; Rosny's faith in the human involvement in the fundamental questing impulse of science fending off the Azathothic terror brought on for Lovecraft in contemplating its actual findings:

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[26] Houellebecq, *op.cit.*

> Modern research, you who have made of the abstract a tool rather than a limit, oh incommensurable spiral – reaching into the depths of the spaces where the human spirit ascends […] [27]

As we know, for Lovecraft, there is no mistaking that this spiral is a *descent* … Furthermore, for Rosny, universal community becomes a link between the everyday world of emotion and sociality, and the arid calculus of exact science; thus suggesting a very definite view of science's positive historical and social import: it is, after all, this intuition of structure common to all life that, in Rosny's *Les Navigateurs de l'infini,* allows a human to fall in love with a six-eyed martian 'of ternary symmetry'![28] The instinct for beauty, an *a priori* for all possible consciousness and recalling the role of purposiveness in Kant's aesthetics, reflects the cosmic dominance of structure, and therefore implies the possibility of bringing the human into harmony with a universe full of uncharted inhuman forms of life. Rosny's touching suggestion – utterly unthinkable for Lovecraft – is that we can even come to empathic terms with 'luminous networks of phosphorescent matter' – as ridiculous as it might seem, perhaps not such a very different sentiment from the spirit that inspired the plaque on the Voyager space probe.

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[27] Vernier, *op.cit.*

What intervened in between 'Another World' and 'The Mountains of Madness', between the cosmic optimism of diaphanous, playful lifeforms and the absymal horror of tentacular crawling chaos, was the Great War – technological arsenals unleashed in a senseless, implacable and indifferent manner that Lovecraft perhaps saw as a revelation of the very eternal truth of the universe.[29] Nevertheless, Rosny is no mere anti-Lovecraft, any more than he is merely anti-Meyersonian. In fact it is the black romantic Lovecraftian vision of dissolution into confusionist schizophrenic chaos[30] that is the reverse image of the Meyersonian glacial ascent to monolithic identity. Rosny's differential ontology means that his pluralism can affirm both simplification and complexification, in a non-dialectical relation; differentiation and selection together with a univocity that preserves an empathic opening to the cosmic. Seeing no contradiction between an immediate aesthetic apprehension of the universe (beauty) and scientific knowledge (structure), arguing for the equal importance of conceptual reduction and an experimental/experiential immersion, Rosny's work is a unique, lyrical vitalist-structuralist apology for pluralism.

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[28] Rosny, *Récits de science-fiction*, 40-91.

[29] See China Miéville's introduction to H.P. Lovecraft, *At the Mountains of Madness* (NY: Random House, 2005); Note also that 1910 saw the publication of Rosny's *Mort de la Terre*, where the parallel life-forms – this time 'ferromagnetic beings' – finally turn on man, killing off the human race.

[30] See *A Thousand Plateaus*, 73-4, 240, 245, 248.

'Another World' typifies the Rosny narrative arc: an alienated being is reconciled with our world through systematic scientific experimentation, conducted by the sympathetic figure of the curious but prudent and objective Doctor van den Heuvel.[31] A mediation is achieved between 'durations' which would otherwise exist in parallel, unknown to each other; ending in a union which promises more experiments, more differentiations, to come.

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[31] Note that the protagonist of 'Another World' finds both social acceptance and the scientific expertise necessary to bring him into engagement with the wider world, in the cordial cosmopolitan setting of *the city*, which, for Lovecraft, promised only the horror of pullulating 'shoggothic' masses (see Houllebecq, *op. cit.*).

ANOTHER WORLD

I

I am a native of Gelderland. Our inheritance had dwindled to a few acres of heather and yellow water. Pine trees lined its borders, quivering and rustling with a metallic sound. The farmhouse had hardly any habitable rooms, and was crumbling, stone by stone, in its solitude. We were a clerical family of old, once numerous, now reduced to my parents, my sister and myself.

My destiny, so dark to begin with, has become as wonderful as I could ever have dreamt of: I have met with those who understand me; they have learnt that which I alone amongst men know. But I suffered for such a long time, I despaired, prey to doubt, to the solitude of the soul, which ended up corroding even absolute certainties.

I came into the world with a unique constitution. From the start, I was an object of astonishment. Not that I seemed maladapted: I was, so they told me, more graceful of body and countenance than is normal in a newborn. But I had a most extraordinary complexion, a sort of pale violet hue – very pale, but most definite. In lamplight, especially that of oil-lamps, this tint became even more pale, turning into a peculiar whiteness, like a lily submerged in water. That was, at least, what other people saw: myself, I saw it differently, as I saw differently all objects in the world. For this first peculiarity was to be supplemented with others which would reveal themselves later on.

Although born with all the appearance of good health, I grew very slowly. I was thin, I cried endlessly; at eight months old, no-one had ever seen me smile. They soon began to despair of the prospect of raising me. The doctor from Zwartendam declared that I was stricken with a physiological infirmity: he could recommend no other remedy than a strict regime of hygiene. But this did not prevent my wasting away; it seemed that, day by day, I was just fading away. My father, I believe, was resigned to it, his *amour-propre* – the *amour-propre* of a Dutchman of order and regularity – somewhat injured by the bizarre nature of his child. My mother, quite against the grain, loved me all the more in proportion to my bizarreness, having eventually found the tone of my skin lovable.

Things stayed just so, until a rather simple event came to my rescue: but, just as everything was abnormal for me, this event too was to be an occasion for scandal and fear.

Upon the departure of a servant, to replace her we took on a vigorous young girl from Friesia, full of honesty and enthusiasm for work, but with a weakness for drink. I was entrusted to the new arrival. Seeing me so weak, she came up with the idea of giving me, in secret, a little beer and water mixed with jenever: a remedy, according to her, for all ills.

The most curious thing is that I wasted no time in regaining my full vigour, and that from that time onwards I demonstrated an extraordinary predeliction for alcoholic drink. This fine girl secretly rejoiced, not without a certain relish at the puzzlement of my parents and the doctor. Put on the spot, she finally solved the mystery. My father flew into a violent rage; the doctor railed against superstition and ignorance. Strict orders were given to the servants; and my nurse was sent back to Friesia.

I began to get thinner again, to waste away, to the point where, hearkening only to her love for me, my mother put me back on the regime of beer and jenever. At once, I regained my vigour and vivacity. The experiment was conclusive: alcohol was revealed to be indispensible to my health. My father took it as a humiliation; the doctor took charge of things by arranging for medicinal wines to be brought, and after this my health was excellent: although one would be forgiven for presaging for me a career of drunkenness and debauchery.

A little after this incident, a new anomaly struck those around me. My eyes, which first of all had appeared quite normal, started to become strangely opaque, taking on a calloused appearance, like the hard wingcases of certain beetles. The doctor predicted that I would lose my sight; all the time avowing that the condition seemed absolutely inexplicable to him and that he had never had occasion to study anything remotely similar. Soon the pupil was so amalgamated with the iris that it was impossible to tell the one from the other. It should be remarked, meanwhile, that I was able to look at the sun with no apparent unease. In truth, I was not in the least bit blind – in fact it would have to be admitted in the end that I saw extremely well.

Thus I attained the age of three years. I was, according to the opinion of those of the neighborhood, a little monster. The violet colour of my skin had hardly changed; my eyes were now completely opaque. I spoke poorly and with incredible speed. I was nimble with my hands and well adapted for any movements that demanded more speed than strength. It could not be denied that, if I had had a normal complexion and normal eyes, I would have been graceful and pretty. I showed signs of intelligence, but with certain gaps which those around me could not fathom, especially as – apart from my mother and the Friesian girl – they did not like me at all. For strangers I was an object of curiosity, for my father a continual source of mortification.

If, however, the latter may have nursed hopes of seeing me one day become equal with other men, time served only to dash them. I was to become more and more strange, in my tastes, in my conduct, in my qualities. At six years old, I nourished myself almost uniquely on alcohol. Only very rarely did I take a few mouthfuls of vegetables or fruits. I grew prodigiously fast, I was incredibly thin and light. I mean light in a quite specific sense – something different to merely thin people: I swam with the slightest of effort, I floated like a plank of poplar-wood. My head didn't sink any more than the rest of my body.

I was nimble in proportion to this lightness. I ran as fast as a deer; I leapt over ditches and obstacles which no man would even try to clear. In the blink of an eye, I could climb to the top of a beech-tree; or, what is even more surprising, I could jump right onto the roof of our farmhouse. On the other hand, even the slightest burden exhausted me.

*

All of these, in sum, were only phenomena indicative of a peculiar nature, which would not, on their own, serve to distinguish me or make life hard for me: none of them categorised me outside the bounds of humanity. No doubt I was a monster, but certainly no more than those born with the eyes or ears of an animal, with the head of a calf or of a horse, fins, no eyes or an extra eye, four arms, four legs, or no arms or legs at all. My skin, despite its surprising tint, was near enough to being just a tanned skin; my eyes were not particularly repugnant, despite their opacity. My extreme agility was an asset; my need for alcohol could have passed for a simple vice, the result of a family legacy of drunkenness: in any case, rustic folk like our Friesian servant would see in it only a confirmation of their ideas about the 'potency' of jenever, a particularly acute proof of their tastes. As to the speed of my speech, its volubility, which made it impossible to follow, this might have been mistaken for faults of pronunciation – stuttering, stammering, lisping – common to so many small children. I therefore did not have, properly speaking, any striking traits of monstrosity, even if the whole was extraordinary in its combination: for the most curious aspect of my nature escaped those around me, because none of them could know that my vision differed strangely from normal vision.

If I saw some things less well than others, I also saw a great number of things that others did not see at all. This difference was especially manifest with regard to colours. Everything that is called red, orange, yellow, green, blue, indigo, appeared to me as a more or less dark grey, whereas I perceived violet, and the series of colours beyond it, colours which are nothing at all for normal men. I recognised later on that I could thus distinguish about fifteen colours as dissimilar as, for example, yellow and green – with, of course, an infinity of gradations.

Secondly, transparency does not manifest itself to my eye in the usual way. I saw quite poorly through glass and through water: glass is very densely coloured for me; so is water, noticeably, even when quite shallow. Many so-called diaphanous crystals are more or less opaque to me, and inversely many supposedly opaque bodies are no barrier to my vision at all. In general, I can see through things more often than you; and translucidity, semi-transparence, is so commonplace that I might say that it is, for my eyes, the rule for nature, whereas complete opacity is the exception. Thus it is that I see objects through trees, leaves, the petals of flowers, magnetised iron, coal, *etc.* However, as their thickness varies, these bodies become an obstacle: such as a large tree, water a metre deep, a thick block of coal or of quartz.

Gold, platinum, mercury are black and opaque, ice is blackish. Air and water vapour are transparent, but somewhat coloured, like certain types of steel, certain very pure clays. Clouds do not prevent me from seeing the sun nor the stars. However, I can perceive the clouds suspended in the atmosphere.

This difference between my vision and that of other men was, as I have said, very little remarked upon by those close to me: it was known that I distinguished poorly between colours, that was all; and that is too common a problem to draw much attention. It was without great consequence for the day-to-day proceedings of my life, since I saw the forms of objects the same – and perhaps even more subtly – than most people. The designation of an object by its colour, when meant to differentiate it from another object of the same form, was only a problem if they were new to me. If someone called the colour of one waistcoat blue and that of another red, the real colours in which the waistcoats appeared to me mattered little: blue and red became purely mnemonic terms.

Along these lines, you can well understand that there emerged a certain sort of accord between my colours and the colours of others, and that ultimately it became just as if I saw their colours. But, as I have already written, I perceived red, green, yellow, blue, etc. when they were pure – as are the colours of a prism – as darker or lighter shades of grey; they simply were not colours for me. In nature, where no colour is pure, things are not the same: some substances called green, for example, are for me a certain composite colour;[32] but another substance called green, and which to you looks exactly the same shade as the first, is not at all the same colour for me. You can therefore see that my palette of colours does not correspond to yours: when I agree to call both brass and gold 'yellow', it is a little as if you were to agree to call both a cornflower and a poppy 'red'.

II

If the difference between my vision and normal vision had stopped there, this would, certainly, have been extraordinary enough. It is nothing, however, in comparison to what remains for me to tell you. The world coloured differently, differently transparent and opaque – the faculty to see through the clouds, to see the stars even on the most overcast of nights, of seeing through a wooden partition what is happening in an neighbouring room or outside a house – what is all that, compared to the perception of a LIVING WORLD, of a world of animated beings who move alongside and all around man, without man ever being conscious of it unless he is alerted to them by some sort of immediate contact? What is all that, compared to the revelation that there exists on this earth a fauna other than our fauna, one which does not resemble ours whatsoever, either in form, organisation, or behaviour, nor in the way it is born, grows, and dies? A fauna which lives side-by-side with ours and beyond ours, influences the elements which surround us and is influenced by them, is nourished by these elements, without our ever suspecting their presence. A fauna which – as I will demonstrate – knows nothing of us just as we know nothing of it, and which has developed in complete isolation from us just as we have in complete isolation from it. A living world, with just as much variety as ours, just as significant as ours – and perhaps more so – in terms of its effects on the face of the planet! A kingdom, finally, moving across the oceans, in the atmosphere, in the soil, modifying these oceans, this atmosphere and this soil, in a completely different way than we do, but with an assuredly formidable energy, and in that way acting indirectly upon us and on our destinies! … This, nonetheless, is what I saw, what I see, alone among man and beasts; this is what I have studied fervently for five years, after having spent my childhood merely observing it.

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[32] And this composite colour, of course, does not contain green, since green is but a shadow for me.

III

Observing it! For as long as I can remember, I instinctively supressed the attraction of this creation so alien to our own. At first I confused it with other living things. Perceiving that no-one else took any notice of its presence, that everyone, on the contrary, seemed utterly indifferent to it, I made no effort to point out its peculiarities. At six years old I knew perfectly how to distinguish it from the plants of the fields, the animals of the farmyard and stable, but I sometimes still confused it with inert phenomena such as fire and light, or the motion of water and clouds. These beings were intangible: when they touched me I felt no sensory effect from their contact. Meanwhile their forms, however highly varied, had the peculiarity of being so thin in one of their three dimensions, that one might compare them to drawn figures, to surfaces, mobile geometrical lines. They traversed all organic bodies; on the other hand, they seemed sometimes to be blocked, entangled in invisible obstacles … But I will describe them later. For now, I want only to indicate, to affirm, the variety of their contours and lines, their almost complete absence of thickness, their impalpability, along with the autonomy of their movements.

*

Around the time of my eighth year, I finally realised definitely that they were just as distinct from atmospheric phenomenon as from the animals of our natural kingdom. Enraptured by this discovery, I tried to express it. I could never succeed in doing so. As well as my speech being nearly completely incomprehensible, as I have said, the extraordinary nature of my vision rendered what I said suspect. No-one would bother to spend the time to decipher my gestures and my phrases, any more than they would be minded to admit that I could see through wooden partitions, however many times I might furnish proofs of so doing. There was, between myself and others, an almost insurmountable barrier.

I fell into discouragement and reverie; I became a sort of solitary child; my presence caused unease – and I could sense it – when in the company of children my own age. I was not exactly a victim, since my speed put me well out of the reach of childhood malice and gave me the means to wreak revenge easily. At the least sign of trouble, I would be far away, leaving the pursuer floundering. No matter what numbers they came in, children could never hope to surround me, much less get a hold of me. It was not even any use to try to grab me by stealth. As weak as I was when it came to bearing a load, my speed was irresistible, and I would escape instantly. I could return unexpectedly and overcome the adversary, or even adversaries, with prompt and sure blows. So they left me alone. They took me at once for an innocent and something of a sorceror, but one whose brand of sorcery was apparently so limited that he deserved scorn. By degrees, I began to live a life apart, insular, meditative, and not completely devoid of peaceful moments. Only the kindness of my mother humanised me, even if, busy most of the day, she found little time for caresses.

IV

I will try to describe summarily several scenes of my tenth year, before making more concrete the preceding explanations.

It is morning. A large lamp lights up the kitchen, a lamp which is a pale yellow for my parents and the servants, very different for me. Breakfast is being served, tea and bread. But I do not take any tea. They just give me a glass of jenever with a raw egg. My mother busies herself tenderly with me; my father questions me. I try to answer him, I slow down my speech; he only understands one syllable here, one there, and shrugs his shoulders.

"He'll never speak! …"

My mother looks at me compassionately, convinced that I am a little simple. The domestic staff and the servants are not even curious any longer about the little violet monster; the Friesian returned to her homeland a long time ago. As for my sister – she is two – she plays around me, and I feel a great fondness for her.

The meal finished, my father goes on his way, along with the servants, and my mother begins to attend to the daily chores. I am in there in the courtyard. The animals gather around. I regard them with interest, I love them. But all around, the other Kingdom shifts and changes and captures me even more: the mysterious domain that I alone know.

On the brown earth, there are various scattered forms; they move, stop, palpitate across the expanse of the ground. They are of many types, differentiated by their shape, their movement, and above all by their behaviours, the contours and the hues of the curves which traverse them. These curves constitute, in sum, the principle of their being and, even as a child, I could see this quite well. Whilst the greater part of their form is dull and greyish, the lines are almost always sparkling. They form very complicated webs, they emanate from centres, they radiate, until they die out, becoming indiscernible. Their hues are innumerable, their curves infinite. These hues vary for one single line, as they do also, but less so, for the whole form.

Taken as a whole, each being is described by a contour, rather irregular but very distinct, by centers of radiation, by multi-coloured, multiply intersecting lines. When it moves, the lines vibrate, oscillate, the centres contract and dilate, whilst the contour hardly varies.

All of this, I saw quite well, already, even if I was incapable of defining it; I was penetrated by an exquisite charm in contemplating the Moedigen.[33] One of them, a colossus ten metres long and almost as wide, passes slowly across the courtyard, with great centres like eagles' wings, interests me greatly and almost frightens me. I spend a moment following it, but then others claim my attention. They are of all sizes: some are no bigger than our most common insects, whereas I have seen some attain more than thirty metres in length. They proceed on the ground only, as if they are attached to solid surfaces. When a material obstacle – a wall, a house – presents itself, they clear it by moulding themselves to its surface, always without any significant modification of their contours. But when the obstacle is of matter that is living or has lived, they pass directly through it: I have seen them thus, a million times, emerging from a tree and under the feet of an animal or a human. They also pass through water, but prefer to remain on the surface.

These terrestrial Moedigen are not the only intangible beings. There is an aerial population, marvellous and splendid, of an incomparable subtlety, variety, and lustre, besides which the most beautiful birds are dreary, slow and heavy. Here again, a contour and some lines. But the bottom is not greyish; it is strangely luminous; it sparkles like the sun, and the lines detach themselves from it in vibrating veins, the centres palpitating violently. The Vuren, as I named them, are more irregular of form than the terrestrial Moedigen, and generally speaking they direct themselves with the aid of rhythmic behaviours, crossings and uncrossings whose nature, in my ignorance, I could not determine and which confounded my imagination.

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[33] This is the name which I spontaneously gave them during my infancy, and which I have kept for them, even if it does not correspond to any quality or form of these beings.

Meanwhile I had taken my route across a recently-mown lawn: the combat of one Moedig with another drew my attention. These combats are frequent; they intensely excited me. Sometimes, it is a combat between equals; most often the attack of a strong one against a weak (the weak is not necessarily the smallest). In the present case, the weak one, after a summary defense, takes flight, pursued briskly by its aggressor. Despite the speed of their progress, I follow them, and I succeed in not losing sight of them, up to the moment when the battle recommences. They fall on one another, firmly, rigidly even, each one solid against the other. At the shock, their lines phosphoresce, are directed towards the point of contact, their centres blanching and contracting. At first, the struggle remains fairly equal, the weaker expending energy the most intensely, and even succeeding in obtaining a respite from its adversary. It profits from this by fleeing anew, but is rapidly caught up, attacked with force and finally seized upon, that is to say consumed through an opening in the contour of the other. This is precisely what it had sought to avoid, by responding to stronger shocks with less energetic, but more sudden shocks. Now, I see all of its lines vibrating, its centres pulsing despairingly; and, in proportion to this, its lines fading, growing finer, the centres becoming more indistinct. After a few minutes, it is granted its liberty: it moves away slowly, dimly, debilitated. The antagonist, on the contrary, sparkles yet brighter, its lines are more highly coloured, its centres more distinct and more rapid.

This struggle has profoundly moved me; I re-imagine it, I compare it to battles which I have seen sometimes between our animals; I grasp confusedly the fact that the Moedigen, essentially, do not die, or only rarely so; that the victor contents itself with taking energy at the expense of the vanquished.

The morning wears on, it is nearly eight'o'clock; the Zwartendam school will open soon: I make a leap back to the farmhouse, I gather my books, and there I am, amongst my classmates, where no-one divines the profound mysteries which pulsate all around us, where no-one has even the most confused idea of the living things which all humanity traverses and which traverse humanity, with no indication of this mutual penetration.

I am a truly awful scholar. My writing is but a halting trace, unformed, unreadable; my speech remains uncomprehended; my distraction is obvious. The schoolmaster continually cries:

"Karel Ondereet, are you finished watching the flies buzzing around? …"

Alas! Dear master, it is true that I watch the flies buzzing, but how much more my soul follows the mysterious Vuren which move through the room! And what strange sentiments haunt my young soul, in observing everyone else's blindness, and above all yours, grave pastor of minds!

V

The most painful period of my life was from twelve to eighteen years old.

Firstly, my parents tried to send me to college; there I knew only miseries and vexations. At the cost of exhausting difficulties, I was able to express in an almost comprehensible manner the most common things: slowing my syllables with great effort, I spat them out maladroitly and with the accent of a deaf person. But, as soon as it was a question of something more complicated, my speech reverted to its inevitable speed; and once again no-one could hope to follow me. I could not hope therefore to make my progress known orally. On the other hand, my writing was atrocious, my letters squashed up one on top of the other, and, in my impatience, I missed out syllables, words: it was a monstrous gibberish. In any case, writing was for me a torment perhaps even worse than speaking: – of an asphyxiating heaviness and slowness! – If, on occasion, by sheer painful force of will, and sweating great drops, I managed to begin some work, soon I was at the end of my energy and patience, and felt I was about to faint away. So that I preferred the remonstrances of the masters, the punishments, the scorn, to this horrible labour.

Thus, I was almost totally deprived of any means of expression: an object of ridicule, already, because of my skinniness and my bizarre colouring, because of my strange eyes, I now also passed for some sort of idiot. I would have to remove myself from the school, resign myself to being a peasant. The day when my father decided to renounce all hope, he said to me with unaccustomed kindness:

"My poor boy, you see, I have done all I can … all I can! Do not reproach me for your fate!"

I was intensely moved; I cried hot tears: I had never felt with such bitterness my isolation from the world of men. I ventured to embrace my father tenderly; I murmured:

"But still, it isn't true that I'm an imbecile!"

And, in fact, I felt myself superior to those who had been my colleagues. For a while now, my intelligence had taken a remarkable turn. I read, I understood, I did some guesswork, and I had sufficient occasion for meditation, far more than others, in this universe visible to me alone.

My father did not decipher what I said, but he softened to my embrace.

"Poor boy!" he said.

I looked at him; I was in dreadful distress, knowing more than ever that the void between us would never be filled. My mother, by some intuition born of love, saw in that moment that I was not inferior to other boys of my age: she beheld me with great tenderness, mouthing naïve pleasantries from the depths of her being. But I was nonetheless condemned to cease my studies.

Because of my feeble muscular power, they entrusted me with the care of the livestock. I acquitted myself marvellously; I never needed a dog to keep the herds or a foal under control, no stallion was more agile than I.

I lived, then, between the ages of fourteen and seventeen, the solitary life of the shepherd. It suited me more than any other. Given over to observation and contemplation, and also to much reading, my brain never ceased to develop. I compared ceaselessly the double creation I had before my eyes, drawing from this some ideas on the constitution of the universe; I vaguely fabricated hypotheses and systems. If it is true that my thoughts could not have at this time a perfect correlation, did not form a lucid synthesis – for they were the thoughts of an adolescent, uncoordinated, impatient, enthusiastic – they were nevertheless original and fecund. That they were only of value to my unique constitution, I would not deny at all. But not all their force came from this. Without the least pride, I believe I can say that they surpassed appreciably, in subtlety and in logic alike, those of ordinary young people.

They were the sole source of consolation in my sad life of a semi-pariah, without companions, without real communication with those around me, even my beloved mother.

*

At seventeen, life became decidedly unbearable for me. I was sick of dreaming, sick of vegetating in a desert island of thought. I fell into languor and boredom. I spent long hours immobile, disinterested in the whole world, inattentive to everything that happened within my family. What did it matter to me to know things more marvellous than other men, since in any case this knowledge was to die with me? What use to me was the mystery of the living beings, and even of the duality of the two vital systems traversing one another without any knowledge of each other? These things could have intoxicated me, filled me with enthusiasm and ardour, had I been in any way able to teach them or to share them. But what hope of that! Vain and sterile, absurd and miserable, they rather contributed to my perpetual psychic quarantine.

Many times, I dreamt of writing, of setting down, all the same, at the price of continual efforts, some few of my observations. But, since I had left school, I had completely abandoned the pen, and, such a poor writer before, now, even when I applied myself fully, I could barely write the twenty-six letters of the alphabet. If I could have still conceived of some hope, perhaps I might have persisted! But who would take my miserable lucubrations seriously anyhow? Where was the reader who would not think me insane? Or the sage who would not dismiss me with disdain or irony? What purpose, then, could I adduce for such a vain task, such a tiresome devotion – something like the obligation, for an ordinary man, to carve his thoughts on tables of marble, with a hammer and chisel! Any writing of mine would have to be stenographic – and what's more, a stenography more rapid than the usual!

Thus I had not the courage to write, but nevertheless I hoped fervently for some unknown, some happy and singular stroke of destiny. It seemed to me that there must exist, in some corner of the earth, impartial, lucid, rigorous minds, able to study me, to understand me, to be able to speak with me and to communicate my great secret to others. But where might these people be? And what hope did I have of ever meeting them?

And I fell again into a vast melancholy, into desires for immobility and annihilation. For a whole autumn, I despaired of the universe. I languished in a vegetative state, from which I only emerged to give voice to great laments followed by dolorous revolts.

I became thin again, to the point of becoming fantastically so. The people of my village called me, ironically, Den Heyligen Gheest, the Holy Ghost. My silhouette trembled like that of the old poplars, light as a reflection, and, at the same time, I attained the stature of a giant.

Slowly, a project was born. Since my life was sacrificed, since none of my days held any appeal to me, since all was darkness and bitterness to me, why stagnate in inactivity? Even supposing that no soul existed which could respond to mine, surely it was worthwhile to make the effort to convince myself of it. At least it was worth quitting this morose land, going to find the great cities of scientists and philosophers. Wasn't I, after all, an object of curiosity? Before even calling attention to my superhuman cognitions, could I not excite the desire to study my person? Weren't the physical aspects of my being alone worthy of analysis: my sight, the extreme quickness of my movements and the peculiarity of my nutrition?

The more I reviewed these thoughts, the more it seemed reasonable to hope, and the more my resolution grew. The day arrived when it became absolutely firm, and I revealed it to my parents. Neither of them really understood, but both ended by ceding after repeated insistences: I obtained the means to take myself to Amsterdam, and to return should the outcome be unfavourable to me.

I left one morning.

VI

From Zwartendam to Amsterdam it is around a hundred kilometres. I made this distance easily in two hours, with no particular incident apart from the extreme surprise of those coming and going at seeing me run with such speed, and some gatherings at the outskirts of small towns and large market-towns which I passed. To be sure of my route, I addressed myself to two or three solitary old people. My sense of direction, which is excellent, did the rest.

It was around nine'o'clock when I got to Amsterdam. I entered resolutely into the great city, I walked the length of its beautiful dreamy canals where the commercial flotillas live. I did not attract as much attention as I had expected to. I walked fast, amongst people who were busy, suffering here and there the gibes of a few young urchins. I decided not to stop, however. I walked around the city a little in every direction, until finally I resolved to enter a cabaret, on one of the quays of the Herengracht. The location was peaceful; the magnificent canal stretched out, full of life, between fresh rows of trees; and amidst the Moedigen which I saw circulating on the banks, I seemed to see a new species. After a moment of indecision, I crossed the threshold of the cabaret and, addressing myself to the patron, as slowly as I could manage, I asked him to be so good as to tell me the way to a hospital.

The host looked at me with a mixture of stupor, defiance and curiosity, took his big pipe from his mouth and put it back, many times, then finished by saying:

"You are from the colonies, no doubt?"

As it was perfectly useless to contradict him, I responded:

"That's right! …"

He seemed enchanted by his own perspicacity; he set me a new question:

"Perhaps you come from that part of Borneo where no-one has yet set foot?"

"The very same! …"

I had spoken too fast: he opened his eyes wide.

"The very same!" I repeated more slowly.

The host smiled with satisfaction:

"You can't speak Dutch too well, eh? … Well, it's a hospital you want … You're ill, are you?"

"Yes …"

Some customers had approached. The rumour was already going round that I was a cannibal from Borneo; nevertheless, they looked at me more with curiosity than antipathy. Some men ran up from the road. I became nervous, disquieted. Nevertheless I kept a straight face, and said, coughing:

"I'm very ill!"

"Just like the monkeys from that country," offered a very fat dutchman cordially, "the Netherlands kill them!"

"What funny skin!" said another.

"And how does he see?" asked a third, indicating my eyes.

The circle drew nearer, enveloping me with a hundred curious looks, with new arrivals constantly entering the room.

"How tall he is!"

It is true that I was taller than the tallest of them by a head.

"And thin!"

"He doesn't seem to be getting much nourishment, this cannibal!"

None of the voices seemed particularly malevolent. A few sympathetic individuals protected me:

"Don't push him like that, he's ill!"

"Come on, friend, courage!" said the big fat man, seeing my nervousness. "I'll take you to a hospital myself."

He took me by the arm; he set about pushing through the crowd, shouting:

"Make room for an invalid!"

The dutch crowd were not particularly fierce: they let us pass, but tagged along after us. We strode along the canal, followed by a compact multitude; with people crying:

"It's a cannibal from Borneo!"

*

Finally, we got to the hospital. It was visiting time. They led me to an intern, a young man with blue glasses, who received me sullenly. My companion said to him:

"It's a savage from the colonies."

"What, a savage!" cried the other.

He removed his glasses to look at me. For a moment his surprise held him immobile. He asked me brusquely:

"Can you see?"

"I see very well …"

I had spoken too fast.

"It's his accent!" said the fat man proudly. "Say it again, friend!"

I repeated it, and made myself understood.

"They are not human eyes …" murmured the student. "And the colour! … Is that the colour of your race?"

I said, making a terrible effort to slow myself down:

"I've come to be seen by a scientist!"

"You're not ill then?"

"No!"

"And you're from Borneo?"

"No!"

"Where are you from then?"

"From Zwartendam, near Duisbourg!"

"So why did your companion claim that you were from Borneo?"

"I didn't want to contradict him … "

"And you want to see a scientist?"

"Yes."

"Why?"

"To be studied."

"To make some money?"

"No, nothing like that."

"You're not a poor person? A beggar?"

"No!"

"Why are you so keen to be studied?"

"My constitution … "

But I had again, despite my efforts, spoken too fast. I had to repeat myself.

"Are you sure that you can see me?" he demanded, looking fixedly at me. "Your eyes are like callouses … "

"I see very well."

And, moving right and left, I swiftly picked up objects, put them down, through them into the air and caught them.

"Extraordinary!" continued the young man.

His voice now softer, almost amicable, filled me with hope:

"Listen," he said finally, "I think doctor Van den Heuvel might well be interested in your case … I'll go and tell him about it. You wait in the next room … And, about …. I forgot … you're not ill, then?"

"Not at all."

"Good. Come on … in here … the doctor won't be long … "

I found myself seated amongst monsters conserved in alcohol: foetuses, children of bestial form, colossal frogs, vaguely anthropomorphic reptiles.

This is definitely, I thought to myself, my waiting-room … Aren't I a candidate for one of these formaldehyde sepulchres?

VII

When doctor Van den Heuvel appeared, emotion overwhelmed me: I had the frisson of the promised land, the joy of touching it, the fear of being banished from it. The doctor, a large bald man, with a powerful analytical gaze, a soft but stubborn mouth, examined me in silence, and, as with everybody, my excessive thinness, my great height, my encircled eyes, my violet complexion, were causes for astonishment.

"You say that you would like to be studied?" he asked finally.

I responded with great force, almost violence:

"Yes!"

He smiled in an approving manner, and then posed the customary question:

"Do you see well with those eyes?"

"Very well … I can even see through trees and clouds …"

But I had spoken too quickly. He shot me a disquieted glance. I reiterated, sweating great drops:

"I can even see through trees and clouds …"

"Really! That would be extraordinary … Well then! What do you see beyond that door … there?"

He indicated to me a long-disused door.

"A large glass-fronted bookcase … a large carved table …"

"Really!" he repeated, stupefied.

My chest expanded, a profound peace descended upon my soul.

The scientist remained in silence for a few seconds, then:

"You speak with great difficulty."

"Otherwise I speak too fast! … I can't speak slowly."

"Alright, then tell me something in your usual voice."

I recounted then the episode of my entry into Amsterdam. He listened with great attention, with an air of intelligence and observation that I had never before encountered from my own people. He did not understand anything I said, but he displayed great sagacity in his analysis:

"If I'm not mistaken … you pronounce between fifteen and twenty syllables per second, that is to say three or four times more than the human ear can perceive. Your voice, also, is far more acute than anything I have heard from a human voice. Your gestures, excessively rapid, correspond to your speech … Your constitution is probably as a whole more rapid than ours."

"I run," I said, "quicker than a greyhound … I write …"

"Ah!" he interrupted. "Let's see your writing …"

I scribbled a few words down on a blotter he handed to me, the first quite legible, the others more and more mixed-up, abbreviated:

"Perfect!" he said, and a certain pleasure was mixed with his astonishment. "I really think that I can count myself lucky in making your acquaintance. It will assuredly be most interesting to study you."

"It's my most dear, my only desire!"

"And mine, obviously … Science … "

He appeared preoccupied, in a reverie; he finally said:

"If only we could find some more easy way to communicate … "

He paced the room from end to end, his brow furrowed.

All of a sudden:

"Am I stupid! You must learn stenography, by jove!… Eh! … eh! … "

A jovial expression appeared on his face:

"And I forgot about the phonograph … the perfect confidante! It will allow us to turn it slower for listening than for recording … That's it then: you will stay with me during your stay in Amsterdam!"

The joy of a satisfactory vocation, of never having to spend vain and sterile days! Before the intelligent person of the doctor, in this scientific milieu, I felt a delicious well-being; the melancholy of my soul's solitude, the regret for my lost faculties, the long misery of a pariah that had crushed me for so many years, all disappeared, evaporated in the sentiment of a new life, a real life, a destiny saved!

VIII

The next morning the doctor made all the necessary arrangements. He wrote to my parents; he arranged a stenography teacher for me and procured some phonographs. Since he was extremely rich, and science was everything to him, there was no experiment he wasn't ready to try, and my vision, my hearing, my musculature, the colour of my skin were subjected to scrupulous investigations, the results of which made him more and more enthusiastic, crying:

"What wonders!"

I realised with marvel, after the first few days, how important it was that things were carried out methodically, from the simple to the complex, from the simple abnormality to the marvellous abnormality. I myself also had recourse to a little skill of mine, of which I made no secret with the doctor: that is, only to reveal my faculties bit by bit.

It was the rapidity of my perception and my movements that occupied him first of all. He hypothesised that the subtlety of my hearing corresponded with the speed of my speech. Graduated experiments on more and more fugitive sounds, which I was able to repeat back with ease, the sound of ten or fifteen people speaking at the same time, each of which I was able to understand perfectly well, proved the point clearly enough. The speed of my vision was no less proved by experiment; in comparative studies of my ability to decompose into separate images the gallop of a horse or the flight of an insect, and the same task carried out with instantaneous photographic apparati, demonstrated the superiority of my eye. As to my perception of ordinary things, the simultaneous movement of a group of people, of children playing, pebbles thrown in the air or little balls thrown in an alley to be counted as they flew – it amazed the family and friends of the doctor.

My walks in the large garden, my bounds of twenty metres at a time, the instantaneity with which I seized objects or replaced them were even more admired, not by the doctor, but by those around him. And it was a totally new pleasure, for the children and the wife of my host, on a walk in the country, to see me run ahead of a rider at a gallop or to follow the flight of swallows: there was no thoroughbred that I could not outrun by two-thirds, whatever the running, no bird that I could not easily outdo.

As for the doctor, more and more satisfied with the results of his experiments, he defined me thus: “A human being endowed, in all his movements, with a speed incomparably superior, not only to other humans, but to that of all known animals. This speed, found in every particular of his organism just as in the whole, makes him a being so distinct from the rest of creation that he merits a new category for himself alone in the animal hierarchy. As to the most curious disposition of his eye, as for the violet tint of his skin, we must consider them as simple indices of this special state."

Verification made of my muscular system, he found nothing remarkable, except for an excessive thinness. Neither did my ears seem to show any peculiar characteristics; nor, for that matter did my epidermis, except of course for its unusual colour. As for hair, of a rich dark colour, a violet-black, it was fine like a spider's web, and the doctor made a meticulous examination of it:

"We shall have to dissect you!" he sometimes said laughingly to me.

Time passed most pleasantly. I had picked up stenography very quickly, thanks to the intensity of my desire to do so, and the natural aptitude which I displayed for this method of rapid transcription, to which I actually introduced further new abbreviations. I began by taking notes, which the stenographer transcribed; and for the rest, we had phonographs, made to a design specially formulated by the doctor, and which we found perfectly suited to rendering my speech, at a slower speed.

The confidence of my host, over time, became unreserved. In the first weeks, he had not been able to avoid the suspicion – quite natural, of course – that the peculiarity of my faculties was not unaccompanied by some form of insanity, some cerebral derangement. Once disabused of this fear, our relationship became wholly cordial, and, I believe, equally captivating for both parties. We made an analytical examination of my perception of objects through a great number of different substances said to be opaque, and of the darkish coloration which water, glass and quartz had for me when a certain thickness. You will remember that I saw very well through wood, the leaves of trees, clouds and many other substances, but that I could distinguished but poorly the bottom of a pool of water half a metre deep, and that glass, although it might be transparent to me, was less so than for the common man, and was of a dark colour. A large piece of glass appeared almost black to me. The doctor was able to convince himself at leisure of all of these peculiarities – and was struck above all by observing how I was able to make out the stars on cloudy nights.

It was only at this time that I began to tell him how colour also seemed different to me. Experiments showed beyond doubt that red, orange, yellow, green, blue and indigo were as completely invisible to me as infra-red and ultra-violet to the normal eye. On the other hand, I was able to demonstrate that I could perceive violet, and, beyond violet, a range of graduated shades, a colour spectrum at least twice the range of that which extends from red to violet.[34]

This astonished the doctor more than all the rest. His study of it was lengthy, minute, and, meanwhile, conducted with infinite art. It became, in the hands of this able experimenter, the source of some very subtle discoveries in the order of the sciences, providing the key to phenomena as far removed as magnetism, affinity, inductive power, and guiding them towards new notions of physiology. To know that a certain metal contained a series of unknown gradations, which varied under pressure, temperature, electrical charge, that the finest gases had distinct colours, even when very thin; to learn of the infinite richness of tones of objects that appear more or less black, but which display a gamut of tones more magnificent in ultra-violet than all the known colours; to know lastly how an electrical circuit, the bark of a tree, the skin of a man, vary in unknown nuances during a day, an hour, a minute, – it is easy to imagine all the many lines of research an ingenious scientist might initiate on the basis of such notions.

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[34] Quartz gave me a spectrum of around eight colours: extreme violet and seven colours beyond it within ultra-violet. But there remained about another eight colours which quartz did not separate further but which other substances separated more or less.

With his study, whatever it might be, the doctor was plunged into the delight of scientific novelty, set against which the products of the imagination are cold like ashes from the fire. He never ceased exclaiming to me:

“It’s clear! Your extra-perception of light is, essentially, just an effect of the great speed which your organism has developed!”

We worked patiently for a whole year without my making any mention of the Moedigen – I absolutely wanted to convince my host, to give him innumerable proofs of my visual faculties before venturing to bestowing on him the supreme confidence of this disclosure. Finally, the moment came when I felt I could reveal all.

IX

It was one morning, during a lovely autumn full of clouds, which had rolled along for a week in the dome of the sky, without any rain having fallen. Van den Heuvel and myself were walking in the garden. The doctor was silent and thoughtful, completely absorbed by speculations of which I was the principal object. Finally, he began to speak:

“It’s a lovely dream to be able to see through the clouds … to penetrate right to the ether, whereas we … blind as we are … ”

“If only I saw just the sky!” I replied.

“Ah! Yes, the whole world is so different for you … ”

“Even more different than I’ve told you so far!”

“How?” he cried, with avid curiosity, “have you hidden something from me?”

“The most important thing of all!”

He stood before me, staring at me fixedly, with a look of veritable anguish mixed with who knows what mystical intuition.

“Yes, the most important thing!”

We had arrived outside the house; I called for a phonograph. The instrument they brought me was of a scale perfected for my friend, able to record a long discourse; the domestic placed it on the stone table where the doctor and his family took their coffee on sunny summer days. The apparatus, a miracle of clockwork, lent itself admirably to discussions. Thus we pursued our conversation almost like a normal conversation:

"Yes, I hid the main thing from you, wanting to make sure first that I had your full trust. And even now, after all the discoveries my organism has allowed you to make, I still think it will be hard for you to believe me, at least at first."

I stopped to repeat the phrase using the machine: I saw the doctor become pale, the pallor of great scientists observing a new disposition of matter. His hands trembled.

"I will believe you!" he said with a certain solemnity.

"Even if I tell you that our creation, I mean our animal and vegetable world, is not the only life on earth … that there is another, just as vast, just as multiform … invisible to your eyes?"

He suspected some sort of occultism and couldn't stop himself from saying:

"The world of the afterlife … souls, the ghosts of departed spirits?"

"No, no, nothing like that. A world of living beings condemned like us to a brief life, to organic needs, to birth, to growth, to struggle … a world as precarious and ephemeral as our own, a world subject to laws just as fixed as ours, if not identical, a world that is also a prisoner of the earth, just as helpless before its contingencies … but nevertheless totally different to ours, without any influence on us, as we are without influence on it, – except for changes which it can effect upon our common ground, the earth, or by parallel modifications that we can make to this same earth."

I no longer knew whether Van den Heuvel believed me, but had no doubt he was in the throes of intense emotion:

"Are they fluid, then?" he asked.

"This is something I can't answer, because their properties are too contradictory to the idea which we have of matter. The earth is resistant to them as to us, the same for most minerals, although they can enter a little into a humus. They are totally impermeable, solid, in relation to each other. But they pass through, if with some difficulty, plants, animals, organic tissues; and ourselves, they pass through us in the same way. If one of them could perceive us, we would appear to them perhaps as fluid in relation to them, as they appear so in relation to us; but it would probably be unable to conclude anything, it would be so struck by parallel contradictions … Their form has the strange quality that it has no thickness at all. Their size varies to infinity. I have known one reach one hundred metres in length, other common ones as small as our smallest insects. Their nutrition is taken, for some of them, from the earth and from meteors; with others, from meteors and from other individuals of their kingdom, without this ever being cause for murder as it is with us, since it suffices that the strongest takes some energy and that this energy can be tapped without exhausting the sources of life."

The doctor said brusquely:

"Have you seen them since childhood?"

I suppose that he suspected some more or less recent disorder in my organism:

"Since I was a child!" I answered energetically … "I can give you all the details you want."

"Do you see them now?"

"I see them … the garden contains a great many… "

"Where?"

"On the path, on the lawns, on the walls, in the air … because, you see, there are terrestrial and aerial varieties … and also aquatic ones, but those ones rarely leave the surface of the water."

"Are there many of them everywhere?"

"Yes, but less in towns than in the fields, less in houses than in the streets. Those which like to be indoors tend to be smaller, doubtless because of the difficulty of moving about, although wooden doors are no obstacle to them."

"And iron … glass … brick…"

"They are impermeable to them."

"Can you describe one to me … one of the larger ones?"

"I can see one near to that tree. Its form is extremely elongated, quite irregular. It is convex on the right, concave to the left, with bulges and notches: one might imagine it as the projection of a gigantic, squat larva. But its structure is not typical of the Kingdom, because structure varies a great deal from one species (if you can use the word) to another. Its infinite thinness is, on the other hand, something common to all of them: they are never more than a tenth of a millimetre, whereas they are five feet long and forty centimetres at the widest point. What defines them most of all, and their entire Kingdom, are the lines which traverse them, in every direction, finishing in webs which get finer between two systems of lines. Each system of lines has a centre, a sort of slightly raised patch beneath the mass of the body, or sometimes on the contrary, sunken. These centres have no fixed form, sometimes almost circular, or elliptical, sometimes circumscribed or spiraloid, occasionally divided by many loops. They are astonishingly mobile, and their size varies from hour to hour. Their outline palpitates strongly, with a sort of transversal undulation. Generally, the lines which lead out from it are thick, although they can also be quite fine; they diverge, ending up in an infinity of delicate traces which gradually disappear. Some lines, meanwhile, far paler than others, don't belong to any centre; they remain isolated in the system and grow without changing in colour: these lines are able to move around the body, and to vary their curves, whilst the centres and the lines radiating from them remain stable in their respective places … As to the colours of my Moedig, I can't hope to describe them: there is nothing perceptible to the register of your eye, none of them have a name for you. They are extremely bright in the webs, less so in the centres, very faint in the independent lines which, however, do have a sheen, a metallic ultra-violet sheen, if I could describe it like that … I have collected various observations on the way of life, the nutrition, and the autonomy of the Moedigen, but I don't want to give them to you now."

I became silent; the doctor replayed several times the words inscribed on our impeccable intermediary, and then remained a long time in silence himself. I had never seen him in such a state before: his face was rigid, frozen, his eyes glassy, cataleptic; sweat ran down his temples and dampened his hair. He tried to speak but could not. Trembling, he made a round of the garden, and, when he reappeared, his look and his mouth expressed a violent, fervent, religious passion: one might have taken him for a disciple of some new faith rather than a serene researcher of phenomena.

Finally he murmured:

“You’ve got me beat! Everything you say seems hopelessly lucid, and have I really the right to doubt you, after all the marvels you have revealed to me?”

“Doubt,” I said to him warmly, “Doubt as strongly as you can … Your experiments will only be more fertile for it!”

“Ah!,” he replied in a dreamy voice, “it is a veritable miracle, and so magnificently superior to the vain miracles of legend and fable! … My poor human intelligence is so tiny compared to such knowledge! ... but my enthusiasm is infinite. However, something in me still doubts …”

“Then let us begin work on dissipating your uncertainties: our efforts will be repayed a hundredfold!”

X

We worked. It took several weeks for the doctor to fully dispose of his doubts. Ingenious experiments, irrefutable correspondences between each of my affirmations, two or three lucky discoveries about the influence of the Moedigen on atmospheric phenomena, left no remaining place for equivocation. The addition of the eldest son of Van den Heuvel, a young man full of the greatest scientific aptitude, increased yet more the fecundity of our work and the certitude of our findings.

Thanks to the methodical spirit of my companions, thanks to their power of investigation and classification – faculties which I was assimilating more and more – that which, in my understanding of the Moedigen, was uncoordinated and confused was transformed in no time. Discoveries multiplied, rigorous experiments gave firm results, from evidence which, in ancient times and even in recent centuries, might have suggested at most some fanciful speculations.

It is now five years that we have been pursuing our research: they are far, very far, from finished. The first report of our work will not appear for some time yet. We are, however, determined as a strict rule not to submit to haste: our discoveries are of too important an order to be reported but in the greatest of detail, with the greatest of patience, and with the most minute precision. We have no other researcher to compete with, no brief to follow nor any ambition to satisfy. We exist at such heights that vanity and pride are no longer an issue. How can we reconcile the delicious joys of our work with the miserable enticement of human fame? In any case, isn't the random chance of my constitution the source of the whole affair? In which case, how base it would be of us to glorify ourselves because of it!

We live passionately, always on the verge of marvellous things; but also we live in an immutable serenity.

*

Something has happened to me which may add to the interest of my life, and which, in my rest, has brought me infinite joy. You well know how ugly I am, how strange, fit to scare away any young lady. However I have found a companion who has been able to accept my affections to the point of our being happy together.

She is a young girl, a hysteric, with a nervous illness, who we encountered one day in a hospice in Amsterdam. You would say she had a miserable look about her, as pale as plaster, hollow-cheeked, wild-eyed. But to me, her aspect seemed agreeable and her company most charming. My presence, far from astonishing her, as it did all the others, seemed from the first to please and to comfort her. I was touched by her, I wanted to see her again.

It did not take long to notice that I had a beneficial effect upon her health and her well-being. On closer examination, it appeared that I affected her magnetically: my approach, and above all the touch of my hands, communicated a gaiety to her, a serenity, a truly restorative spiritual equilibrium. In return, I found great joy being with her. Her face appeared so pretty to me; her paleness and her thin body were the fondest delicacy for me; her eyes, capable of seeing the glow of lovers, like those of many hyperesthetics, hadn't for me in the slightest that character of wildness of which she was accused.

In a word, I felt a great affection towards her, which she reciprocated with passion. So that I took the decision to marry her, and arrived easily at this goal, thanks to the goodwill of my friends.

The union was a happy one. My wife's health returned to her, although she remains extremely sensitive and frail; I tasted the joy of being, in principle at least, equal to other men. But my destiny has been even more enviable since six months ago: a child was born to us, and in this child are united all the characteristics of my constitution. Colour, vision, hearing, extreme rapidity of movement, nutrition – he promises to be an exact replication of my organism.

The doctor watches him grow up with delight: a delicious hope has come to us – that the study of the life of the Moedigen, of that Kingdom parallel to our own, that study which demands such time and such patience, shall not end when I am no more. My son will continue it, no doubt, in his turn. And why should he not find collaborators of genius, capable of taking it to new heights? Why should he also, in turn, not father new witnesses of the invisible world?

And may I not myself expect more children, may I not hope that my dear wife will give birth to new offspring of my flesh, just like their father? … In thinking of it, my heart trembles, an infinite beatitude overcomes me, and I feel blessed amongst men.

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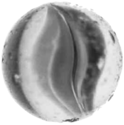
Speculative Realism

A One-Day Workshop
1–7pm, Friday 27 April 2007
Lecture Hall, Ben Pimlott Building
Goldsmiths, University of London
New Cross, London SE14 6NW

Participants: Ray Brassier (Middlesex), Iain Hamilton Grant (UWE), Graham Harman (American University in Cairo), Quentin Meillassoux (Ecole Normale Supérieure)



Contemporary 'continental' philosophy often prides itself on having overcome the age-old metaphysical battles between realism and idealism. Subject-object dualism, whose repudiation has turned into a conditioned reflex of contemporary theory, has supposedly been destroyed by the critique of representation and supplanted by various ways of thinking the fundamental correlation between thought and world.

But perhaps this anti-representational (or 'correlationist') consensus – which exceeds philosophy proper and thrives in many domains of the humanities and the social sciences – hides a deeper and more insidious idealism. Is realism really so 'naïve'? And is the widespread dismissal of representation and objectivity the radical, critical stance it so often claims to be?

This workshop will bring together four philosophers whose work, although shaped by different concerns, questions some of the basic tenets of a 'continental' orthodoxy while eschewing the reactionary prejudices of common-sense. Speculative realism is not a doctrine but the umbrella term for a variety of research programmes committed to upholding the autonomy of reality, whether in the name of transcendental physicalism, object-oriented philosophy, or abstract materialism, against the depredations of anthropocentrism.

Schedule
Chair: Alberto Toscano (Sociology, Goldsmiths)
1-1.15 Welcome
1.15-2.30 Ray Brassier
2.30-3.45 Iain Hamilton Grant
3.45-4.15 Break
4.15-5.30 Graham Harman
5.30-7.00 Quentin Meillassoux
7.00-8.00 Drinks

for further information, and advance excerpts of speakers' work see http://www.goldsmiths.ac.uk/csisp/
THIS EVENT IS FREE, BUT PLEASE REGISTER BEFOREHAND BY EMAILING a.toscano@gold.ac.uk

Images: NASA/WMAP Science Team; R. Mackay; NASA, ESA & R. Massey

Speculative Realism

Ray Brassier, Iain Hamilton Grant,
Graham Harman, Quentin Meillassoux

'Speculative Realism: A One-Day Workshop' took place on 27 April 2007 at Goldsmiths, University of London, under the auspices of the Centre for the Study of Invention and Social Process, co-sponsored by **COLLAPSE**. *Rather than announcing the advent of a new theoretical 'doctrine' or 'school', the event conjoined four ambitious philosophical projects – all of which boldly problematise the subjectivistic and anthropocentric foundations of much of 'continental philosophy' while differing significantly in their respective strategies for superseding them. It is precisely this uniqueness of each participant that allowed a fruitful discussion to emerge. Alongside the articulation of various challenges to certain idealistic premises, a determination of the obstacles that any contemporary realism must surmount was equally in effect. Accordingly, some of the key issues under scrutiny included the status of science and epistemology in contemporary philosophy, the ontological constitution of thought, and the nature of subject-independent objects.*

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However, as workshop moderator and co-organiser Alberto Toscano indicated, a common feature of the work presented was the implication that from a genuine interrogation of the continental tradition necessarily ensues a repudiation of the orthodoxies symptomatic of that tradition's conceptual exhaustion (the most visible of which being the seemingly endless deluge of insipid secondary literature and the 'X-ian' identity of its authors), thus rendering the task of doing philosophy 'in one's own name' essential once again. 'Speculative Realism', then, forces contemporary philosophy to make a decision, but it is not so much one concerning idealism or realism. Rather, at stake here is the possibility of a future for audacious and original philosophical thought as a discourse on the nature of reality – or, as one might otherwise call it: philosophy itself.

PRESENTATION BY RAY BRASSIER

Rather than reading a paper, I'm just going to make some general remarks about what I take to be the really significant points of convergence and divergence between Iain, Graham, Quentin, and myself. The fundamental thing we seem to share is obviously a willingness to re-interrogate or to open up a whole set of philosophical problems that were taken to have been definitively settled by Kant, certainly, at least, by those working within the continental tradition. This is why, as I'm sure everyone knows, the term 'realist' in continental philosophy is usually taken to be some kind of insult – only someone who really hasn't understood Kant could ever want to rehabilitate something like metaphysical realism, or any form of realism which does not depend upon some kind of transcendental guarantor, whether that guarantor is subjectively instantiated by pure apperception, or construed in terms of linguistic practices, or a communicational consensus, etc. Much of the mainstream of nineteenth and twentieth century post-Kantian philosophy is about simply redefining, generalising, specifying, these transcendental structures or conditions of cognitive legitimation. And in a way, it doesn't really matter whether you claim to have replaced the subject and the object with some form of communicational consensus or being-in-the-world or any variant of the latter on these issues: The transcendental function has been variously encoded in different versions of post-Kantian continental philosophy. But the thing that seems to be assumed within this tradition, the thing that actually Graham's work first brought out to me, is the notion that whatever structure there is in the world has to be transcendentally imposed or generated or guaranteed, which is to say that objectivity can only be a function of synthesis. And it's striking that in post-Kantian philosophy the difference between Kant and Hegel seems to be that where Kant will localise the synthesising function in something like pure apperception or wholly on the side of the subject, Hegel and the various forms of objective idealism will say that reality itself is self-synthesising, that there is a kind of principle of synthesis encoded in objective reality itself. So that, famously, in Hegel's objective idealism, the relational synthesis which Kant takes to be constitutive of objectivity is simply transplanted from its localisation in the subject and construed rather as the relation between subject and object, which Hegel recodes as the 'self-relating negativity' that yields the structure of reality. So the question is: If you refuse to say that synthesis – the synthesis which produces objective structure – is anchored in a subject, does this mean that you have to idealise the real by attributing to it this capacity for self-relation? A capacity for self-synthesis whereby a continuum of relation itself yields the type of discontinuity that gives rise to discrete objects? In other words, is there a principle of intelligibility encoded in physical reality?

This is absolutely the key issue, I think, in Iain's book on Schelling.[1] And according to Iain's reconstruction, Schelling proposes an alternative variant of objective idealism, one wherein structure and objectivity are intrinsic to nature, but the ideal structures that are intrinsic to or inherent in physical reality are no longer construed in terms of a dialectic of opposition and contradiction. In Iain's brilliant reconstruction of Schellingianism, what you get is something like a 'transcendental physics', a physics of the All, where ideas are differential dynamisms, attractors immanent to and inherent in material reality. So, nature is self-organising. And the ideal structure of nature produces the structure of thinking. But if cognition is a result, a product – if it's every bit as conditioned as any other natural phenomenon – the question then becomes whether there's any reason to suppose that thought can limn or grasp the ultimate structure of reality at any given moment, any specific historical juncture. Because the key thing, if you're committed to a transcendental realism, of which Iain provides a powerful reconstruction in his book, is that it is the structure of material reality that generates the structure of thinking. But this means that one must discount any appeal to intellectual intuition, which is to say, the idea that thinking can simply transcend its own material, neurobiological conditions of organisation and effectuation and grasp the noumenal structure of reality as it is in itself. The problem is this: If the structure of reality produces the structure of thinking, then the challenge is to avoid both transcendentalism and a kind of pragmatism which would say that evolutionary history simply guarantees the congruence between representation and reality as a function of adaptational necessity, so that only creatures that have a cognitive apparatus that is appropriate to their kind of biophysical environment will be able to survive. And this is a claim that fuels much of naturalised epistemology, but one that I think is metaphysically problematic, because there is no reason to suppose that evolutionary adaptation would favour exhaustively accurate beliefs about the world. There's no reason to suppose that evolution would infallibly provide human organisms with a cognitive apparatus that can accurately track the salient features or the deep structure of reality. So in other words, there seems to be a kind of incompatibility between any pragmatic, adaptationist rationale for cognitive functioning, and scientific realism, which says that the physical structures of reality, as articulated by the natural sciences, can't simply be explained in terms of their usefulness as viable survival strategies. And the force of Iain's book is to try to propose what he calls a 'transcendental naturalism' – which claims that you can explain the emergence of the structure of ideation from the ideal structure of physical reality, so that ideation would be capable of tracking the ideal dynamisms, the transcendental dynamisms, that underlie merely empirical or merely somatic reality.

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[1] Iain Hamilton Grant, *Philosophies of Nature After Schelling* (London: Continuum, 2006).

An important distinction in Iain's book is between the Aristotelian-Kantian reduction of materiality to somatic or corporeal reality – the idea that to be material means to be some sort of body with a set of perceptible properties – and the transcendental materialism that Iain ascribes to Schelling, where the real material structures are the abstract differential dynamisms that generate and produce bodies, organisms, and spatio-temporal objects, but can never be reduced to them. But here's one consequence of this: if the structure of ideation is a function of the ideal structure of material self-organisation, then the process is ongoing – and Iain emphasises this – so it's simply not the case that biological history has reached some sort of apex in human consciousness. And if the process is still ongoing and will keep going, then not only is there more to know about the structure of *reality* than we currently know just now; there's also more to know about the structure of *ideation* than we currently know. And I think this presents a quandary for someone who's committed to a version of speculative realism: transcendental physicalism insists that there are real conditions of ideation but that these conditions have an ideal structure. The question then is: can the specific conceptual details of these ideal physical structures be satisfactorily identified using the currently available resources of conceptual ideation? What does this mean? It means using either the available registers of mathematical formalisation available to contemporary science; *or* – if we are thinking in terms of transcendental philosophy – a set of suitably generic conceptual categories. But then, can we be sure that any of the abstract conceptual categories in terms of which we propose to reconstruct these ideal structures

Ray Brassier

are applicable? Can we be sure that these self-organising features of material reality can be linguistically encoded and encapsulated? In other words, are the resources of natural language sufficient to successfully articulate the transcendental dynamisms that fuel material processes? Or do we need to discover more about the machinery and structure of ideation before we can confidently specify the physical structure of nature? So, as regards the characterisation of ideas as 'phase space attractors', the question is whether that could ever satisfactorily characterise the underlying dynamisms of physical nature. More importantly, with regard to the category of 'dynamism', which, as Iain shows, goes back to Plato and Aristotle: Is it enough simply to supplant a somatic or Aristotelian metaphysics, which equates material reality with constituted bodies, products, organisms, and objects with a metaphysics of dynamisms as the real, underlying motors of self-organisation, or ultimate generators of material structure?

So, I guess what I'm asking is: what is the status of dynamism in speculative physics? Is it truly adequate to physical infrastructures? Or might it not be contaminated by certain folk-physical prejudices? I agree with Iain about re-inscribing the machinery of ideation within the physical realm, and about the need for a transcendental naturalisation of epistemology, but wonder whether that re-inscription provides a warrant for what he calls 'speculative physics'. What is the relationship between the dynamic structure of the idea and the mathematical register deployed for its formalisation? So my question to Iain then is really about the status of epistemology within transcendental materialism: Although the advantages of the latter vis-à-vis the pragmatic variants of naturalised epistemology are fairly evident, I think there's an issue here about what articulates ideation and the mathematical resources of ideation that have been crucial in ridding us of this parochial Aristotelian model of physical reality. It was the mathematisation of nature that definitively ruined and shredded the medieval Book of the World. And the question is, can we rehabilitate a form of transcendental or speculative materialism or realism that would also explain the success of mathematical formalisation in supplanting the old, pre-Galilean models of physics and metaphysics?

One final point, concerning the nature of dynamism, and this is a general point related to process philosophy:

If you privilege productivity, if these ideal generative dynamisms that structure and constitute material reality can be characterised in terms of the primacy of production over product, then the question is, how do we account for the interruptions of the process? How do we account for discontinuity in the continuum of production? And while I have no doubt that it's possible to do so, I think it's a significant problem for any process philosophy that wants to defend or prosecute a form of ontological monism based on something like 'pure productivity', 'pure becoming', 'duration', or whatever one chooses to call it. Because then it seems that you always have to introduce or posit some sort of conceptual contrary, some principle of deceleration, interruption, disintensification or whatever, in order to account for the upsurges of stability and continuity and consistency within this otherwise untrammelled flux of becoming and pure process. So even if one then goes on to reintegrate it into the former as a mere moment, one still has to explain why there is anything but pure process or why the processual flux is ever momentarily stabilized. It's striking that you see this in Bergson: the idea that you need something to explain what interrupts the process, what produces or introduces discontinuity into the flux of becoming.

And I think Graham's contribution lies precisely in this key area. The idea is that if you begin with some form of preliminary methodological dualism of production and product or, in its classic Bergsonian articulation, something like duration and space, then you need to explain what interrupts the continuum – how duration ever externalises itself or coagulates into something like a spatial fixity or stasis. And Graham gets around this problem by simply having a metaphysics of objects, which in a way removes the question of synthesis altogether. What's striking about Graham's account is that you don't need to explain how objects are synthesised, because you simply take objects as nested within one another. You have this kind of infinite nesting of objects within objects within objects … Every relation between objects itself unfolds within another object. So Graham turns the question around by showing how the problem consists in showing how discontinuous, autonomous objects can ever enter into relation with one another – his answer is that they do so on the inside of another object. In other words, every relation is itself another object. So what you have then is a kind of egalitarian objective univocity, a kind of ontology of pure objectivity: there are nothing but objects, objects nested within one another, and the really significant metaphysical challenge is explaining their interaction.

But I have two questions vis-à-vis Graham's project: First, Graham explains the interaction between objects in terms of their sensual properties, *i.e.*, no object ever exhausts the ultimate reality of another object. It engages or interacts with it on the basis of a set of sensual or perceptible properties, and it is these that provide the basis for the reciprocal interaction between objects. And my question is: what is the criterion for distinguishing sensible from non-sensible properties for any given object? Is it possible to provide such a criterion without giving it some sort of epistemological slant or formulation? In other words, in order to interact with one another, it seems that objects need to 'know' something about one another. The fire must 'know' that the cotton is not rock; the rock must 'know' that the ice is not water. Whatever kind of interaction objects have, the fact that their interface is possible on the basis of this recognition of something like sensual properties, which are capable of locking together and causing the interaction – well, I think the question is whether it is possible to explain how objects discriminate between the sensual or perceptible and the imperceptible properties of any other object. And this ties into a second question, which is about the status of the distinction between real and imaginary objects for Graham, because, for Graham, it makes no sense to ask whether something is real: everything is real, everything is objective, so nothing is more real than anything else. He provides us with an absolutely egalitarian, flat ontology of objects. But the danger then is – and Graham and I have spoken about this before – that this would simply license too much or result in too liberal a construal of objectivity. For instance, what would be the distinction between a hobbit and a quark here? This is a very serious metaphysical question! And Graham maintains that the properties of the hobbit or any other kind of fictitious, contrived, artificially generated example would be purely imaginary, and of course one can contrive and generate imaginary qualities for imaginary objects. But how do we make the distinction, given that we know that imaginary objects or fictitious entities such as the Virgin Mary or Yahweh or phlogiston seem perfectly capable of producing real effects – it's perfectly possible for these things to generate real effects in so far as people believe in them and do things in the world on the basis of their belief in them. If we say that this is a misdescription, and that there's actually a real object underlying the imaginary object, and it is this real object that causes things to happen, then the question is: on what basis do we make this distinction if not by invoking some form of epistemological criterion that distinguishes between real and imaginary properties or objects?

In other words, my question to Graham is: Is it possible to prosecute an ontology of objects without explaining *how it is that we are able to do so*; *i.e.* how we seem to have to *know* something about objects? This is not to reintroduce the Kantian primacy of the subject, but just to say that even objects seem to have to know certain things about one another in order to interact, just as we seem to have to know something simply in order to be able to describe and identify objects. And Graham is clear that the epistemological relation, which Kantianism took to be absolutely primary and fundamental – *i.e.*, the subject-object relationship – is merely a relation between objects just like any other. It has no kind of epistemological or transcendental primacy, so that explaining how we're able to know the laws of mechanics is an interesting question, but it's not really fundamentally different in kind from explaining how fire is able to burn cotton, or how a marble is able to interact with a table. But I think I want to problematise this issue further – my conviction is that it's not so clear, and that philosophy should do more than simply generate a formal metaphysics of objects; my conviction is that describing or reconstructing the structure of interaction between objects does not exhaust the task of philosophy.

And finally, I'm just going to say a few things about Quentin and how I situate myself vis-à-vis his work. My key reservation concerns the status of intellectual intuition.

Quentin defends the claim that mathematical ideation, mathematical intellection, has a grasp of things-in-themselves. It grasps the intelligible structure of reality. He has an extremely interesting hypothesis about why it's precisely the meaninglessness or the insignificance of mathematical inscription that allows you to grasp what he calls the 'absolute contingency' of reality. But he explicitly wants to rehabilitate the Cartesian project, where mathematical ideation accurately describes the objective structure of reality as it is in itself, against the Kantian one, which would limit the scope of scientific cognition to the phenomenal realm. My question is very simple: Is it possible to abstract ideation from the physical reality which it grasps or apprehends, given what we know since Darwin, *i.e.*, that the capacity for mathematical ideation which underwrites the objectivity of scientific cognition is the result of a long process of evolutionary development? And the question here again is: Can one concede that ideation, even the most sophisticated form of abstract conceptual ideation as it's deployed in mathematical science, simply supervenes on a set of fundamental neurobiological processes? Can one grant this without reducing cognition and ideation to pragmatic expediency – *i.e.*, the claim that we represent the world in the way we do because evolution has guaranteed this congruence between mind and world (a claim which I think provides an extremely feeble warrant for scientific realism)? In other words, can one reject pragmatism, and naturalist pragmatism in particular, without ascribing some kind of mysterious transcendence to thinking; without saying that thinking, and specifically scientific cognition, is this mysterious kind of capacity that human beings have either stumbled upon or had bestowed upon them by some mysterious sort of process, and which it's impossible to try to understand in more rudimentary terms? And I think that arguably *the* most significant philosophical development of the twentieth century is the emergence of a science of cognition; that is, the idea that the process of cognition can be re-integrated into the realm of objective phenomena studied by the empirical sciences. In other words, there's a circle here, and a circle which, I think, is too quickly disqualified as vicious by transcendental philosophy. Husserl tried to disqualify psychologism on the grounds that if you reduce ideation to a set of psychological processes, then you remove the dimension of necessity, of logico-mathematical validity, which is the guarantor for the cognitive authority of the natural sciences. In other words, you reduce scientific discourse to a discourse like any other discourse, simply a way of speaking, and you basically turn into Richard Rorty.

So, as I see it, the key challenge for speculative realism is: Can one be a realist about the sorts of entities and processes postulated by the sciences without having to shore up that commitment to realism with some sort of pragmatism on the one hand, or transcendentalism on the other? Can one be a naturalist without turning into Richard Rorty, and can one maintain that what science says is true without becoming a Husserlian or something of that ilk? And I think this is a really interesting question; I think this is where some kind of communication is needed between the speculative audacity which is a characteristic of so-called 'continental philosophy' and the really admirable level of engagement with the empirical sciences which is a feature of the most interesting work being done specifically in the kind of Anglo-American philosophy of mind that engages directly with, or that sees its project as continuous with, cognitive science. So, can one be a transcendental realist without idealising ideation, but without reducing it to a set of pragmatic functions either?

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Iain Hamilton Grant: This is fascinating, Ray, not least because I've never heard anyone talk about my work before! But several things you mentioned brought to mind certain features which I think are perhaps necessary to any speculative project. One of them is a certain commitment to a variety of realism, and the question is, which realism? And my question is: Is it possible that there is a realism which is in some sense eliminativist? Because if so, then there are all sorts of ontological problems with that. If not, then, if nothing can be eliminated, then we have a situation where it no longer makes sense to ask, 'What is the difference between a hobbit and a quark?', or for that matter, between Rorty and Husserl! Actually, is there one? Or rather what are the differences? There are several differences between these entities, but to use a difference as a disqualification for their being 'real' or not is simply to beg the question about realism, fundamentally. And for that reason, it seems to me that a non-eliminative realism is committed to becoming a form of idealism, in which case we merely extend realism to the Ideas: In which case we no longer have the problem of the separativity, the subtraction, of ideation from nature, which you were suggesting might be a problem; nor do we have the reducibility to a simple state of affairs whose mere existence guarantees an equilibrium reached between the forces of nature and this highly evolved product or what have you – what you've described as 'pragmatism'. So really my question to you is – and this is also in the light of what reading I've done of your book,[2] really – what are the grounds on which it would become possible for any realist to say, '*x* or class *x* or category *x* cannot and does not enjoy being'?

RB: Well, the traditional way, although it may be completely implausible, is to say that to be real is to make a difference. Anything that makes a difference is real. And of course, then you have to say, 'Well, it has to be a *real* difference, so what do you mean by *real* difference?' And one traditional response to this is that anything that has effects, anything that produces effects, must be real, no matter how else it might be qualified. And this is the key question for Graham, who refuses any distinction between the real and the imaginary, so that it doesn't make sense to ask if anything is more real than anything else. I can see why, because it seems that the difficulties attendant upon trying to articulate a difference between what is real and what isn't just seem insuperable. But it seems to me that if you're willing to grant that we know more about the world than we used to – which I know some people are not willing to grant, but which I'm kind of desperately wedded to – then it seems that you want to say that what happens when we discover something real about the world is that we discover the real causal mechanism, we discover what is *actually* making the difference – so it's not the Virgin Mary who's making the difference, it's a complicated set of processes for which the Virgin Mary is some sort of figurative shorthand. In other words, I'm not simply saying there is no such thing as the Virgin Mary, because clearly there is, in the same sense simply in which there are such things as hobbits or unicorns: the sense in which all these things have made a difference to *our* world, at least. But the claim would be that this is a kind of a folk-language, a kind of linguistic shorthand to describe something else, something that is inapparent, and whose proper description would invoke complex configurations of psychological, as well as socio-historical, processes. In other words, this stuff happens, everyone knows it: why is it that people's apparently false beliefs can have real consequences in the world? The answer would be because we can account for how things can happen even when we ourselves as agents of that happening are deluded about the causally salient factors. There is a way of describing what the salient mechanisms are that produce what's happening. And I think the question of scientific realism is: What are the salient mechanisms that make a difference in the world, that produce difference? In the history of science, phlogiston, calorific fluid, etc. – these things were thought to be viable explanatory categories, and when we dispensed with them, when we said, 'No, that's not an adequate explanation for heat, etc.', we realized we were misconstruing or misdescribing the relevant factors or mechanisms. My conviction – and I think it's a necessary conviction if you want to be a transcendental realist – my conviction would be that we can always misdescribe the structure of reality, but that doesn't mean that there isn't a kind of underlying, deep structure, even if there's always going to be something unsatisfactory or superficial about the mechanisms that we describe. For instance, when Newtonian physics was supplanted by Einsteinian physics – did Einstein 'falsify' Newton? Well, not really, he just showed that his physics had only a limited domain of applicability. And it seems to me that that's the dynamic, the cognitive dynamic that underlies science. It's not that we discover that what we knew was false, but rather that it was limited. This is what it means to find out more about the world, that there's much more going on, and that it turns out to be more complicated, and that we need to forge new resources in order to be able to adequately describe or identify these complex processes. So, in a way, the distinction then wouldn't be between what's real and what isn't real, but between degrees, I suppose – possibly between degrees of adequation. And I think it's possible to describe what adequation would be, what it means for thought to be adequate to its object, without resorting to a Kantian framework. But I'm still groping at this. I really haven't got anything worked out, so these are just kind of intuitions.

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[2] Ray Brassier, *Nihil Unbound: Enlightenment and Extinction* (Basingstoke: Palgrave Macmillan, 2007).

GRAHAM HARMAN: Ray also mentioned a few things about my work that I can respond to. First I want to say, though, in your response to Iain you mentioned defining the real as that which has effects, and I would encourage you to stay away from that definition, because then it seems like you're defining the real by something outside the real. So it's not the real in its own right, but something outside of it – potential or something. We can argue about this, but this is why I shy away from that definition, just as I shy away from the definition ‘reality means resistance’, which you see in Heidegger and Max Scheler and others. That might be a way we measure reality, but that can’t be reality in itself, because *something* is resisting. The resistance itself is at best a way of *knowing* the reality.

The last thing you asked about my work was whether I think that this theory of relations between objects exhausts philosophy, and at this point I’m not in a position to say yes or no – but that’s definitely my project, that’s what I’m trying to say. And just in the last week in London I’ve decided what I’m going to do for the second half of this next book, which is go through every one of the metaphysical problems that Kant throws out and try to rehabilitate every one of them – such as, ‘is there a smallest possible unit of substance, or does the division go on forever?’, ‘is there freedom or no freedom?’ It would be fun to try to rehabilitate all these problems in terms of objects and the relations between them. I was struggling with how to organise that metaphysical part of the manuscript, but I think this is the way to do it, since Kant is the one who destroyed all these problems, according to everyone. Why not just go right in his face and try to bring them all back? Who knows if it will work or not, but it should be fun.

The hobbit and the quark, I think, was the second point, and that’s actually easier to deal with than the first. I’m a Latourian on this point. For Latour, every kind of object is real, and you simply judge an actor by how many allies it has, and what sorts of … – I almost said ‘effects’, I’m contradicting myself – how well it resists tests of strength that are made against it. Clearly a hobbit has to be a real object in some sense, because I can ask ‘What is a hobbit?’, ‘What does a hobbit do?', 'How does it behave?', and this will never be completely reducible to all the things that Tolkien says in all of his novels, because you can imagine new scenarios. You can ask, 'Could a hobbit fit in a Lovecraft story?', 'Could a hobbit fit in a Proust novel?' I would say no. Now why is that? It's never been tried, so why is it that when I mention these possibilities we immediately reject them? It's because you have a sense of what the hobbit is beyond all of the things that have been said about hobbits in films and novels that we already know. So I'd say a hobbit is real. Okay, of course you don't want to say a hobbit is as real as a quark – why not? Or to take an even sharper example, you don't want to say that five hundred imaginary crowns are the same as five hundred real crowns. And the way I would deal with that problem is as follows: The traditional pre-Kantian solution was to say there isn't really anything different in the two. God creates the five hundred real crowns, being becomes a real predicate in the real ones that wasn't there in the imaginary ones. And then Kant says it's not a real predicate, it has to do with our position, namely their relation to us. But why not say that the five hundred real crowns and the five hundred imaginary crowns do not have the same qualities in the first place? They differ in essence, not just existence. That's my solution, and it's not fully worked out yet. The shiny gold lustre of the real coins is not the same as that of the imaginary coins, because somehow qualities are borrowed from the parts of a thing, I would say, and the five hundred real crowns have real parts, the five hundred imaginary crowns do not. So that's the direction I would go in, to answer that: to say that everything is real, and that the qualities of things are not universals. The qualities of things come from individual parts. And then you have to explain what universals are, which is another problem I haven't even touched yet – how do you explain what 'red' means?

The first question you asked was the hardest. Objects interact on the basis of essential properties. In order to interact, objects need to know something of one another. I'm not sure if this answer will satisfy you, but what I say is that objects do not interact with each other directly, but simply somehow allude to each other, and what they're coming in contact with are qualities of each other, that somehow allude to the things. And I think you see this in metaphor, and this is the example I used in *Guerrilla Metaphysics*[3]: The example Max Black uses was 'man is a wolf', which is a different metaphor from 'wolf is a man', it has a completely different effect. When you've got 'man is a wolf' in Black's example you have some sort of elusive human thing there that's being orbited by wolf qualities that are transformed in a human direction. But somehow those qualities allow you access to the human underneath that wolf-man thing, whatever it is. So, things do interact but they interact only on the interior of another object where one of them is merely sensible, or an intentional, object, and you're trying to point at a real object in that way.

I don't want to hog the time here, but I was going to answer Iain's rhetorical question about whether there's a difference between Husserl and Rorty. I think there is a difference, and the difference is that the key to Husserl is the intentional objects. Husserl *is* speaking of the phenomenal realm, but he's also speaking of a phenomenal realm broken up into objects that are never fully exemplified by our specific perceptions of them – I think that's his great discovery. These are different from real objects that withdraw and hide as in Heidegger and in various realists. In Husserl what you have are objects that are already there yet somehow covered over with too much detail, so you have to eidetically vary them and circle the thing from many different directions and finally, asymptotically perhaps, get at what the thing is by looking at it from all the different possible angles. And you certainly don't see that in any of the empiricists. Objects are merely arbitrary bundles imposed by us on sense data, for empiricists. Whereas I think the object is really there, organising the qualities, and Merleau-Ponty actually does a nice job on this. I'm not the greatest fan of Merleau-Ponty, but he does a nice job arguing that the black of a pen is not the same as the black of a coat – there's a connotation to the blackness that is different in each case, because the quality is somehow impregnated with the object to which it belongs. So … I will let our visitor from Paris take the reins now.

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[3] Graham Harman, *Guerrilla Metaphysics: Phenomenology and the Carpentry of Things* (Chicago: Open Court, 2005).

Quentin Meillassoux: Thank you, Graham. I would say the following about formalisation, mathematics, in relation to the world: I don't want to demonstrate that there is a necessary relation between mathematics and reality. My problem is a problem of *possibility*. In *After Finitude*,[4] the problem that I encounter is that of explaining the possibility of science, physics, being able to describe a world without humans. For a transcendental philosopher, for what I call ‘correlationism’, this makes no sense – it is an absurd question to ask, ‘What would the world be if there were no humans?’ ‘What would the world be like if we didn’t exist?’ – This is an absurd question, *the* absurd question, I think, for every Kantian or post-Kantian philosophy. But the problem is that sciences are supposed precisely to explain what the world is like even if there are no humans. What is the world before humanity? What could the world be after humanity? So, my problem is just a problem of possibility. What distinguishes scientific description is its mathematicity. So, the problem that I encounter is to explain how mathematics might possibly be able to describe this world. Of course this description may be deficient, it may be that there is far more in the world than mathematics is able to describe. But at least we must explain the possibility that the theory – a theory which may be refuted in the future – a physical theory, might be able to describe the world. That is the fact I want to explain. I don’t feel that contemporary theories are necessarily true – maybe they are false, but maybe they are true; this ‘maybe’ must be explained. So, it is really a modest position. I just want to explain the possibility of mathematical explanation. For I think this possibility is a condition of an explanation of science itself. By which I mean: how it is possible that mathematics could be able to describe the world, even a world without humans. This is the problem of science.

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[4] Quentin Meillassoux, *Après la finitude: Essai sur la nécessité de la contingence* (Paris: Seuil, 2006), translated into English by Ray Brassier as *After Finitude: An Essay on the Necessity of Contingency* (Continuum: London, forthcoming 2008).

About Rorty and Husserl, I would say this. I think that every time a Rortian speaks and argues, he always has the following position. He always says that, ‘Your discourse is a contingent discourse, a discourse among other possible discourses'. And he will say that about mathematics. So, I will say he has this sort of primitive theme in his mind: Maybe there could be some non-human organism, some extra-terrestrial, that would be able to have a radically different relation to the world – a different perception, different conceptual apparatus, etc. So all discourses are historically or maybe biologically contingent. So I would say that contingency is the ground of every relativist theory. What we have in common with every human or non-human discourse is that we think we are able to be Rortian – even an extra-terrestrial can be Rortian. And imagine an extra-terrestrial which was Rortian – what would he say? He would say the same as the terrestrial Rortian, he would say, 'Maybe all discourses are contingent, maybe there could be other possible discourses, *etc.*'. So contingency is a common property of all relativisms of all times, on all planets. That's why I made contingency the real ground, the universal and eternal ground, of every relativism in the universe – I'm sure of that. So, if there is a certain sure ground of every discourse, which would be accepted by every Rortian – human or non-human – I would say it would be contingency. So, my problem is very simple: are we able to derive, to deduce, from this eternal ground – which, according to me, is contingency – the capacity of mathematics to possibly be able to describe a world without humanity? I have the ground, I have the problem. Between them what I try to show is, if contingency is eternally true, maybe there are determinations of contingency itself. Maybe to be contingent, you must be *a* or *b* or *x*. Because you can't be just anything if you want to be contingent. My hypothesis is that to be contingent you must not be contradictory, because if you are contradictory you are everything and you can't change. So if I can derive, deduce – but I don't yet do this in *After Finitude* – if I could derive from contingency a condition which explains the possibility of mathematics describing a world without humanity, okay, bingo. I didn't do that in *After Finitude*. But I think it's possible. And in that case, you know, we would be sure to be immune from Rortian refutation, because Rortian refutation is always grounded on contingency; and on the other hand, we would have explained what must be explained to understand the capacity of sciences to possibly describe a world without us.

RB: Okay. It's a question of scientificity here: whether mathematical formalisation or mathematical science can and should be the privileged paradigm of scientificity. Because there's another issue here, which is that lots of what we know about the world before and after humans is not mathematical knowledge. Lots of biology and geology is not mathematically formalised. And yet surely we want to say that we know that dinosaurs existed, and that we know quite a lot about the morphology of brontosauruses. I mean, I know the question of dating is crucial here, but it's not just that we know that the accretion of the earth happened 4.5 billion years ago because we have a mathematical way of determining the date, but that we know much more. We know about the processes involved, which are geological, physical, chemical processes, just as we know an incredible amount about the pre-human world, about pre-human flora and fauna. And surely it's important to be able to defend the reality of the claim that brontosauruses had such and such a property. There's very little that is mathematical about what we know about brontosauruses. And my worry is that if you turn mathematisation into the criterion of scientificity, you accidentally or unwittingly compromise the authority of all sorts of non-mathematical knowledge, which surely we want to say is objective: geology, biology, etc. And this can be turned around, because lots of people will say – an idealist will say – certainly mathematics is the only reliable guarantor of objectivity, the irrefutable canon of objective validity, and they will use that to discount biology and all sorts of other things. And this position has been used to disqualify lots of other areas of knowledge which are deemed not to be scientific just because they haven't been formalised. So I wonder, is it possible to loosen or weaken the criterion of scientificity in order to guarantee the same degree of insuperable objective validity to biological, geological, and even zoological discourse, without saying that science is purely about a set of stipulative conventions and criteria of legitimation? And I think this is a really profound epistemological problem, and that's why I want to refuse the idea that Kant definitively resolved the epistemological problematic. Kant gave a bad answer, it's not a satisfactory answer, because of what we know about the contingency of thought and consciousness. We know that thought and consciousness are not ineliminable features of reality, and that reality would have many of the same characteristics even if thought were not there. As Steven Jay Gould said, if the dinosaurs hadn't been wiped out by whatever wiped them out, they would have carried on, evolution would have followed some other trajectory, in which consciousness and all those characteristics and peculiar cognitive prowesses exhibited by sentient creatures would simply never have come into existence, and yet reality would have been the way it is. So I want to generalise, I want to be able to say that we can describe a non-human world, or the inhuman world, without mathematics. Because if you cast doubts upon the objectivity of these non-mathematical discourses, then it seems a very … well, it's a concession that I'm not willing to make, because it simply seems to open the door to all sorts of obscurantism, which I think really need to be exterminated.

Presentation by Iain Hamilton Grant

The basic thing I want to talk about is the philosophical problem of nature, and I think this is a springboard for speculation – not opportunistically, but necessarily. I think that if philosophy of nature is followed consistently it entails that speculation becomes necessary, as the only means not of assessing the *access* that we have, but of the *production* of thought.

I'll start from two things that I think everyone would accept and see if we can work outwards from there. I think that, unless you're some kind of convinced dualist, it's absolutely necessary that we accept that there's something prior to thinking, and that there are several layers of dependency amongst what is prior to thinking. It's not just one thing, it's an entire complex series of events. Now we could articulate that by means of some form of causation. We could try to establish, as it were, a direct line between the event we're trying to analyse, the event we're trying to account for in naturalistic terms, and all the causes that might have contributed toward its production, and so on. Such a task is inexhaustible in principle, not merely in fact. It's inexhaustible in principle because the conditions that support the event that's produced also support the production of other events. So if we accept that there are naturalistic grounds for the production of thought, then we have to accept that the naturalistic grounds for the production of thought are not themselves evident in thought except in so far as thought is regarded as part of nature.

So that's the starting point, and I take this to be Schelling's central contribution to philosophy. Schelling, of course, is known as a transition engine. He was a sort of facilitator, a go-between, for philosophical history. He sits between Fichte – who we all equally understand because, after all, Fichte talks about ethics – and Hegel – who no one understood but who everyone would like to. Schelling had neither of these benefits nor deficits, and in consequence, no one could understand him nor wished to! However, Schelling also produced this monumental series of works on the philosophy of nature, this extraordinary series of overtly speculative works – and when I say that, there's partially a descriptive element here. It's like a genre of writing, at one level. That is to say, the commitment to getting it down as it's coming out, is not merely that of a poet under inspiration – it's also an ideational requirement, really. If the thought as it's happening is to have any impact whatsoever on the world in which it's happening, then it's absolutely necessary that it be got down. So if you look at Schelling's output, it's hideous, it's absolutely frightening. No wonder people hated his guts: he was writing six books a year – and that's not counting essays and journals edited and so on. It was frightening – he turned out more than a novelist. So there's this extraordinary record of production of works on the philosophy of nature. And to distinguish the philosophy of nature as Schelling propounds it or explicates it successively, again and again – and not always in the same way or according to central shared principles – it's convenient to call it 'speculative physics', as indeed he did in the journal he edited under that name, the *Journal of Speculative Physics*. I don't know about you, but the very idea of combining those two things seems an absolute recipe for heaven on Earth. This is building particle accelerators that cost billions, that bankrupt countries, sinking great tunnels into the centre of mountains in order to capture sunlight from aeons ago, starlight from aeons ago – this is speculative physics. So the combination isn't at all strange to us at one level, but at another level it's strange to see it coming out of a philosopher's works.

So those really are the two things. Speculative physics: what is entailed, on the one hand, vis-à-vis the nature of philosophy; and on the other, what it entails for the nature of thought. Those are the two areas I'm particularly interested in. And the reason I think these are significant – beyond the fact that they happen to interest me, which isn't significant – the reason I think these are interesting at all is that they present us with an idealism which is wholly and utterly different. And to illustrate this I'm going to cite, paradoxically, Bernard Bosanquet. I'm very concerned to show that idealism, as it were, doesn't look like we think it does. I'm very concerned that we see and acknowledge this to be the case, because the speculative tools that it has built into it are immense. This is from a book that Bosanquet wrote called *Logic, or the Morphology of Knowledge*. It's a book on logic. One question is, why are the idealists so fascinated by logic? Why are they all experimenters in logic? Why do we get vast tomes, repeatedly, from idealists on logic? There are many possible answers to this, and I'll come to one of them later. But this is what Bosanquet has to say at the very conclusion of his book. Upon starting it out he has two epigrams, one from Hegel, from the *Science of Logic*, the other from Darwin, from *The Origin of Species*, and his avowed aim is to bring these two things together. I won't use the phrase 'evolutionary epistemology', although obviously there's a certain kinship between these strategies

– but there is certainly something about knowledge that entails that it is evolutionary, if it is knowledge of nature. This is what he has to say:

> In knowledge, the universe reveals itself in a special shape which reposes on its own nature as a whole and is *pro tanto* proof against contradiction. The detail that the universe presents in the form of cognition is true *of* the universe, although falling within it, because the universe *qua* object of cognition, in it's self-maintenance against self-contradiction, in that form, shows that it must take the detailed shape it does and no other. And to know it is to endow it with that form, making the given more and more of itself.[5]

Now this has got a lot in it, but the two things to pull out of it are: 1) the fact that there is, again, this nature that precedes the production of logic – and incidentally, in the quote from the *Science of Logic*, is Hegel talking about, you know, how evolution is significant if and only if we can account for the production of the syllogism in evolutionary terms, which is fair enough, really: a true philosopher, there. But this is not Bosanquet's project. He thinks that the universe is actually manifesting logical laws and their expression is largely indifferent. What we will find is that nature does behave in this way. So there's this *prius*, this 'firstness', preceding, as it were, the production of the laws of logic in so far as they are *overt* laws of logic and are articulated by ourselves or some variant thereof. 'To know it is to endow it with that form', Bosanquet says; and that form is the form it necessarily has in so far as it is the universe, manifesting itself and maintaining itself against self-contradiction. There is a reality to the law of non-contradiction. It's not merely a formal thing, it derives from natural history. There is a production of non-contradiction which takes place constantly throughout the production of nature. The productivity of these logical constants can be measured in terms of existence. Beings are everywhere the fruit of the stated mechanism. It would be one and the same thing if we discovered any other law of nature. All that's happening here, all that Bosanquet is suggesting, is that the grounds for our being able to have a law of non-contradiction are supplied, as they are for all thought or all systems of thought, *not* from the ether, *not* from some non-physical cause, but from nature.

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[5] B. Bosanquet, *Logic, or the Morphology of Knowledge* (Oxford: OUP, 1911), Vol. II, 322.

Now if we accept that, it seems to me that idealism is committed to a realism about all things, a realism that applies equally to nature and to the Idea. And in general terms I think this is true, I think this is what all idealism in fact does: it approximates, more or less. If you look at Plato, who is often regarded as the very archetype of the 'two-worlds' metaphysician, what does he say? He says fundamentally that becoming is caused by the Idea which it can never be but can only approximate. This is a physics, this is fundamentally a physics. The Idea is a content-free point that denies accessibility, that determines, as it were, the chaos around it to be chaos around it. Why? Because the chaos around it cannot be what it is, because it is the only self-identical thing there is. There are several Ideas of course, so it's not just one, despite certain splits toward the end of the *Republic*.

Okay, so I think basically there are grounds to assume that idealism is realism about nature coupled with realism

Iain Hamilton Grant

about an Idea. In terms of the situation in which we find ourselves today, my question really is: does this or does this not, as it seemed to at the turn of the nineteenth century, provide an exit from the strictures of Kantianism? Clearly, I think it does, and it does so by denying that interiority plays any role whatsoever. The Idea is external to the thought that has it, the thought is external to the thinker that has it, the thinker is external to the nature that produces both the thinker and the thought and the Idea. There are a series of exteriorities between thinker, thought, Idea, the various strata of the nature necessary to produce that event – necessary but not sufficient, it should be stressed. So you can't say that this and only this nature could produce that event, but we can say that it's necessary. I've said a little about why, and that's a huge problem actually. It's simply that the problem of ground, naturalistically understood, presents us with a tremendous series of problems. If it is the case that the Idea is exterior to the thinking, the thinking is exterior to the thinker, and the thinker is exterior to the nature that produced it, then, inevitably, we no longer have a series of interiorities within which it's possible for anyone to recognise themselves in the production of their thoughts. It's simply a banal accident that we know what it feels like to have thoughts. That is not particularly significant. What's significant is the thought. The thought is the product, and of course there are events taking place that surround that thought. It's very difficult to imagine, as I said, that what's necessary for the production of a particular event in nature is sufficient for the production of *that* and only that event. In other words, we have no reason whatsoever to assume that our perception of our own interiority guarantees that that interiority is somehow reproduced in reality. It just isn't: that the Ideas are separate from the thinker that thinks them, the thinker that thinks them is separate from the thinking that he or she thinks, and the separateness of the thinker from the nature that *necessarily* produced it isn't sufficient *on its own* to produce it, seems to me to guarantee that.

So that's idealism. What does idealism therefore offer speculation? Why does it make it necessary? There are two reasons why, and I'm really going to concentrate on one – and this is part of an answer to one of the questions that Ray asked earlier concerning, 'how do you arrest the process of production, as it were?', 'how does the product intervene, as it were, in a process of production such that in some sense the process of production has an outcome?', because without that surely it isn't a process of production. So is this a dualism of principles or is there something else going on there? I'll begin this with a re-articulation of what Schelling did to Kant. This is brutal. If thought had an anatomy, and if a thinker were to have done this to an anatomy, then the owner of that anatomy would be completely dismembered. In other words, this is Schelling being the Furies chasing after Orestes in the forest. He rends Kant to shreds. He takes the *a priori* and the *a posteriori* and totally inverts their purpose. The *a priori* is intended to guarantee that prior to the production of any thought, there are certain laws in place of that thought that entail that that thought and only that thought can be legitimate within the sphere it's being thought. Schelling turns it around and says, 'No this is not *a priori*, this is a *prius*. It's firstness'. *A posteriori*, Kant wants to claim, is a matter of almost total indifference. Any science that studies, for example, as chemistry does, 'mere' sensible *a posteriori* evidences, is basically mistaking the product for the law that produced it, and is therefore pointless, not really a science but a cataloguing exercise – something, incidentally, that both Hegel and Darwin complain about in the epigrams in Bosanquet's book, this 'cataloguing exercise'. The *posterius* and the *prius* for Schelling – far from representing this divide between what is *a priori* true for all knowledge, for all knowing, and what is *a posteriori* going to be given, that *a priori* once granted – is to say that this is simply a firstness and secondness that belongs to a generative program. The firstness is firstness not merely by the nature of thought but by the nature of what it is that thought is. In other words, it's not an internal problem of thought that there is firstness – apriority, if you like – it's rather a problem of nature that there is a problem, that there is a question or an apriority. The *a priori* is nature. Unless there were a nature there would be no thinking, I think we can agree. If there were no nature there would be no thinking. The *prius* of thinking is necessarily nature. But the *prius* never goes, is never a *prius*, unless there's a *posterius* for it to be *prius* to. In consequence, the product and the productivity, the *posterius* and the *prius*, are two co-present and constant elements in the articulation of process. It's simple. It's a formal nugget at one level, but at another level, it's actually the way in which firstness and secondness – time, in other words, or its production – becomes particular, becomes particular entities, becomes particular thoughts, whatever kind of entities are produced down the line. All we have is sequencing, and the sequence is *prius* and *posterius*. But a *posterius* can never, no matter what it is, capture the sum total of the causes of its production. This applies to physical entities, it applies to mountains: Imagine a mountain trying to contain within itself and catalogue, lay out, merely to lay out and catalogue, all the elements that went into its production. '4.5 billion years. By God, that's a long life', says the mountain. 'How much further have we got to go? Only another 10 billion years, till we get back to the point where I catalogue all the events that are necessary to my production', and so on. It's as important to the production of physical entities, such as is commonly understood, as it is to thought. What is it that happens when thought pretends to chase its own tail? – the Ourobouros diagram from the front of the Macmillan edition of Kemp

Smith's translation of Kant's first *Critique*. What is it that happens when thought tries to catch its own tail, tries to trap its own conditions of production in its product? First of all, it can't happen, because, as for the mountain, the conditions of the production of the thought are simply far too extensive for it to be in principle possible for a thought to recover them. So there's a necessary asymmetry, if you like, between thought and what precedes it, and it's this asymmetry which means that thought is always different from what precedes it and always at the same time requires what precedes it as its necessary ground – necessary but not sufficient. So there we have a process of generation that's understood as one then the next, that is demonstrated, if you like, by the incapacity of thought or mountains, by the lithic or the noetic, to go back and to recover its conditions of production. It's simply not doable.

So that is the beginning of a problem, the beginning of a naturalistic interpretation, a speculative physical interpretation, of the question of ground, of the problem of ground, which, it seems to me, is a problem that we're all addressing. Several consequences flow from it which it seems to me are worth explicating, not in so far as they relate necessarily to this project but in so far as they relate, I think, to speculation in general. I would like to make certain claims, in other words: I would like to make the claim that speculation is entailed by natural productivity. We don't have, in other words, the comfort zone of an interiority which really masks an impossible reflex. We don't have that comfort zone to slip back into, and to say to ourselves, 'Ah, look, we have recovered the totality of the conditions under which thought is possible, and *only* possible'. We don't have that comfort zone, that interiority, and that's one reason why speculation's entailed … It also means something very bizarre epistemically at a quite mundane level, at the level of reference. What is it that happens when we have thoughts about things? Two things happen: there are things and there are thoughts. What's the basis of their relation? Well, the thought that specifically occurs at that point is the means by which they are related, and that if there is no other body of reference, are we talking about a world? No, the world's talking. Now, the question therefore becomes: If the world talks, if the world is articulate, and if, that is, nature thinks – and however many strata we want to place in between the agent and its product is fine by me, well, there ought to be loads … however many strata we want to place between the agent and its product, between the thinker and the thought is fine – but it seems to me that if nature thinks, then it follows that nature thinks just as nature 'mountains' or nature 'rivers' or nature 'planetises', or what have you. These things are the same to all intents and purposes. In other words, there are new products every time there are thoughts, which creates the problem of ground. And as I see it, the problem as it presents itself through these lenses, seems to me to focus on a single question: Are there one or many grounds? If there is one ground for example, the law of non-contradiction, such as Bosanquet espouses, being a fruit of nature – if there is one ground, then all of the fruits of nature can be related to that ground. Necessarily? Certainly. But sufficiently, no. If there is more than one ground, if there is ground every time there is event, then that becomes a question of what job it is that the ground is doing. Is the ground a *prius* or a *posterius*? And as a product, an entity, it must be *posterius*. So the reformulation of the question of ground, it seems to me, is the means by which we can guarantee a consistent speculation concerning the origins of thought as much of as the origins of stones. And that's where I'll stop and open it up …

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Alberto Toscano: What's not entirely clear to me when we talk about realism is the particular relationship being proposed between thought, consciousness, cognition, and various other terms. Because on one level, this Schellengian idea that nature thinks in the same sense that nature planetises or blossoms or does whatever – that seems to give thought a kind of substantiality and materiality of sorts, although it's not entirely clear how one would define it. On the other hand, for instance, when Ray was speaking about a science of cognition, one of the things that's very striking in a lot of work being done on these issues is precisely a tendency towards something like a substrate-independent or matter-independent notion of thought, whereby indeed thought would be something that is perfectly compatible with a kind of inhuman horizon, inasmuch as it's not by any means necessarily individuated over human beings or intellects and so on. So in a sense it would be sort of radical anti-Kantianism that would also involve avoiding anchoring thought in any form of subjectivity. And so, I suppose, one of the issues is not just the question about a realist epistemology or epistemology's relationship to realism, but it's also a question about whether speculative realism is also a realism about thought. And if it's a realism about thought, does it necessarily depend on thinking of thought as something that has a substantiality and materiality? Another possible option would be to be a formalist about thought. I'm thinking, for instance, of the Churchlands. There's a point in one of the debates where they say, 'Well, if thought is to some extent or another understandable as a type of formalism' – you know, they talk about pattern activation vectors, etc. – 'then why can't thought be instantiated over a social collectivity or a network of computers or indeed whatever other assemblage or entity you might find?' And this seems to me very important vis-à-vis science, because if we start talking about science and realism and then act as if scientific discoveries take place in the sense of individuated human thought, it seems that the entire process of the generation of scientific statements is completely misrepresented. Because it seems to say that whatever statements are being produced about quarks or about galaxies and so on, involve the capacity of a single human scientist to think about the cosmos – which seems a totally farcical scenario about how science operates. It seems like a false epistemological scenario. So I was wondering – I mean, obviously these are a broad set of questions – but vis-à-vis this kind of Schellingian line, what is the status of the reality of thought? Is it some form of substance?

IHG: I'd like to start from one of the points you make, because in the terms in which you put it I think the interesting point is this: If this is true, if there is an unrelated *prius* and *posterius* in the production of thought, and if this has the effect of making the thought particular to its conditions of production but incapable of reflexively recovering those conditions, then we are condemned to a complete particularity that would seem, on the face of it, to deny the prospect of collective work. So it certainly would make, for example, subatomic physics impossible. There would be no prospect whatsoever of collective work. So I'd like to start from an almost sociological point of view. I mean, it seems to me that clearly there is sufficient consistency across a range of individuals in laboratories and so on and so forth, to generate the sort of work that was done in early sociology. It seems there is, obviously, consistency. Theory itself, the very idea that there are theories, is dependent on some kind of consistency being reached that makes it irrelevant what the conditions of the production of thought are.

AT: In the individual?

IHG: In the individual, yeah. So the question is how this happens. And it seems to me that this is why the idealists are fascinated by logic. If it is true that we have nothing to go on other than the thoughts being produced, then the demand that the relations between thought, things, and so on be formalised becomes an imperative. It's the only way this could possibly happen. This is something I was thinking about while reading what you had to say, Quentin, on formalism, on mathematics, and about the *signe dépourvu du sens*. This seems to me to be necessary if there is going to be any kind of communication between sciences such that a programme becomes possible. However, what does that mean? It means, in effect, that there must be produced a series of reproducible patterns. The whole question ceases to be, therefore, a question of the conditions of production and starts being a question of the kinds of products required. The fact that they are available could of course then be used to trigger a rekindling of the transcendental. To some extent, the criterion of utility attaching to maintaining a scientifically realist epistemology, as it were, gives the game away here. We can't recover the conditions of its production such that it's possible for us to say, 'Well we know this because …', and so on. We might be able to do this in one particular case, but there will always be others, other cases that produce other thoughts, and that's why it becomes necessarily a question of ground once again. Is there one ground for all patterns, or are there several grounds for several patterns? In other words, how malleable are logics? How many possible formalisations are there? That seems to me the question that nature poses to thought.

Ali Alizadeh: One word which is not being mentioned so often here is 'cognition'. You talk about consciousness and you want to talk about the difference between the ideal and nature, but how far would it take us away from Kantianism and transcendental philosophy altogether if we tried to abolish completely the synthetic unity of apperception? That's kind of what Ray mentioned as well. There is the difference between thought and thinker, as you said, and the difference between thought and Idea, but the problem is the implicit evolutionary theory here. And if you go for an evolutionary theory the move from nature to thought and from cognition to thought has to be gradual, it has to be linear, but we cannot really trace these trajectories all the way back from humans, who think self-consciously, to all the forms of inorganic life from which we emerged. But we do know that the difference between cognition and thought is disjunctive. It's a difference in quality. So that's the problem: Kant was not interested in finding the totality of the conditions of the production of thought, he was interested in finding the conditions of the possibility of cognition, whereas you're just interested in the former.

IHG: So Kant was also interested in necessary but not sufficient conditions also, as it were, in that regard: not the conditions of the production of this thought here and now but rather the necessary conditions if there is thought, the form it must take, and so on. Yeah, I agree, and I don't think, as it were, that there is no attraction to the transcendental. I don't think that the idea that Kant was just gloriously wrong and how we laughed when we look back and we think, 'Oh God, the eighteenth century, they were so dumb!' It's not really that. There is such a powerful attraction to the domain of the transcendental, the domain that is anchored by – not that anchors, and this is crucial – but is anchored *by* the transcendental unity of apperception. There is an attraction there, because it presupposes a domain, the one domain in all being, where everything can be ruled by what Freud called 'the omnipotence of thought', where it's sufficient for me to think to be able to determine what goes on. So I think, yeah, that aspect of Kantianism, that reason why Kantianism, or the transcendental apparatus in Kantianism, has become so embedded in our philosophical practice, is because of its powerful attractiveness – a domain wherein it's possible for thought to legislate for itself, not for others, not for anything outside itself, and not to be legislated to by anything outside itself. The problem is, it's impossible. There must be something that produces this, this must come from somewhere, unless of course it's parachuted in from Venus. It could be a Venusian Richard Rorty, I suppose, who legislates what we think. Thought comes from somewhere, and the somewhere it comes from is nature. To that extent, it's no longer going to be possible to consider that the transcendental unity of apperception is responsible for the transcendental. Rather, the transcendental is responsible for the unity of apperception. So, regard that as a product rather than the producer of the field. It's not the autonomous judge, it's rather the heteronomous satellite of the transcendental, if you like, turned around on the basis of a naturalism about how thought got here at all. And we simply have to give up the illusion that the domain of thinking that we call reflection is coextensive with the domain of thinking *tout court*, as it were. So, I think – although abrupt and hideous – that's what's necessary.

AT: Can I just follow up on that briefly? On what grounds, in the step beyond the critique of Kantianism, does one want to make the argument that the conditions, let's say, of the *genesis* of thought, however defined, are relevant to the *conditions of possibility* of thought? For instance, if you have a kind of substrate-independent notion of what are the formal or formalisable conditions for thinking, however defined, then whether it's arrived at by a particular genetic lineage, or whether it's artificially produced, etc., the argument would be that ... well, isn't it the case that if the Kantian project at its core remains persuasive, then in a sense whether it's evolutionary or machinic or whatever other genetic process is to some extent irrelevant? … I mean, wouldn't that be the reply, to say that it seems to beg the question to say that somehow genesis is necessary to understand the immanent conditions of the possibility of thought? Unless obviously you totally pluralise thought in a way in which the thinking of the Venusian and our thinking are only the same thinking by convention rather than by a set of formal conditions.

IHG: Yes, one thing the transcendental entails, epistemically and metaphysically, is that it gives us license to be able to think a finitude of possible types of knowledge. If we don't have that, if we don't have the transcendental to rely on, then either we find some other mechanism that does the job without entailing that this finitude is active fundamentally in a subject or we just haven't got it.

AT: So there's no closure to whatever we might understand by thought?

IHG: No, no, no … But I think that must be the case if we hold that time is to some extent involved in the production of nature. I put it that way around. I don't say that if we hold that, you know, neo-Darwinism is the correct account of genetic transfer, then, etc. … I don't put it that way around. If there is time involved in the production of nature, then that time is the reason why the particular aspect of nature that happens to think, as it were, is what it is. It's necessary that it is, but its sufficiency is always in question. And what are the mechanisms by which it can be assessed? Well, inevitably, third-party ones. It can't be done by reflection.

There is the possibility of a morphology of thought, as it were, where we look at the patterns. This is the suggestion that Whitehead made years ago, and there are interesting suggestions in contemporary logical formalisms – for example, Graham Priest. There's a thing he's working on, a thing called 'dialetheism', which is basically a logic that makes self-contradictory propositions coherent elements of a formal system.[6] He says that two properties are contradictory – one is closure, the other is transcendence – and neither of them can be reduced, one to the other, and both are operative. This is a system which is entirely inconsistent but generates consistent systems. So the question of patterns might become more important. But then we don't have to ask the questions, or we're not tempted in the same ways, to ask the questions about 'what is the horizon of the possibility of these patterns', because the horizon of nature is possibilizing them – you know, nature is the reason.

Graham Harman: I'll save some bits for my comments later, but Ray already alluded to a principle of 'retardation' in your book: so you have a primal flux or becoming that's pre-individual in some way, and retardation is what makes it crystallise into individual things such as rivers and mountains. Now, of course, we've seen this in other philosophers, where it's the human that's the retarding principle. So, for example, in Bergson, if not for humans time would go like that [*snaps fingers*]. And for the early Levinas: if it weren't for the human subject, being would be an *apeiron*. It would be a rumbling *il y a*, and it's only the human that breaks it into parts. But obviously you don't want to do that because you're a realist. So it can't be the human who does all the work. So how exactly is this retardation – I know it's a tough question – but what are some of the ideas you have about how the flux can be retarded to give rise to individual shapes?

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[6] G. Priest, *Beyond the Limits of Thought* (2nd edition, Oxford: Clarendon, 2002).

IHG: It generally happens that when asked questions of this nature, the answer will strike me in about three days' time! But this in a sense illustrates the answer that I'm going to give now, which is, it seems to me, that if there is production there is product and vice versa, and there is no production if there is no product. And instead, therefore, of thinking of the question of how there is this substrate where the mobile is static, where it acquires form, we think about, you know, this is the conjunction of product-production, as the kernel of all possible production. Then, to some extent, the question disappears. Now I know that doesn't answer the question, so it's a solution that evidently I haven't thought through.

Peter Hallward: This is a way of going back to Alberto's question, but you said at one point that nature talks, or nature thinks, and I just wanted to know what that means, exactly. What does that add to our understanding of linguistics or the symbolic or the semiotic or, you know, conventional accounts of how language works, by saying that it's nature that's doing the speaking? How does that sharpen or inflect a research agenda in a way that people who work on linguistics, for example, might understand?

IHG: Two things, I suppose. One is, if we're talking about purely symbolic language, then clearly the answer to that question belongs to the answer I made to Alberto concerning patterns, concerning shared languages, a shared symbolism. But that is possible only on condition that the symbolism has no reference. The alternative would be that there is a way of accounting for the production of linguistic units in terms of referential signs. So you need to place the cart before the horse to some extent in so far as you're asking: Given that signs have this property of reference, how is it they get there; was it the natural production of reference, and so on? And this suggests that reference is an essential property of signs. But the principle I take Schelling to be espousing – and of course the possibilities for error are immense, not least because Schelling and consistency were only sometimes bedfellows – is quite simply that if, when it comes down to it, there is a process, a necessary process of nature, culminating in a particular product, and there's no alternative to that view, unless we accept some form of dualism, then what we can accept as being produced in this way exists by virtue of it. The ground is provided by nature. The production of anything else has to be simply accounted for in terms of abstract languages. So the abstract elements of it have their ground, as Bosanquet suggests, in nature. The question is, how many possible formalisms are there? How many possible abstract languages are there? – not really how this particular abstract language can be used to make, as it were, referential sense of a body of natural language, and how speakers use it. So I think the question may be the wrong way around, and that's how I would respond. Although one of the things which interests me, which I think is not just interesting but imperative, is to find ways of conjoining philosophical work with all the sciences. If idealism becomes an operating principle of any sort whatsoever, if it is true, there's nothing which can be ruled out *a priori*. And all the sciences become imperative, in the form of this idealism, and no-one can do all of the sciences. Therefore it becomes a cooperative labour. Therefore the question that Alberto's raising, and which I think you're raising just now, becomes imperative. But we can't, I think, do that so long as we do it through lenses that presuppose exactly what's being explained, as it were. That's a disappointing answer, I'm sorry …

Dustin McWherter: I have a question that also kind of follows up on Alberto's question about the ontological status of thought, but also a question about how this plays out in your book. In the *System of Transcendental Idealism*, Schelling has an explicitly epistemological agenda, and it seems to me that that's elided a bit in your book, despite the brilliance with which that work is otherwise interpreted and explicated. So, how would you handle Schelling's epistemological agenda in the *System of Transcendental Idealism*? And furthermore, it seems as though, in that reading of the *System of Transcendental Idealism*, you construe ideation as simply a regional phenomenon in nature: Nature becomes an object to itself through organisms that can think. So it's merely regional; thought's not everywhere. But at other times it seems as though you're speaking of Ideas in the Platonic sense, as things that exist independently of thinkers – and I think this is a reflection of an inconsistency in Schelling's philosophical trajectory. So, those are my two questions: what about the epistemological agenda of the *System of Transcendental Idealism*? And, is there a kind of oscillation in your book between the regionality of ideation and a kind of universality?

IHG: To take the second question first, it's fascinating, I suspect my answer to this would have been different a few months ago. But I think that what's going on is effectively that thought isn't everywhere all at once, but there are thoughts, wherever, at various times, and there's no region for which we can rule out thought occurring prospectively at any particular point. However, it remains true that thought does happen at such and such locations. That's the bridge, as it were, between the nature of thought and the thinking doing it – which is the inversion that Schelling explicitly undertakes in the epistemological work that he does in *System of Transcendental Idealism* – but it's an inversion premised precisely on the unrecoverability of the conditions of genesis of thought. So, he says, for example, 'the lamp of knowledge points only forwards'. This lovely line provoked a great deal of consideration on my part, and I thought – well, actually this is definitely true. And there is no prospect, really, of it being otherwise. Even the reflexive recovery of the conditions of production of the thought that is pointing only forwards would entail a lapse of time. Whatever comes after it would be a second, with the lamp shining in one direction rather than another as its *prius*, *but* that gives determinacy at the same time as it denies the possibility of recovery. And so it's the question of determinacy which I think is core to the epistemological project that Schelling pursues. This is the vexed question of the presumed identity between nature-philosophy on the one hand and the transcendental philosophy on the other. This is why, I think, Schelling says at the outset of the *System of Transcendental Idealism* that it's necessary to consider this as an adjunct, to consider it to be simply true that there's always a double series involved in thinking about thought, because it tends to be that they're closely related, I take it, in time, although I'm not sure. I'm not satisfied with that answer. I mean, it seems phenomenologically apt, but whether it's got any basis in the principles he offers for a consistent priority and posteriority, I don't know, or the *prius* … there are ways it can be worked out, perhaps. But the final thing, therefore, is the question of identity, which comes back to the question of the Ideas, and why the Ideas might be one and at the same time many, and yet the thinking of them may be potentially everywhere, and so on. This is really the core of the problem. Is Schelling a Platonist, a neo-Platonist, or some form of hyper-Platonist? So long as the 'Good beyond being', as it were, is not taken as being the entire anchor to the system of Ideas, which structure is then reproduced here on Earth. Schelling's conception of identity seems to me to go a long way towards explaining the possible relations between Idea and thought. He actually makes this explicit in *Presentation of My System* and *Further Presentation of My System*. On the one hand there are Ideas which are identical. *They* are identical; but not to the things they are ideas *of*. They're not ideas *of* anything – they're Ideas, and their identity is their being as Idea, fullstop. And that means that everything which is not them is in chaos, in flux, and so on. So the means by which to relate the Idea to the thinking is the concept. The concept is a partial grasp of the Idea, or a finite and differentiating grasp of an infinite identity. That's his description of it, which seems to me to do quite a better job than the 'double series' claim. In other words, if the proto-phenomenology of the double series is an explanation of an epistemology, it seems to me not as good as the neo-Platonic exposition by way of the difference between concepts and Idea in the later work. But what we have not got to deal with is an absolute identity of thought here and being there, in this hideous symmetrical way in which Hegel will pretend, and which bad readers of Parmenides always maintain.

Noortje Marres: This is a partly related but somewhat more general question, regarding realism as an epistemic question, a question of knowledge and of thought. Because listening to your talk, and also Ray's, made me think of other kinds of undoings of Kant in the twentieth century, because that's obviously taken many forms and has been launched on many different occasions. And one of them, I thought, had to do precisely with undoing the primacy of the epistemic. There you get arguments concerning realism as a question that must be taken out of the realm of epistemology if it is to be addressed pertinently, and this shift can take various forms. It can be a shift to historic ontology or a shift to ethics or embodied experience, with various consequences for the type of realism, obviously, that results. But I'm curious how, on the basis of the types of arguments you have presented now, what your position is on this question. Should it be preserved as an epistemic question, or is your mode of arguing actually moving along with this ontologising and making ethical of the question of realism?

IHG: I'm certainly ontologising, certainly *not* ethicising. I think one of the badges by means of which Kantianism is maintained, the reason why it remains a problem despite the various attempts to undo it, is because, all too often, the Good assumes authority over being, and it becomes possible to say things like, 'The universe ought to be…', and this statement is assumed to have philosophical significance. In fact, Fichte says just that. He started with an identity, a realism about, 'Here I am, what do I know about myself? Well, all this accidental stuff, plus I'm free, dammit! … and I'm gonna show it!' And that's the basis of Fichte's realism. He goes to great lengths to demonstrate this, but fundamentally, what he reserves the right thereby to do is to call realism the view that – and here I'm going to cite a passage from Kant – desire consists in being the cause, 'through one's presentations, of the actuality of the objects of those presentations'. It occurs in two places: in the *Critique of Practical Reason* and the *Critique of Judgement*.[7] What that means is that it's simply enough to will or desire it in order that it be, because being is secondary to acting. And that, it seems to me, is simply not true. It's transcendentally adequate only on certain conditions, and those conditions are that the remit of realism is maintained solely within the transcendental field, *i.e.*, solely within the field of possible reflection, so that I can always say, 'Oh well, I know I got run over by a bus, and I know that looks like the revenge of the not-I, but in fact I willed it thus!', which is what Nietzsche said, in effect. So I think there can be no liberality at that level, and realism can't be regionalised, as it were, nor said to be realism if it is dependent on the willed suppression of some external condition. An ethical realism is precisely not a realism, in the same way that a political realism is not a realism. In the same way, in fact – and I know this is contentious, but it seems to me a point that needs to be made – a *critical* materialism is *not* a materialism. Fundamentally, it's a materialism oriented, driven, steered, designed, by critique. In other words, it's a theory of matter held by people with some use for certain bits of it and none for others. How is it possible for critical materialism to think that there can be a difference between what *matters* and crude *matter*, you know, things like plants? So I think that there can't be any liberality at that level, that would be my answer. And the very fact that such positions are perpetuated is the reason why this needs to be done again.

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[7] *Ak*.V 9n. and *Ak*.V 177n., respectively.

GH: I can guess what you think of Marxist materialism.

IHG: Love it! No, it's simply wrong. The idea that it's possible to invoke a diminished realm, as it were, for matter and to condemn whatever does not fulfil the economic, teleological purposes of certain types of agents to a sphere of 'merely crude matter', where it has absolutely no effects whatsoever, where it's left to one side of the philosophical and the political problem, seems to me a recipe for disaster. If you're trying to do politics, if you're trying to work out, 'we need to do *x*, how are we going to do *x*, we need a strategy', and so on. What's the first thing you do? You take account of the environment, and so on. What's the first thing critical materialism does? 'I want a theory of matter, what am I going to do? I know, I'll ignore half of it'. That's just not good metaphysics, fundamentally. It's not a good way of approaching reality, it seems to me.

PH: But what about cases where you *do* will something to be true, though, or to be the case? I mean, just banally, holding a promise, making a commitment. There are cases in which something comes to be because you will it so, and politics would be completely disarmed if you lost that.

IHG: There's the Spinozist response to that: what I think of as my freedom is my incapacity to explain the cause of the event that I'm trying to describe. I move my arm because I will it so, or do I just not know the causes of my arm moving? That's the Spinozist answer …

PH: And like I said, that disarms, well, that *is* the disarming of politics.

IHG: Yeah, yeah it is. I think … fundamentally it seems to be a question about consistency of effects, at one level. It's possible that a series of actions can be maintained despite having, let's say, punctual conditions of production. So there seems to be a consistency of events, and they're all tending in one direction. I want to raise my arm because I want the bus to stop. So I stick my arm out and the bus stops – a triumph for transcendentalism! I have achieved the stopping of the bus by means of my will alone. Let's say that happens. It really does seem to be about a question of consistency, and the problem from the perspective I come from is how to explain the consistency, and I do acknowledge that's a problem. But do we explain it any more by saying that it's an act of will? I don't think so. I think the reason we move our arms is because we have arms to move, first and foremost, and because there are certain contours of the world that make that a possible gesture and a significant gesture: naturalistically possible and socially practical. It has outcomes. But the question of whether we should hold ontology ransom to political expediency seems to precisely re-present the problem of transcendentalism, in so far as the latter concerns 'what are the spheres of my legitimate autonomy, over what can I legislate?'

AA: Action and will do not only belong to the practical realm of philosophy. They go back to Descartes, in a sense, because will and action are the very necessary elements of thinking itself. Without willing to think there is no thought – so before it becomes the practical element, it's epistemic.

IHG: Again, this is a solution, I think, that's often tried. Let's say we've accepted the point that in order to think I have to will it, yes? And let's say I'm not thinking yet, but I will to think. I will to think, and then comes the thought. How can I will to think prior to the thought that I will to think being there? I can't. So the idea that there is a will that thinks thought for me makes sense if and only if that will is outside of me, is nothing to do with me. So it's not *my* will that causes the thought to occur. If we call it 'will' that presumably serves some additional ontology, some additional metaphysics – Let's say the Fichtean one, which does subsume epistemology, the theoretical under the practical. Let's say that's the aim. Then it begins to make sense to do that, but only given those caveats. Fundamentally, however, I don't think it's true that my thinking is caused by my will. Would that it were! For God's sake, then practical problems like writing papers late at night would disappear!

AA: But you don't have any criteria for the intensity of the receptivity of sense data here – that is, whether or not I'm aware of the intensity of what I'm receiving, reinforcing that data, and that I'm not just receiving it in a kind of semi-unconscious state …

IHG: Yeah, put it in the form of a question: What is the impetus to thought? Where does thought come from? If you can answer that question, then we can say what the source of the thought is. And the necessary answer, I would contend, is that it comes from nature.

Cecile Malaspina: And where does nature come from?

IHG: What's the ground of the ground? – absolutely. Why is there this nature rather than another, and so on? That's the principle of sufficient reason, that's the problem of ground. That's why I think it's an important question.

Ray Brassier: Obviously you claim that so-called transcendental metaphysics says that you can't be compromised by any concessions to folk-psychological superstitions. I wonder, then, what's the status of categories like 'production'? What happens to the conceptual register that you use – that Schelling used – to articulate this kind of transcendental philosophy? Given that transcendental philosophy, or even a nascent speculative materialism, is carried out using the semantic resources of natural language, doesn't there need to be a kind of dialogue between the critical and eliminative dimension of a properly scientific psychology which systematically undermines the viability of these folk-psychological categories, and the project of a transcendental metaphysics? In other words, this is why I think the relationship between ontology and epistemology can't be straightforwardly adjudicated from either side. For instance, imagine a Schellingianism informed by the Churchlands: recasting the categories of speculative metaphysics using the resources of dynamic vector activation patterns. So, doesn't this requirement for a dialogue with eliminativism mean that you have to kind of stipulate a revisability in terms of even the most fundamental conceptual categories you use, such as productivity or production?

IHG: Okay, let's start with the question about the Churchlands. It's not hard, actually, to make the Churchlands into Schellingians. In fact, at the end of Patricia Churchland's *Neurophilosophy* – the biggest manifesto ever written – she says, 'So it is that the brain investigates the brain […] and is changed forever by the knowledge',[8] which seems to me perfectly Schellingian. There's an absolute symmetry there between what she's arguing and what Schelling discusses in his own epistemology. How do you anchor the knowing of things, as an extra product, in the being of those things that you want to know? So there's a new entity in being. That's the way of addressing the problem. So I don't think, philosophically, metaphysically, that there's a problem there. I do think, however, that there's a point when the epistemic demand makes demands on ontology that ontology can't meet, when we have to ask, 'is this a correct epistemological approach?' But that's the way around to do it, I suspect. So, for example, this is the method of eliminativism: I'm investigating an object, call it a car, and this car, it is alleged, drives by itself. Now my job is to explain how it is that the car drives, and at the end of the explanation it should be clear. The false explanations have been gotten rid of and a good explanation put in their place. So, let's say all those criteria have been satisfied, let's say that is achieved. What has the theory achieved at the epistemic level? It's managed to produce exactly that explanation. What's achieved ontologically? It's managed to commit itself to an ontology which requires that things that do not exist exist in order that they be eliminated. So it's ontologically inconsistent but epistemologically necessary. I can see its virtue, or I can see its requirement epistemologically. But the question must be put, I think, the other way around: If we work out what the ontology demands, then that provides a means of working out answers to the differences between good and bad explanations, whatever they might be. My suspicion is that otherwise we find ourselves backed into an unsustainable metaphysics of not-being. You called it a 'dialogue between the critical and the ontological' – but that's exactly what Kant maintains metaphysics should be replaced with, a critical dialogue where fundamentally Reason will have the ultimate say. So I think it really is a one or the other question, at that level. The question becomes, how do we think about the problem of epistemological rectitude without invoking, as it were, the transcendental categories?

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[8] P. S. Churchland, *Neurophilosophy. Toward a Unified Science of the Mind-Brain* (Cambridge, MA: MIT, 1990), 482.

PRESENTATION BY GRAHAM HARMAN

Firstly, I'd like to thank Ray Brassier for conceiving of this event and organising it. This all started for me about a year ago, when Ray came back from Paris and he strongly recommended that I read Meillassoux's book, *Après la finitude*, which you should all definitely read. And from there I got into Iain's work, and from reading these works, there are definite points in common, which I've had plenty of opportunity to enjoy over the past year.

'Speculative Realism', first of all, is a very apt title, because realism, of course, is very out of fashion in philosophy. And I think one of the reasons it's out of fashion is that it's considered boring. Realism is the philosophy of the boring people who smack down the imaginative ones and force them to take account of the facts. G.E. Moore supposedly held up his hand and said: here it is, external objects exist. Yes, but that hardly exhausts the field of reality! And as yesterday's Lovecraft conference[9] title indicated, realism is always in some sense *weird*. Realism is about the strangeness in reality that is not projected onto reality by us. It is already there by dint of being real. And so it's a kind of realism without common sense. If you look at the work of all four of us, there's not much common sense in any of it. The conclusions are very strange in all four cases. In Ray's case you have a reductive eliminativism, and you end his book with the husks of burnt-out stars and the meaninglessness of everything. That's not something you usually get in G.E. Moore and those sorts of realists!

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[9] A one-day conference, 'Weird Realism: Lovecraft and Theory', held under the auspices of Goldsmiths Centre for Cultural Studies on 26 April 2007.

In Iain's book you have a pre-individual dynamic flux that somehow meets with retardations and becomes encrusted into rivers and mountains. In my work you get objects infinitely withdrawing from each other into vacuums and only barely managing to communicate across some sort of qualitative bridge. And of course in Quentin's philosophy you get no causal necessity whatsoever. Everything's pure contingency. These are not the sorts of notions one usually associates with realism. Metaphysics is usually thought to be concerned with wild, speculative sorts of ideas, and speculation is usually not considered a form of realism. You hear 'speculative idealism', not ' speculative realism'. Another obvious common link is a kind of anti-Copernicanism. Kant is still the dominant philosopher of our time. Kant's shadow is over everyone, and many of the attempts to get beyond Kant don't get beyond Kant at all. I think Heidegger is a good example of this. Heidegger's a great example of the 'correlationist', in Meillassoux's sense.[10] Obviously, we all think of Kant as a great philosopher. But that doesn't mean he's not a problem. It doesn't mean that Kant is the right inspiration for us, and in fact, I hold that the Kantian alternatives are now more or less exhausted.

One of the things I did to prepare for this conference is to put each of our names on an index card, and I was shuffling them around on my table in Cairo, trying to group us together in different ways. And you can come up with different combinations in this way, various differences between us despite the shared similarities. I came up with some interesting ones; but if you were going to say what distinguished each of us, I think it's fair to say – and they can contradict me if I'm wrong – that Ray is really the only reductionist or eliminativist, Iain is the only dynamist, I'm the only phenomenologist, and Quentin is the only one opposed to causality *tout court* – there's no chance of any necessary relations between anything in his vision of the world. And you can also see different influences in each case. In Ray's case, I think: Badiou and Laruelle. Those are the two chapters that seem most central to me in his manuscript. And cognitive science, of course. In Iain's case: German Idealism, Deleuze, Bergson, and his own reading of Plato. In my case: Husserl and Heidegger, with a bit of Leibniz and a bit of Latour. And in the case of Meillassoux: Badiou, of course, but also, I see a lot of similarities between him and David Hume in many ways; not only the clarity of his writing style, but even some of the arguments, seem Humean in inspiration.

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[10] For 'correlationism' see **Collapse** Vol. II (March 2007).

Before I comment on the work of the other three on the panel, maybe I should give a quick summary of my own work. It all started for me with Heidegger. I don't think I was ever quite an orthodox Heideggerian, but I certainly loved Heidegger very much. And early on in my graduate studies, I was focusing on the tool-analysis, the way things hide behind their facades as we use them. And it occurred to me at a certain point fairly early that all of Heidegger boils down to this. There's really just one fundamental opposition that keeps recurring, whether he's talking about being or tools or Dasein or anything else: a constant, monotonous reversal between the hiddenness of things and their visible presence-at-hand. And it started as just a reading of Heidegger, and there wasn't really any metaphysical inclination whatsoever at that point.

What first started doing it for me was when I was writing an article on Levinas a couple years after that, and trying to piece together Levinas's theory of how the human subject breaks up the unity of being and hypostatises it into individual things. And this struck me as so inherently preposterous. I'd never really thought of it that clearly before, but the more you think about it, why should it be that the human subject breaks the world up into parts? This actually has a precursor in the pre-Socratics; it was Anaxagoras, for whom *nous* makes the *apeiron* rotate very quickly, and it starts breaking up into fragments, and so it's mind's fault that the world has parts, and each of the parts contains all the others and mirrors all the others. But you see that in Levinas, too. And I realised I was opposed to that, but I didn't quite have the language to start defining why that was so. Then, for my dissertation – which is now *Tool-Being*,[11] the book – if you look closely at Heidegger's tool-analysis, what he's explicitly saying there is that the floor you're using now, the air you are breathing now, the bodily organs you are using now, tend to remain invisible because you're simply using them. You're not staring at them, you're not creating theories about them. Fine, it's a great concept, arguably one of the great insights of twentieth century philosophy. The equipment tends to remain invisible as long as it's functioning solely as equipment – fine. But that can sound like the old reversal between theory and practice. One of the great things about playing with an idea in your mind for a long time is that you become bored with it after a few years. That's why I think we often make progress, because we have a great idea, then we become bored with it and see its shortcomings – and that's what happened to me. I started realising: this is not going to be anything more than 'practice comes before theory', and 'praxis breaks down when the hammer fails'. It also occurred to me that praxis does not get at the reality of the object any more than theory does – that was the next step. Yes, by staring at this chair I don't exhaust its being, but by sitting in it I also don't exhaust it. There are so many deep layers to the reality of that chair that the human act of sitting is never going to exhaust. Even if humans created the chair, even if only humans see it as a chair, there will still be, I'd say, an infinite number of qualities in the chair itself that cannot be exhausted by any seeing or by any counting. So now I had both theory and practice over here, both on this side. On the other side, the causal relations seem to be happening in the depths. But the problem with causal relations is, you really can't say that inanimate objects exhaust each other either, and this doesn't even really get into the whole panpsychism debate. Fire does not have to be conscious to turn cotton into a caricature. (I always use fire and cotton because that's the great example from Islamic philosophy, which I've read a lot of since moving to Cairo.) The cotton has a scent, a colour, numerous other attributes we can speak of, and they're irrelevant to the fire in those senses. And so, it became to clear to me that as soon as you move away from the idea that the world is a homogeneous unit, as Levinas or Anaxagoras think, then you have a world with many parts. And as soon as you have a world with many parts, they're going to interact. And if they interact they're going to have the same relationship of caricature to each other

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[11] Graham Harman, *Tool-Being: Heidegger and the Metaphysics of Objects* (Chicago: Open Court, 2002).

Graham Harman

that we have. And reading Whitehead at about the same time really cemented that idea, that you cannot privilege the human relationship to the world of over any other kind of relation. Whitehead's still the best source for that, I think, even better than Leibniz, because for Whitehead it can happen at all different levels and sizes. With Leibniz there's always a privileged caste of substances that are natural, and you can't talk about an international corporation having relations with real things. But for Whitehead you can, and for Latour you also can. So Whitehead was one key, and another key was Zubiri, Xavier Zubiri, a Basque ontologist who studied with Heidegger and Ortega y Gasset, who's not as well known as Whitehead, of course, but who I think is a pivotal twentieth-century thinker. Because his idea is that the essence of the thing is never adequately expressible in terms of any relations or any interactions with it, and so that's where the kind of vacuum-sealed objects withdrawing from all relations came into my work, from Zubiri.

And then what I did in *Tool-Being* was that I more or less showed how a lot of things – Heideggerian concepts such as time and space and referential contexture, and all these things – boiled down to the tool-analysis; that was Chapter 1. In Chapter 2, I took that and used it as a weapon against all the things commentators usually say about Heidegger. In Chapter 3, I simply tried to turn in a more speculative direction. And I can make this short, because the real speculative problem that arises from this immediately is that if you have objects that are incapable of contact, why does anything ever happen? Given that it is in the nature of things to withdraw from all relations, you have a real problem with causation. One thing can't touch another, in any sense at all. And this immediately got me thinking about occasionalism in the history of philosophy, of course, where, before the French you had the Arabs – in Iraq you had the Ash'arite school of theology. And of course this fits a lot more easily in Islam than it does in Christianity, which never had any real occasionalists in the pre-modern period, because for the Muslims, in that period at least, if God sends an innocent man to hell, so be it. God is all-powerful. It doesn't create a paradox of free will, as it did for many Christians. So you see that first in the Arabs. It's not only a threat to God if other entities are creators, in the sense of creating the whole universe – obviously there has to be only one entity that can do that – but things like creating furniture and brewing coffee would also somehow denigrate God's power, if individual agents were able to do this themselves. And so God is there to explain all actions, recreating everything constantly. And although the theology seems a bit outrageous to us now, it's a very profound metaphysical idea, the idea that things cannot relate, inherently, that things-in-themselves are totally sealed off from each other. We see this come back in the seventeenth century in Europe of course, and historians of seventeenth-century philosophy are often extremely finicky about who they allow to be called an occasionalist: just Malebranche, Cordemoy, and maybe a couple of other French names. I see no reason not to expand it to include Descartes, and I would also say Spinoza, and Leibniz, and definitely Berkeley. I take the name occasionalism in a very, very broad sense: any time that individual entities do not have causal power you're giving in to a kind of occasionalism. And then Hume is the important final step. Skepticism in many ways is simply an upside-down occasionalism, and it's no accident that Hume was a great fan of Malebranche. Hume owned Malebranche's books, marked them copiously, and here you have a hardcore theist and there an unrepentant atheist. The connection between them is the fact that in both cases you have the problem of things being unable to relate directly, and the difference of course is that for the occasionalists, in the classical sense, you have independent things in the world that are apart from each other from the start and the question is how they relate. In a sense, with Hume you already have their relations. We're already born into a world where there are habits. Things are linked in my mind already, and the question is only whether they have any existence outside it. So Hume starts with relations, whereas Malebranche starts with substances. I think in both cases the solution is incorrect, because in both cases they're privileging one magical super-entity that is able to create relations where others cannot. So for the occasionalists: 'No one else can do it? Oh, God can do it'. For Hume, my mind does it, my mind creates objects ('bundles') through customary conjunction, creates links.

So, the question is how we can have a form of indirect causation that does not use God as the solution – which would lead us back into the discredited old forms of theological philosophy – and which equally does not use my mind as the solution, which would lead us ultimately to idealism, as Hume eventually did lead us. How do we have a realist version of occasional causation, without laying everything on God? And I coined the term 'vicarious causation'[12] just because whenever I mentioned occasional causation people always laughed – that was the first reaction, and I realised it was hopeless to keep this term for myself! It's too associated with doctrines that have been refuted by undergraduates for the past three hundred years, so I had to invent this new term. So I speak of a vicarious theory of causation; but where does this causation happen? That was a mystery to me for a long time, and the mechanics of it are still a mystery to me. The *Collapse* article is about as far as I've gotten; I've gotten only a little bit further than that. But I got the answer from Husserl, of all people, because what we have in Husserl is a second kind of object. Neither Heidegger nor Husserl are really realists, I would say. They both focused too much on human access to the world over the world itself. But in Heidegger we have these tool-beings, these objects; they're real objects, they withdraw from us, they do things in the world outside of our access to them. What you have in Husserl – which is often confused with Heidegger's own discovery – are the intentional objects. If you read the whole first half of the *Logical Investigations*, after he's done refuting psychologism, his real enemy is British empiricism, and what he is up against is the notion that what we encounter are qualities, and that somehow the qualities are bundled together by us. Somehow the objects are not given for British empiricism. What's given are qualities, and those qualities are fused together by the human subject. That's what the entire phenomenological tradition most opposes, I would say, because in Husserl you have intentional objects. You have this table, which I'm only seeing the top surface of, I'm not seeing the front of, as these people [*indicates audience*] are. I'm not seeing the bottom of it. I could circle around it, crawl beneath it and look up at it. All of these changing perceptions, though, do not lead me to think I'm seeing a different object. I think I'm only seeing different aspects of the same object. This table is not hidden from me like the tool-being of the table, like the real table would be. It's here. I look at it, I see the table. I'm not seeing all aspects of it at once, but I am seeing the table, not just scattered qualities. Furthermore, this table is not the same as the real table in the world, doing its own independent work, because the one I think I see might not exist – hallucinations do occur. And so intentional objects are not the same as real objects, despite what Husserlians always tell me. There was a big fight in Iceland last year with the 'Husserlian mafia' – they tried to tell me that intentional objects are the same as the tools, because they want to say that Husserl discovered everything that Heidegger did eight years earlier. It's not true!

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[12] See **COLLAPSE** Vol. II, 171-205.

One other point about Husserl: Husserl made another bizarre discovery that no one ever talks about, which is that one object contains others: namely, consciousness. My intentional relationship with the table for Husserl can be viewed as a unit, the relation itself as a whole. Why? Because I can talk about this relation, I can retroactively think about it, I can have other people analyse it for me – because, that is, other phenomenologists can analyse my relationship to the table – and none of those analyses ever exhaust the relation, which is enough to make it an object. That's the definition of the object: not a solid, hard thing, but a thing that has a unified reality that is not exhausted by any relation to it, so that the intention as a whole is one thing. But then within that intention, notice there are two things contained. There's the table and there's I myself, both contained within the intention. And there's an asymmetry here because this table is simply phenomenal; I myself, however, am real. And you can reverse it: if the table's actually encountering me, which might not happen then in that case, when you look at the relation asymmetrically in the other direction, the table is the real object in that case and I am the phenomenal object being reduced by the table to a caricature of myself. I know it sounds strange. But I generalise from there to say causal relations always occur on the inside of a third entity. It's not just something that's true of human consciousness and phenomenology. Containment is what a relationship *is*. 'Relationship' means: a real object meeting a sensual or intentional object on the inside of a third real object. And there are incredible problems trying to work out exactly how this happens. There are paradoxes that arise, and I started putting together the puzzle pieces in *Collapse II* in that article 'On Vicarious Causation'. And that's where the project is today. So I hope that gives some idea of what I'm doing so I can better situate it with respect to the other three, who I think are a very good match for what I'm doing. I think Ray chose exquisitely in this case.

I'll start with Ray since he went first. What is always refreshing for me in dealing with Ray and conversing with Ray is his knowledge of and sympathy for the empirical sciences, which is extremely rare in our discipline. Especially in the case of cognitive science, because, probably like most of you, I grew up in an environment where the name of the Churchlands was always spoken with a wince and a sneer. I don't know the work of the Churchlands nearly as well as Ray does. I just picked up Metzinger and am looking forward to reading that, but I don't know these things that well. So that's extremely refreshing. Ray, like the rest of us, does not want to see the human subject privileged in its relation to the world. The idea that our relation to the world is special could be eliminated, that it is a kind of folk-psychology, perhaps, I agree with him on all that, definitely. The two ways in which we may differ … Ray is something of a reductionist, because you heard his objections to me earlier about the hobbits, and he's mentioned the tooth fairy to me before. These are good objections. Are they really as real as solid physical objects? I'll address that one first. The point is well-taken, and this is a flaw in the Latourian position, I think – the position from which I come. Since I diverged from Heidegger, Latour was one of the first life preservers I grabbed on to, since he treats all objects on an equal footing, and I like that part of him. But I think there is a problem. You have to be able to explain reduction, and the way he does it is from the principle of “irreduction”, which is to say, yes, anything can be reduced to anything else, as long as you do the work to show how it’s related. Now this puts too much of the power in the hands of the human scientist, I think. Isn’t it necessarily the case that some things just *are* inherently reducible to other things? I think that’s probably true, and so I wouldn’t want to go the ‘irreduction’ route. I think there’s got to be a better way to solve this problem.

Ray is also opposed to the ontological difference, which is something I’ve retained as a Heideggerian. I don’t use that term, but for me the ontological difference is the difference between the thing itself and its relation to anything else. Now, I think Ray’s rejection of the ontological difference goes hand in hand with his reductivism, because, for Ray, you wouldn’t need anything hiding behind anything else, right? You see certain things as symptoms or epiphenomena of other things, which are in fact real. Then you get to that real level, and then you try to reach something that’s different from where you started. Now, what I would ask Ray is, how do you avoid what I would call, not naïve realism or speculative realism, but ‘*disappointing* realism’ – my term for Kripke, whom I like very much. Kripke is my favourite analytic philosopher by far. He explodes so much of analytic philosophy, and turns it into metaphysics, by simply saying that Russell and Frege are wrong. A name does not refer to all the qualities we know about a thing, because I can learn that some of the qualities

I thought I knew about you were false and yet I'm still pointing at the same person. So there is something there that I *stipulate* to be you that is deeper than the qualities somehow. And he even criticises Strawson and Searle, who give us the watered down 'cluster theory': 'well, you only have to be right about *most* of the qualities you knew about the person'. But does that mean 51 percent of them, or a group of the most important? And so I follow Kripke in his critical portions, that you have to be pointing at something deeper that is essential and the same, that is not reducible to surface qualities. But the reason I call it 'disappointing realism' is because it ends up being the physical structure of things, for Kripke, that is real about them. So what's real about gold is that it has seventy-nine protons. I find that very disappointing. What's real about each of you is that you had to have the two parents that you had – which, first of all, is genetically false, right? You could get the same DNA, by some outlandish chance, through two different parents. And it just doesn't quite seem like it's my essence, somehow, to have come from those two parents. So, yes, I would like to know if you are committed to such a reductionism. For me, it's easy to escape that problem because I have all these different levels, Latour has all these different levels, and even if we have a problem in showing how things reduce, the reductionist position has the more profound problem of explaining what that final level is that endows something with reality. Is it just the physical structure or is it something more? If it's not a physical structure then you could be in some kind of weird idealism, where you have, I don't know, brain-states floating around … Pan-psychism seems to be coming back in fashion among some of these people. Even rocks and tomatoes have some primitive form of intentionality. So I'd like to know what Ray ends up with as his final stage once eliminativism has succeeded. That would be my question to him.

I'll go on next to Iain – I'm going in the order of the programme. I was cheering him on the whole way as I was reading his book. I am completely sympathetic to the idea that metaphysics and physics are the same, because one of the problems with physics now is that it's not metaphysical *enough*, I would say. It doesn't ever really raise the question, for me, of what causation is, for example. It argues about whether causation is statistical or whether it's retroactively caused by the observer, but it never really gets into the nuts and bolts of what happens when one thing touches another. I think it needs to become more metaphysical, and in 'On Vicarious Causation' I suggest that this is how philosophy can get out of the ghetto. We've been so terrified by the sciences for the past two hundred and twenty years. We find ourselves in this ghetto of human discourse and language and power – probably because we're afraid of stepping onto the level of nature. We're afraid that we don't have the resources, but I think we do. I think in Iain's book you can see there are tools for this that we already have. I'm also very sympathetic to his idea that inversions of Platonism are completely useless, because they keep you trapped in the same two-world theory. So, Nietzsche – great, he flips it over – but then you still have the same opposition between appearance and Platonic Ideas. Another thing I love about Iain's book is that it finally made sense of the *Timaeus* for me. There was a great fad for the *Timaeus* in the 1990s due to Derrida's *chora* essay and, even worse, through John Sallis, which really turned me off! So I never really understood it. Three years ago I had to teach the *Timaeus* because I had to take over the class for someone at the last minute, and I wished he had ordered any other dialogue than the *Timaeus*. But finally, after reading Iain's book, it's starting to become real to me: *Timaeus* is the site of a one-world physics, a physics of the Idea in Plato – it's wonderful. Your critique of Kant, I like that, and you cite Badiou as saying we need to overturn Kant, not Plato. I agree with that. I also completely agree with the idea that life-philosophy is always an alibi. Life-philosophy is an alibi for refusing to deal with the inorganic. Why do people like David Farrell Krell always go straight to life and never talk about rocks? What's so sexy about life? You see, it's an alibi, and it's a way to stay close to the human while claiming that you're going deeper than that somehow. Iain also leans toward anti-eliminativism, as I do in my own temperament, which makes us different from Ray, to some extent. And finally, I think, another thing that unites us, maybe more than the other two panelists, is that we are more ambivalent towards Badiou, I've noticed, although we both respect him. You criticise Badiou for giving us only this alternative of 'number and animal', and say that this is not a real alternative. You point out that it fails to capture the geological and other things, and I would tend to agree with that. And I also miss a philosophy of nature in Badiou. For me, the problem is – as I said in my review of Meillassoux's book in *Philosophy Today*,[13] – is the inconsistent multiple in Badiou really multiple? It doesn't really seem to do anything other than haunt our current count, our current situation. But the proper multiple would actually need to interact apart from the subject. It doesn't seem to me that it does so in Badiou, and that's why I would not call myself a Badiouian, though *Being and Event* is a fantastic work of speculative philosophy, the best one I can think of since *Being and Time*. I really appreciate the ambition of it and many of his strategies for attacking certain things.

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[13] Graham Harman, 'Quentin Meillassoux: A New French Philosopher', *Philosophy Today*, Volume 51, no. 1, Spring 2007: 104-117.

So those are some of the things we agree on. There's really just one central disagreement between me and Iain, and it's a huge one, and it leads into a disagreement about the history of philosophy. The big difference is that Iain is against what he calls "somatism" and I'm totally in favour of it. For him, philosophy is not about the bodies, it's about a deeper force prior to the bodies from which the bodies emerge. For me it's nothing but objects, there is no pre-individual dynamic flux that surges up into various specific individuals. And I suspect there's some influence of Deleuze here, in this position. The objects themselves don't seem to have the power to interact, it all happens at a deeper level. Now, that leads to a big disagreement about the history of philosophy, because he sees Aristotle as being on the same side as Kant. He sees Aristotelian substance as being on the same side as the Kantian phenomenon, which I wouldn't agree with. There are times when Aristotle refers to substance as equivalent to the *logos*, but I think there are more places where he says the real can never be adequately expressed in a *logos*. So I would never go so far as to say that an Aristotelian chair is the same as my perception of a chair for Kant. I would say Aristotle's one of the good guys if you're a realist. He traditionally has been seen that way, so Iain's making a radical move by saying Aristotle's actually on Kant's side, and Plato's one of us – counterintuitive, but interesting. I would say we need to retain Aristotle on our team. I would say the Aristotelian forms are not mathematical formalisations. They are substantial forms, and substantial forms can hide from the *logos*. In fact they do hide, because the *logos*, I would say, never adequately exhausts them. And I would also oppose Iain and defend product over productivity, which I know is very unfashionable. In recent decades the avant garde has always been about process and not product. I would defend product over process, because I think much of process is lost when the product is created, and you don't need to know the process. Much information is lost. Yes, it's true that causation is productive. This is DeLanda, actually, not Iain, but Iain might have said something like this. Causation is productive because there's always more in the effect than there was in the cause. It's also true that there is less in the effect than there was in the cause, because I think many things about the cause are eliminated from the product. Different processes can yield the same object. But my question to Iain would be: Why not just have objects all the way down? Why do we need to have a unified dynamic nature? And notice he talks about geology, but he never, unlike Latour, talks about technological objects – oil rigs and things like that – because the different kinds of objects are less important for Iain than the deeper natural forces that all objects stem from.

Now, on to Meillassoux. There are so many things to admire about Meillassoux's book. Stylistically, it's very clear and economical. You never feel that he's wasting your time. Something Ray said over coffee either last night or this morning is that analytic philosophers would be shocked if they read this. They would say 'This isn't the French philosophy we heard about', because he's actually making rational arguments, step by step deductive arguments, which analytic philosophers pride themselves on doing, as opposed to those from the continental tradition. At first the argument about causation using the Cantorian transfinite was less convincing to me than the others in the book. But I've been thinking about this more for the past few weeks, and it's growing on me. So are there other ways to use the transfinite to solve other problems like this, such as the bogeyman of the infinite regress? Could you talk about a transfinite regress instead? I'm not sure how you would do that, but I've been toying with these ideas. You can certainly do it in the other direction: the universe is getting bigger and bigger and bigger. However big the universe is defined there must be a bigger universe, and physics seems inclined to support this lately.

Disagreements? The main disagreement here is obvious as well, which is: causation is the key for me, and for Meillassoux causation disappears. In some ways he leads us to a more chaotic universe than Hume does, because as Meillassoux himself says, Hume really doubts whether I can *know* that there's a causal relationship between things, whereas Meillassoux *knows* that it's absolutely contingent, the way things happen. He absolutely *knows* that there's no causal necessity between things. And that might be a brand new gesture. I don't know anyone else who has done this. He's doubting the Principle of Sufficient Reason while keeping the concept of non-contradiction, and he's thereby doubting necessity. But he actually goes further than this, and he doesn't talk about this much explicitly, but in my view, since he is saying that everything is *absolutely* contingent, what he's really doubting is that there's any relationality at all. Everything's absolutely cut off from everything else, because if one thing could be connected to another or could influence another thing, then he wouldn't have absolute contingency anymore. He would sometimes have relations between things and sometimes not. So it seems to me that absolute contingency entails no relations at all between anything, and this is why I have called Meillassoux a hyper-occasionalist, because he doesn't even have a God to save us from this problem. And unlike Hume, he does believe there's an ancestral world outside of us that exists, and it's totally outside of our minds, and we seem to have no access to that either, because that would require a relationship between me and what's outside of me, and that also seems impossible. So maybe I can know *a priori* that there's an ancestral world, and I may also have these qualities in my mind that are somehow linked in my mind, but – according to my reading of his system – there's really no hope of linking these things. It seems to me that in his system nothing touches anything else at all, not even partially, so in that way we're very close in our positions. The difference is that I try to find some solution so things can relate through the back door somehow, and he doesn't do this. And this leads to several other related problems.

So my first question to Meillassoux is: Does a thing touch its own qualities? He may disagree with my assessment that he's saying that nothing relates to anything else or touches anything else, but if he accepts that reading of his system, the question will come up as to whether a thing can even touch its own qualities. What is the relation of a thing to its own qualities? Within the mind, things do seem to relate, because there are many things in my mind at once, so there already is a kind of relationship. This is the criticism I made of Hume – you're starting with a relation. I see different splotches and colours and shapes around the room, and they are somehow related, because they're all in my mind at once. Also, if it's true, then there would be no relation between my perception of the world and the world itself. So that even if we know through his brilliant argument at the beginning of the book that there must be an ancestral realm outside of knowledge, what's the bridge between those two? How does my knowledge have any correspondence at all with what's out there? Correspondence seems impossible and so does unveiling, on Meillassoux's model. How does my mind relate to the world? And finally, what are the things outside the mind? Because if it's true that there's a problem, for Meillassoux, of linking a thing to its qualities, this means you have nothing but disconnected qualities outside the mind. And that doesn't make any sense to me, because, as I mentioned earlier about Merleau-Ponty, the black is already impregnated with the thing of which it is the blackness. So there are already these bridges in perception, and I would say, then, in causation as well. So, my question or objection to Meillassoux – and again, he might disagree with this reading completely – is that he's dealing only with necessity and contingency. Isn't there a middle ground, and isn't that middle ground a relation or interface? Because when two things relate, when you talk about a relationship, well, that's not absolute contingency, because they are affecting each other, right? And necessity implies almost a lack of separation between them, since it implies a kind of seamless mechanical whole in which an action already contains its effects. What a relation really consists of is two things that are somehow partly autonomous yet still manage to influence each other. And so my question is: Is there any possibility of interface in Meillassoux's system? Can one thing influence another without there being a necessary relationship between them? And finally, my real objection to him is that he hasn't published his system yet, because I'd love to stay up the next three nights and read it! That would be great reading. He says he's got multiple volumes coming, six or seven hundred pages. I would be delighted to read this right now, so please hurry! Alright, now I'll listen to the responses from my fellow panelists.

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Ray Brassier: I take your point absolutely about the unfeasibility of reductionism. I think you're right. There are two problems: inter-theoretic reduction is often intractable, but even intra-theoretic reduction, even within a single theory there are often intractable problems associated with trying to reduce something to something else. So in a way I think that's right, and it's my own fault for over-emphasising this, over-egging the pudding, in my objections to a straightforward ontological univocity. But I do think we can revise the criteria in terms of which we ascribe reality to something. So, I would favour the term 'revisionary materialism' – which, before the term 'eliminative materialism' was canonised, was a plausible variant. In other words, the point is that you're not throwing something out, you're replacing something and amplifying and augmenting what you know and what you understand. This is the important thing. So, for instance, the elimination of gods, goddesses, all sorts of supernatural aspects – that can be understood as a diminishment of the world, but surely that would be kind of a parochial perspective! It's the amplification, it's all the other things we know about that's important. The point is that science has *multiplied* the kinds of things that exist in the world, it hasn't *diminished* them. So it seems to me to be a mistake to think that science and the amplification of our cognitive capacities is about having to give lots of things up and having to eliminate things. Sure, we eliminate things, but only in order to re-describe them as vastly more interesting and complicated things.

The second thing is, I think you're also right that it's unfeasible to claim that there's some kind of ultimate ontological substrate underlying appearances. This is the reason why I think materialism is highly problematic and, as Iain pointed out, it seems to dissolve into some form of alibi, a claim about the primacy of practice or suchlike. Because once physics has eliminated any kind of substantial understanding of materiality – and the whole point about the critique of metaphysics is the destitution of substance, of the idea that substance is the ultimate stuff of the world – materialism doesn't make any sense unless you adopt a materialism of process, of pure productivity, which I accept is entirely viable. In which case I think the problem then becomes one of convincingly explaining the interruptions or discontinuities in the process.

So I would say that there's no limit to realism. It's crucial not to have a parochial definition of realism in terms of available semantic or cognitive categories, because we will invariably end up revising or even abandoning them. The reason why I think epistemology is important is because of history, and because it's impossible to fix a moment in time and say now we really know everything there is. There's always a kind of dynamic and a revisability about the way in which we understand the world. And what's interesting about science is just how much it enriches the categories and the criteria we have for making differences in the world. So it's not a diminishment at all, it's a fantastic enrichment and amplification of our discriminatory capacities. We can make all sorts of differences that it was impossible to make previously. So that's my response, basically.

GH: You defended reductionism less than I thought you would. One of the things I like about talking with you is always the way you force me to think about this problem, because it is a problem. In a sense, it's hypocritical to say that nothing can be reduced to anything else, because what does philosophy do? Philosophy takes a very complicated world and reduces it to four or five structures that explain everything else. I guess all the sciences do this as well. Your point about how science has complicated things is also a Latourian point. He sees modernism as hypocritical. At the same time that it's trying to purify the natural from the cultural, it's also creating a multitude of Frankenstein-like hybrids that are crossing over the gap. The ozone hole is both natural and socially-constructed and narrated at the same time. So things only get more and more complicated. How much reduction actually happens? Often when we 'reduce' we are really just explaining things in terms of a new sort of belief. Chemistry is more complicated in the Periodic Table than it was before, in a sense. They weren't just reducing, were they? Although Mendelev did reduce chemicals to a small number of elements via the Periodic Table, he also pointed to a host of new elements and chemical properties that had not been suspected before. I think that's all I have to say, but I'm sympathetic to the idea that reductionism should not just be thrown out. We have to be able to do a better job of showing how the tooth fairy is less real than a forest.

Quentin Meillassoux: I would like to say to Graham that there can't be any contradiction between our positions, and I will try to show why. I try to elaborate a principle, the principle of factuality, which says that only contingency is necessary. Not merely that contingency is necessary, but that *only* contingency is necessary. So, what do I try to do? I try to demonstrate that contingency has properties, fixed properties. And why do I have to demonstrate it? Because contingency is necessary, and a discourse about something necessary must be a demonstration. And if contingency and only contingency is necessary, everything which exists is contingent. So, I can't speak about what exists. I can't speak about what exists, because it is contingent. Now, what can you do with that which is contingent? You can describe it. What I try to demonstrate is that if you want to speak about what exists you can only *describe*, as phenomenology does – phenomenology is a description. If you want to know where I am, where my system is, in relation to your thinking, the connection lies in the fact that you describe things. It is necessary that phenomenology must be description, because, unlike what I do, phenomenology speaks about things which effectively exist. And what I try to do is to show that if you can describe it, it's not for a contingent reason. It's because what exists is just *a fact*. It's a fact that there is relation, that there are really substances, *etc*. And if you want to know how my work relates to what you describe, I would say, maybe it concerns the 'withdrawing substance', because what withdraws from description, for me, is the *fact* that it is. The fact that the thing *is* cannot be described. You can describe *what* it is, *how* it is, relation, *etc*., but that relation, substance, *etc*., are facts, and because they are facts you can only describe them. In my language, this is 'ontical' description. Ontical – concerned with what there is. But the *ontological* is concerned with demonstration. The discourse of being is, for me, demonstration, because for me, to be is to be a fact. Why do I say that? Because when you try to speak about being, you have this problem: for me, Heidegger doesn't speak about being. He speaks about modalities of being – conscience, Dasein, *etc*. That there is something, of course, he speaks of it, but it is very difficult to see if he really manages to produce a discourse about it. For me, if you want to have a discourse, an extended discourse, about this very narrow fact that there is something, you must remark that for something to be means the *fact* that it is. The fact, it clearly means to be, and I just speak about this invisible property, this invisible reality of things. Because animals, etc., don't see factuality, we don't see factuality. We *think* it. So you speak about what there is, whereas I speak about this, that it is a fact. There could be another world than ours. So my conception is not to deny the existence of relations but just to affirm their factual existence.

GH: Okay, but the relation between anything I see and what it might be representing? There doesn't seem to be any such relation for you, because what's withdrawing is the factuality rather than the subterranean being of the table, or something like this.

QM: It is not a necessary relation, but it is a relation. I say that laws exist. There are laws. For example, if I'm a Newtonian, I can say there are gravitational laws. I don't deny the existence of laws. I don't deny the stability of laws. Maybe these laws will persist for eternity, I don't know. I just say that it is *possible*, really possible, that laws just stop working, that laws disappear. They are facts, just facts, they are not necessary. It's not that you say that if something is contingent, you say that that it doesn't exist. It's factual, that's all. I fully uphold your right to be a phenomenologist, if you want to speak about things, because you have to describe them.

GH: Right. This is very helpful. I'm seeing your work differently now. There are relations, they are the relations of something contingent. Yes, that makes a lot of sense.

QM: What is strange in my philosophy is that it's an ontology that never speaks about what is but only about what can be. Never about what there is, because this I have no right to speak about.

GH: Wonderful. I need to think a little more. Maybe I was reading too much into this by interpreting that there were no relations between anything at all in your philosophy.

IHG: Actually, that is fascinating, and I think I accept completely the idea that contingency is fact. We can't gainsay that, because if we do we claim access to some positional element of necessity. But I don't think, actually, that it applies wholly to the position that you're [GH] adopting. You want egress from phenomenological treatment to a genuine description of causality, as you were saying, or a genuine account of causality. And you do that not because you don't want merely to *speak* about being. You reformulate the ontological difference, as it were, not in terms of being and beings but … sorry, how did you put it?

GH: In terms of the subterranean thing and its relation to something else.

IHG: Yeah, in terms of relations. So you really want to speak about causality. Causality must of its nature be responsible for facts, but is it itself a fact? If there is real causality rather than just the laws we might subscribe to concerning causality, then it entails that there's an egress from the phenomenal envelope, the transcendental envelope, if and only if there is such causality. So there are, as it were, ontological commitments or entailments of your position, it seems to me, and so it's not wholly describable in terms of fact. Unless, of course, we have a specifically temporal understanding of facticity, such that factual states, ontic states, do appear and disappear with roughly the speed that they would under the model you explicitly evoked vis-à-vis Arab scholars' versions of occasionalism, where the raw speed of possible replacements, states of affairs, becomes bafflingly unthinkable.

So that was a comment I just wanted to make to pull things together. I do think there's an interesting question there, or a series of questions, actually. Vis-à-vis what you said about bodies, I have a roughly similar point. It's true I do suggest that it's wrong to identify matter with bodies but not that bodies are immaterial. So, at one level, the reason why it must be wrong to identify matter with bodies is that if it were the case that matter was a body, then all different bodies would not be matter, which wouldn't make sense of what a body is. So it must be the case that bodies are matter, but bodies are not all there is to matter, and I think that's roughly, actually, one of the central lessons of the advent of field physics. The dereliction of substance in any corporealist form is made real, is made concrete, with Faraday and so on – the idea of field replacing substance around the 1830s. So you have this replacement of a conception of substance as no longer attaching solely to bodies, but rather being a regional element of *physis*, which is comprised of forces. The question then is not reducing bodies to forces, nor saying bodies are other than matter because forces are genuine matter, but rather how these two elements are in fact elements of a process which is productive. Actually it was incredibly poignant when you said I don't go to geology – I would have, had the time not run out! You pointed out that I hadn't in fact dealt with certain things in the examples I gave of my project – technological objects and geology as a science, actually dealing with the earth and so on. But in fact that's the subject of my next book on ground. So I wanted to suggest a clarification of the relationship between body and *physis*, body and matter – which is why I think Plato's idealist account of what matter is is the best we have in so far as it's an account of matter …

GH: You also mentioned Giordano Bruno as an obvious ally of yours.

IHG: Yes.

GH: I immediately thought of his books when I read yours. But am I not right that, for you, *physis* does not exist in the bodies, except maybe as *expressed* in the bodies – but the action is all at the lower level?

IHG: I don't think one element of it is dispensable. I think maybe there's some work I need to do here, because I think this is a similar question to the question of the relation between productivity and product. Clearly, the relation as I described it earlier, that productivity is unthinkable without product is a dialectical trick at one level. But at another level, productivity really is productivity if and only if there are products. Otherwise, what is it? Is it force? Is there force without resistance?

GH: For you, when fire burns cotton, what's happening? Is the fire burning the cotton or is there some deeper layer at which the causal relationship is unfolding? I thought the latter.

IHG: I'd want to claim that there are innumerable things going on when fire burns cotton, and in the burning of the cotton by the fire.

GH: But it's not a somatic event for you?

IHG: It's a somatic event, a somatic event is one dimension of it, yes.

GH: So you're not actually denying causal relations between bodies, you're just saying that it's paralleled by another relationship at another level?

IHG: Actually, no, I think I *am* denying causal relationships, but only because it's between bodies. And this is not to say that there are no causal relations. It's rather that they go in a variety of directions. If there are causal relationships between bodies – in fact, there must be at one level, there must be, but at another level, it's not by virtue of the bodies that there are causal relationships between them, because there are other things going on as well. So it's the additional element rather than the one or the other. In fact, that was one of the things about your account of occasionalism that I found so useful.

GH: Good, good.

Benjamin Noys: Earlier you made the remark dismissing Marxian materialism as impoverishing. And I just wondered, in relation to the conversation you had with Ray, there seems to be a question of different kinds of reduction …

GH: My idea, which I had vaguely in mind until Bruno Latour said it explicitly about a month ago, is that materialism is a kind of idealism. And that's what I want to say, because when you have materialism, what you're doing is reducing the things of the world to a fairly one-dimensional conception of what they are. Physical bodies taking up space in a measurable fashion. And the funny thing is, Žižek does this and *embraces* it and says the only possible materialism is idealism. The irreality of the world outside of my experience of it. So he actually takes that and celebrates it and Latour condemns it from the other direction. I want to condemn it, too. So I was happy with Iain's answer. I'm an anti-materialist.

Alberto Toscano: I'd like to just follow up on Ben's point. I was wondering if there was another way of organising your index cards, and it has to do exactly with whether the notion of realism should be understood in terms of – this might be a bit abstruse – but in terms of a reference to the real or a reference to reality. It seems to me that if realism has a reference to 'reality', then there is an implicit totalisation of that notion of reality. And I was struck, for instance, by the fact that, in your talk, in a way that didn't really seem to be thematised, you talked about 'the world', and Iain to some extent or another talked about 'nature'. And

I suppose the question is: Is it necessary for speculative realism to totalise reality, or to posit a grand total object of speculation? There are a number of reasons for asking this. I mean, partly, it's out of the notion that if indeed someone like Ray, for instance, or perhaps Quentin, has an attachment to certain aspects of Badiou's ontology, one of those aspects would be a fairly radical gesture of de-totalisation, the idea that the very notion of a universe might be scientifically useful but is philosophically incoherent, the notion of the All. And it also links partly to the question about politics and Marx and so on, because, in one sense, it only becomes a kind of suppressive gesture to politicise ontology or to talk about politics at all if you think that there is actually a total domain of reality or being; because then obviously if this total domain were overdetermined by one aspect of that domain, then this would be some kind of instrumentalisation of ontology. Because that implies the idea that what speculative realism relates to is *all* of reality, and then obviously if politics comes to overdetermine that entire reality, then that would be illegitimate. Now, if there is no total reality or total universe over which ontology or anything, speculative realism, operates, then it seems there's no sense in which one would need to have a speculative realism or an ontology that encompasses science, *etc.* This also has to do with the question Ray raised, because it's also the issue about the extent to which the demands of science and the demands of ontology overlap. Because it does seem that science is wedded to some extent or another to the notion of a universe. Now, it seems to me that speculative realism need not be – in fact, perhaps *shouldn't* be – wedded to the notion of a totality or of *a* reality or of *a* universe.

So when you said 'the world', does a philosophy of objects, of absolutely individuated, vacuum-packed objects, so to speak, as you put forward – does it depend on some totalisation? Because then that would imply that that totalisation is actually the relation within which all those objects are already included.

GH: Ray and I were discussing this on the Tube on the way in. It seems that I have to be committed to the notion of an infinite regress and also infinite progress to avoid this problem of totalisation. And I do feel that I'm committed to that, and I think science is leading that way more and more all the time, right? Where is the smallest particle? They've never found it. Where is this largest universe? Many physicists doubt it now. And I've been speaking openly in the past few years in defence of the infinite regress and the infinite progress. Maybe I should start calling them transfinite. So, no, I don't actually have a totality of the world. There are just objects as far as you look. I never come to the end of them and say there's a largest object that contains them all, precisely for the reason you mention, because then you'd have a final, present-at-hand – in the Heideggerian sense – present-at-hand totality which was constituted totally of relations and which itself was nothing but relations. And I can't have that, for the same reason that I can't have a smallest particle, because then you'd have a tiniest present-at-hand atom that had no other qualities, because it would have no relational structure at all. So yeah I do seem to be committed, and this upset me a little bit for the first couple of years …! No-one wants to be trapped in the infinite regress, right?

Well, what's inherently illogical about the infinite regress? There seem to be a fewer negative consequences than there are to saying there's got to be a final atom.

Daniel Miller: I want to ask you a bit more about infinity, with reference to your notion that the object has infinite qualities. You spoke of the chair, earlier, as having infinite qualities. There seems to be a problem, because, again, earlier still, you spoke about what the difference would be between a real crown and an imaginary crown, and you suggested that they could be distinguished on the basis of their qualities. The real crown would have different qualities to the imaginary crown. But if an object has an infinite amount of qualities, how can you distinguish it on the basis of those qualities?

GH: Just by appealing to Cantor, that there would be different sizes of infinities. You could say the imaginary crowns have an infinite number of qualities and the real crowns may have more or less qualities than the imaginary ones, but you can still have different sizes of infinities.

DM: Do you make a distinction very cleanly, between imaginary and real infinities, in that case?

GH: No, there's only one kind of infinity. They'd be different infinities in each case but only one kind. What I'm trying to say is, I don't think you can distinguish between imaginary and real crowns on any basis outside of qualities, because the distinction has to be in those qualities themselves. My suspicion is that there have to be different qualities in the cases of the real crowns and the imaginary ones. Existence is not something either imposed or not imposed on the qualities from outside, by God, or by its position in relation to a Kantian subject. In the qualities themselves there has to be a difference between real and imaginary crowns – that's just my suspicion in the last couple of months.

Peter Hallward: Without trying to ask questions I've asked before, I understand your system as far as it works for intentional objects: a chair is not exhausted by your sitting in it, but nevertheless it is a chair as opposed to a hybrid of materials or a commodity or something else, in so far as it can be sat on and have all the other associations that make it a chair and not another kind of object; and it's slightly different, then, from a pile of rocks that we can sit on outside – that alone doesn't make it a chair, right? And we've used it as a chair already today. So as regards the issue of its 'chairness' it seems to me that you have this problem of what it means for this particular object, what it is that objectifies it as a chair or as a table if it's not something to do with a very large number of relationships in that very complicated history of the evolution of something like a chair in the course of history and so on that would explain it. And if you abstract from all those relationships, I don't see what's left of the chair *qua* chair. I can see that you can abstract something. You can probably abstract something that starts to look a lot like a Kantian thing-in-itself, but how would it be a chair? Or if you take something that's less obviously an intentional object, like a cloud or something, and you try, in a rigorous way, to isolate the product from the process, you abstract it, then, from all the processes whereby water vapour condenses at a certain temperature and altitude and so on, what are you left with? In what sense is it really a cloud as opposed to a particular moment that we can isolate in the way precipitation is condensing up there in the sky? In what sense is it a cloud except for someone who *intends* it as a cloud?

GH: Right. You made a very similar objection to 'On Vicarious Causation' before it was a *Collapse* article, which is when I was using shoes as an example, and saying the shoes are the same shoes for me and other people and for ants, and you were asking: Is it really a shoe for ants? And I guess now that I've thought about it for a few months, I think the answer is no, obviously, it's not really a shoe for ants, it's something else, but that doesn't mean there's nothing withdrawing behind my use of it as a shoe. DeLanda makes this point very well on the first page of his new book, which is that, even though we are the ones that create social institutions, this does not mean that our concepts of them exhaust them. So yes, I can be the first person ever to see that pile of rocks as a chair, but couldn't there still be a 'chairness' to it deeper than my use of it? Because I could still keep using it as a chair and still find some leeway to use it as a chair differently from how I'm doing it now. So I think that 'chair-form' that I myself have discovered there is still something deeper than my current use of that 'chair-form'. That's how I would describe it. I don't know if that helps.

Robin Mackay: This very much follows on from Peter's question. I'm very sympathetic to the idea that we have to try to break reality out from its incarceration in our relation to it, our conditioning of it, but it seems to me that physics already does that, but it does it precisely at the expense of the commonsense idea of what an object is. And what puzzles me about your system is that you seem to carry over that commonsense idea of what objects are into this other realm. So, for instance, if there's a billiard ball that hits another billiard ball and it envelopes that other billiard ball in its intentionality – first of all, I can't understand, this is not really an important point, but I can't understand why the intentionality is an object; what is it that makes you call it an object? But secondly, what part of the second billiard ball does the first billiard ball envelop? Only the bit that it hits? The whole thing? How does it know the billiard ball's an object? Does it only envelop half of it, quarter of it? And it seems to me the only way you can answer that is by saying every single piece of the billiard ball envelops every other piece in contact with it, with its intentionality. And so you go down and down, and you're just going to end up with physics again, you're just going to end up with the same ontic explanation of causality that disappointed you in the first place. So, just to go back to Peter's point, it's entirely possible that the ant doesn't know the difference between the shoe and the table that the shoe's on or the piece of grass it's on; I don't understand how these things can be unequivocally named 'objects', in other words, and for me this is the profundity of Lovecraft, why he's a profound realist. Because when you go through the gates, when reality is revealed to you, it's just this complete chaos which you can't objectify. And obviously Lovecraft is Kantian in that respect, but I can't see how your system can get past that problem.

GH: There are three questions there and I'll take the easiest one first: Why is an intention an object? Well, if you look at the usual definitions of objects throughout the history of philosophy, criteria are along the lines of naturalness, indestructibility, irreducibility to anything else, and so on – these are the classical definitions of substance. My definition of an object is simply a unified thing that has a reality that's not exhausted by any approach to it from the outside, and intention clearly has that feature, because what is phenomenology about? It's about retroactively analysing intentions. Even if I analyse what my intention is at the moment, what looks and what is looked at are not the same thing. So what I'm doing when I'm looking at my own intention of the cup is converting my relation to the cup into an object. It can remain mysterious and puzzling and they do long phenomenological analyses, even of these very simple relations. So that's why it's an object.

RM: But when you say you're converting your intention into an object, that's a very Kantian thing to say, isn't it?

GH: I think anytime we intend something, the intention can be converted into an object, yes. But, just as DeLanda says about social institutions: even if we're creating it, that doesn't mean that our creation of it exhausts the reality of the thing. So, yes, in a way my relation to the cup isn't really an object until I convert it into one as a phenomenologist. I can decide, 'Okay, I'm going to analyse my relationship to this', but that doesn't mean that my act of identifying the relation for the first time exhausts it. That's why you have to go on and analyse that intentionality there, because there's more in it than meets the eye. Just by creating kids, you don't know everything about the kids. There's always going to be more to them than you suspected. Causation is productive. I don't think you can ever get from my position to physics, because physics never makes causation into a problem, as far as I can see. The problem of causation in physics is always one of whether causation is deterministic, or whether it's statistical, or how you read quantum theory. There's not really any discussion in physics of what actually happens when one thing influences another.

RM: Isn't that because physics has revealed that that's a false problem?

GH: I don't think it's a false problem. I think it's a *forgotten* problem, by physics. You've got four causes in Aristotle. Where have the four causes gone in physics? Nowhere. You have efficient causation, maybe material causation, they've gotten rid of formal and final. Fine, get rid of final, I'll give you that one! – What about formal causation? Formal causation is where all the action's happening in philosophy, I think. Forms do all the work in Aristotle and elsewhere, and that's what I want to retain. There's no formal causation in physics. My favourite author for dealing with formal causation is Marshall McLuhan, one of the really unrecognised giants of the past one hundred years of the humanities. Fabulous stuff, wrongly written off as a kind of pop TV analyst, really brilliant systematic work about how one medium reverses into another under the right conditions. McCluhan deserves to be the founder of a philosophical school. Again, he's a fan of formal cause. And Francis Bacon before him – another completely misunderstood philosopher – not an empiricist in the way people think. You're not just doing experiments and reducing things to their causes, you're actually finding the forms that are locked up and compressed inside of things. And he even says that efficient causation is ludicrous. I was shocked when I read that. We have this textbook image of Bacon that has nothing to do with the real Bacon. So I would appeal to Bacon and McLuhan, great champions of formal cause, which science does not handle properly.

Presentation by Quentin Meillassoux

I would first of all like to give my thanks to the organisers of this conference. I'm very proud to participate in it, considering the exceptional quality of the contributors. And I am very happy to have this opportunity to express my admiration for the books of Ray Brassier, Graham Harman, and Iain Grant. I think that the very existence of such a philosophical configuration of original conceptual projects is in itself remarkable. I think that we also must have in common, the four speakers, the difficulty of explaining our jobs to our families! But as I said to Graham, I think it is a configuration of what could be called a 'weird realism', four modalities of 'weird realism'. I'd like to discuss here one of the theses of Ray Brassier's beautiful book, *Nihil Unbound*, and try to respond to some of his stimulating objections, supported by the non-philosophy of François Laruelle. Thanks to this discussion, I will expose and mark out the fundamental decisions of *After Finitude*, especially concerning correlationism and the principle of factuality.

As you may know, I have given the name 'correlationism' to the contemporary opponent of any realism. By this term, I wanted to avoid the usual 'parade' of transcendental philosophy and phenomenology against the accusation of idealism – I mean answers such as: 'Kantian criticism is not a subjective idealism since there is a refutation of idealism in the *Critique of Pure Reason*'; or 'phenomenology is not a dogmatic idealism, since intentionality is orientated towards a radical exteriority, and it is not a solipsism since the givenness of the object implies, according to Husserl, the reference to an intersubjective community'. And the same could be said about *Dasein*, which is originarily a 'being-in-the world'. Even though these positions claim not to be subjective idealism, they can't deny, without self-refutation, that the exteriority they elaborate is essentially relative: relative to a consciousness, a language, a *Dasein*, etc. No object, no being, no event, or law which is not always-already correlated to a point of view, to a subjective access – this is the thesis of any correlationism.

By the term 'correlation', I also wanted to exhibit the essential argument of these 'philosophies of access', as Harman calls them; and – I insist on this point – the exceptional *strength* of this argumentation, apparently and desperately implacable. Correlationism rests on an argument as simple as it is powerful, and which can be formulated in the following way: No X without givenness of X, and no theory about X without a positing of X. If you speak about something, you speak about something that is given to you, and posited by you. Consequently, the sentence: 'X is', means: 'X is the correlate of thinking' in a Cartesian sense. That is: X is the correlate of an affection, or a perception, or a conception, or of any subjective act. To be is to be a correlate, a term of a correlation. And in particular, when you claim to think any X, you must posit this X, which cannot then be separated from this special act of positing, of conception. That is why it is impossible to conceive an absolute X, *i.e.,* an X which would be essentially separate from a subject. We can't know what the reality of the object in itself is because we can't distinguish between properties which are supposed to belong to the object and properties belonging to the subjective access to the object.

In my opinion, the *Principles of the Science of Knowledge*, written by Fichte in 1794, is the *chef-d'oeuvre* of such a correlationism. The *Science of Knowledge* is to date the most rigourous expression of the correlationist challenge opposed to any realism. I'd like to begin this talk by remembering the principal aspect of this philosophy, so that we can be conscious of the very nature of this anti-realism at its climax. I won't speak, of course, about the details of this very difficult book, but I shall only recall the heart of its argumentation: the principle of its conceptual production, which appears to me as the most precise form of the obstacle that a contemporary realism has to surmount. I will rely on a recent interpretation of the *Science of Knowledge*, which has completely changed the comprehension of Fichte, at least in France: in 2000 Isabelle Thomas-Fogiel[14] proposed a devastating criticism of the dominant interpretation of Fichte in our country – Philonenko's interpretation – and allowed us at last to read the true *Science of Knowledge*, instead of the extraordinary but also eccentric reconstruction elaborated by Philonenko in 1966.[15]

Briefly: Philonenko claimed that the three first principles of the *Science of Knowledge* – including the famous 'I = I' – were not true principles, but dialectical illusions that Fichte undertook to deconstruct throughout his system. So, in the *Science of Knowledge*, you have three principles, and he deduces all that follows from these three principles? – No, it's not true! According to Philonenko, they were illusions that Fichte deconstructed! Therefore, of course, Philonenko also had to explain that Fichte was a strange guy, since he had said to everyone the exact opposite of what he really meant! The situation in France was as if a famous interpreter had claimed solidly for thirty years that the definitions and axioms of Spinoza's *Ethics* were in fact certain illusions deconstructed by Spinoza, and convinced everybody that Spinoza was just a very weird man to say systematically the exact contrary of what he really thought. Thomas-Fogiel quite simply restores – in my view, indisputably – the immediate truth on this point: the principles of the *Science of Knowledge* are *true* principles; and, thanks to her, French philosophers have at last discovered what everyone else already knew!

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[14] I. Thomas-Fogiel, *Critique de la réprésentation: Étude sur Fichte* (Paris: Vrin, 2000).

[15] A. Philonenko, *La liberté humaine dans la philosophie de Fichte* (Paris: Vrin, 1966).

How must we read Fichte, consequently? According to Thomas-Fogiel, as a thinker of the pragmatic contradiction: Fichte is a thinker who intends to evaluate every philosopher by his capacity to do what he says and to say what he does. A pragmatic contradiction consists, as you know, in contradicting the content of a sentence by the enunciation of this very sentence. It is not a logical contradiction – such as: 'Peter thinks and Peter does not think' – but a contradiction between the content of a sentence and its performance, its effective formulation. For example: 'I don't think' does not contain a logical contradiction, but consists in a pragmatic contradiction between the content of the proposition and the fact that I think or pronounce it. The fact that I think this proposition is in contradiction with what I say in the proposition. Thomas-Fogiel used this notion, elaborated by Hintikka in relation to Descartes and Austin,[16] to interpret the *Science of Knowledge* as a philosophy written under the systematic constraint of pragmatic non-contradiction. In particular, the *Science of Knowledge* destroys any attempt at realism by proving it is always and immediately self-contradictory in a pragmatic way. What is a philosopher really doing when he claims to have access to a reality independent of the I? He posits, says Fichte, an X supposed to be independent of any position. In other words, he posits the X as non-posited. He pretends to think what is independent and exterior to any conceptualisation, but in doing so he doesn't say what he effectively does. He says his X is indifferent to thought, but what he does, of course, is simply to conceptualise an X perfectly dependent on his own thinking. Hence, according to Fichte, the pragmatic contradiction between the acts and the thesis of any realist.

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[16] J. Hintikka, '*Cogito, ergo sum*: Inference or Performance?', *Philosophical Review,* Volume 71, No. 1, Jan. 1962: 3-32, included in *Knowledge and the*

But Fichte's very originality, in which he anticipates Hegelian dialectics, is that his contradiction is essentially fruitful. Contradictions produced – notably, by realism – in the *Science of Knowledge* do not lead to the end of the discourse, but to the creation of new concepts able to temporarily neutralise the mortal opposition between content and act. Only temporarily, since such concepts allow one to shift the contradiction again and again but not to abolish it – at least in the sphere of theory, the resolution of the initial contradiction being the privilege of practical reason, not of theoretical reason.

To be more precise, we could say that there is for Fichte a sort of 'double bind' for philosophy itself: it has both to posit the secondariness of thinking relative to

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Known (Dordrecht: Reidel, 1974); '*Cogito, ergo sum* as an Inference and a Performance', *Philosophical Review*, Volume 72, No. 4, Oct. 1963: 487-96.

an independent real – otherwise we couldn't explain the passivity of sensation – and at the same time it can't posit such a reality without contradiction. This 'double bind', which is ultimately still what 'realism' means for contemporary philosophy – we need it, but we can't claim it, so we claim *and* deny it – this double bind never oversteps, according to Fichte, the limits of the I, because the active I is the first and absolute principle of his philosophy. But Fichte carries out the most elaborate destruction of any realism through a strategy we could call the 'pragmatico-genetic contradiction'; that is, an exhibition of the way in which the realist is forced to create his own concepts in order to escape, for a while, his ultimately fatal contradiction.

To be a contemporary realist means, in my view, to efficiently challenge the Fichtean fatality of pragmatic contradiction; not exactly to challenge the very thesis of the *Science of Knowledge*, but the mode of refutation which is therein invented, and whose principle is always the same: If you think *X*, then you *think* X. That is what I called the 'circle of correlation', the first argument of every correlationism which claims that realism is necessarily a vicious circle, a denial of its very act. Can a realism pass the test of pragmatic contradiction? That is the question which has governed my own investigations and which I shall examine in relation to the non-philosophy of François Laruelle, on the one hand, and the principle of factuality I set out in *After Finitude*, on the other. But why this comparison with Laruelle?

In his wonderfully radical book, *Nihil Unbound*, Ray Brassier devotes a chapter to *After Finitude*[17] and another to Laruelle's non-philosophy.[18] Brassier, who is a first-class reader, tries to show that Laruelle's 'transcendental realism' is a more reliable and rigorous way to root out the philosophy of correlationism than that which I propose. Even if Brassier's reading is generally kind towards *After Finitude*, he points out what he sees as some weaknesses in my argument, and particularly the fact that I speak of an intellectual intuition of facticity. In this expression – 'intellectual intuition' – Brassier suspects a possible absolutisation of meaning, and maybe a remnant of speculative idealism that threatens my will to escape from the circle of correlation. I shall try to respond to this objection in the following way: First, I will show why the non-philosophy of Laruelle, despite its admirable rigour, fails, in my view, to efficiently fight the argument of the correlational circle. And I will demonstrate this point by applying to non-philosophy a Fichtean model of refutation – that is, a refutation based on the pragmatico-genetic contradiction. Then, I'll show that what I called 'intellectual intuition' in *After Finitude* – and what I shall now call, more precisely, 'dianoetic intuition' – is able, unlike non-philosophy, to neutralise correlationism, even in its Fichtean version – that is, even at the high point of its rigour.

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[17] *Nihil Unbound*, Chapter 3; also see **Collapse** Vol. II, 15-54.

The funny thing is that I discovered, after I decided to confront Laruelle with Fichte, that Laruelle himself, in his *Principles of Non-Philosophy*,[19] compared his own reasoning with Fichte's in the *Science of Knowledge*. But Laruelle is a tributary of the outdated commentary of Philonenko; that's why his confrontation is disappointing.

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[18] *Nihil Unbound*, Chapter 5.

[19] François Laruelle, *Principes de la non-philosophie* (Paris: PUF, 1996).

Quentin Meillassoux

Let's start with Laruelle's conception of what he calls 'philosophy' – or the 'circle of Decision' – which we could also call the 'circle of objectivity'. Decision – with a big 'D' – is for Laruelle the source of every philosophy in any time. Brassier sums up precisely the meaning of this 'Decision' by recalling the Kantian structure which underlies its conceptualisation. Every philosophy is constituted, according to Laruelle, of three moments: first, an empirical *datum*; second, a *factum* made of *a priori* categories, categories unified by a transcendental (for Kant, transcendental apperception); and finally, we have a return of the *a priori* to the *datum*, that is, a unification of *datum* and *factum*, a moment which, in Kant, corresponds to the transcendental deduction. From this last unification proceeds experience as the transcendent reality produced by philosophy. Those moments we might also call 'circle of philosophical Decision', or 'circle of objectivity'. Brassier contests – and I think he's right to do so – that this triple movement constitutes, for Laruelle, the eternal essence of philosophy. He suggests that what Laruelle calls 'philosophy' can be identified with what I call 'correlationism'. Consequently, Brassier claims that Laruelle, with his non-philosophy, works out a non-correlationism more radical and sure than my own version, burdened as it is by intellectual intuition. Let's see how Laruelle proceeds to extricate himself from the field of philosophy – that is, correlationism, in Brassier's version. I can't of course reproduce all of Laruelle's reasoning, which is complex and evolves from one book to another, but I won't need to do so to explain my objection.

First, I remark that there is a precise reason, different from Brassier's own reason, to refuse the identification of philosophy with the circle of objectivity. Brassier claims it is vain to look for an eternal essence of philosophy, philosophy being constituted by the contingent history of texts. But I think there is another reason, a structural one, to refuse the idea that philosophy should be encapsulated in the circle of objectivity, one that Fichte was probably the first to conceive. This reason is: if you want to think the circle of objectivity – what Fichte calls the representation, the unification of *datum* and *factum* and the *a priori* – you need a point of view outside of this circle. That is, if you want to conceive what a representation is, you need a faculty which can't itself be representative, because there is no representation of representation. You can have a representation – perceptual or imaginative – of a horse or a wall, but you can't have any representation of a representation. If you want to think what a representation is – that is, a unity of *datum* and *a priori* – you need something other than objective knowledge, this being itself constituted by the unity of *datum* and *a priori*. This was Kant's essential failing, according to Fichte: Kant didn't explain how it was possible to write the *Critique of Pure Reason*. He described all knowledge in terms of objectivity – that is, in terms of representation, constituted by the synthesis of categories and space-time – but his own *philosophical* knowledge about objective knowledge, that is, about representation, couldn't be described in the same terms. How was Kant able to elaborate transcendental notions such as matter and form, categories and representation? This operation needed, according to Fichte, another faculty which was almost described by Kant: the faculty of reflection. And this faculty, reflection – contrary to the apparent opinion of Laruelle – is essentially different from objectivity. Reflection is a non-representative, non-objectivating faculty, which is the condition for conceiving objectivity as such. Reflection is what allows Laruelle himself to stand outside the circle of objectivity when he conceives its unity. Laruelle is outside the circle of objectivity when he describes it, because describing it means not being in it anymore. But this is also the case with every philosopher who was able to describe this circle: all of them adopt, consciously or not, the point of view of reflection, but Fichte was the first to consciously and systematically adopt this point of view in order to construct his system.

Consequently, if you want to escape from the circle of correlationism, you must not only escape from the circle of objectivity, but also from the larger circle of reflection, which is outside Laruelle's circle and includes it. Correlationism, as I define it, includes reflection, since reflection is position. When you conceive the circle of objectivity, you are outside this circle, but still in the circle of correlationism, according to me. So if, like Laruelle, you posit something outside the circle of objectivity – in his case the Real outside 'Philosophy' – this Real will still be, according to me, in the circle of correlationism. Because it will be a posited Real: a Real posited by reflection outside of representation. This is exactly what Fichte calls, in his technical vocabulary, the 'independent activity' – that is, to simplify a great deal, the notion of the 'thing in itself', outside representation – Kantian representation – and impossible to conceive through this representation.

Let's demonstrate this point more precisely. Here is my strategy: as I said previously, I propose to apply to Laruelle the Fichtean way of reasoning – not his precise thesis, but the pragmatico-genetic contradiction which constitutes the principle of his argumentation. I am going to reconstruct Laruelle's position in a correlational way, showing how what he calls 'the Real' is nothing but a posited Real, and how the concepts created by non-philosophy just shift this contradiction without being able to abolish it. We shall see clearly, then, why I think that Laruelle doesn't really escape from the circle of correlation.

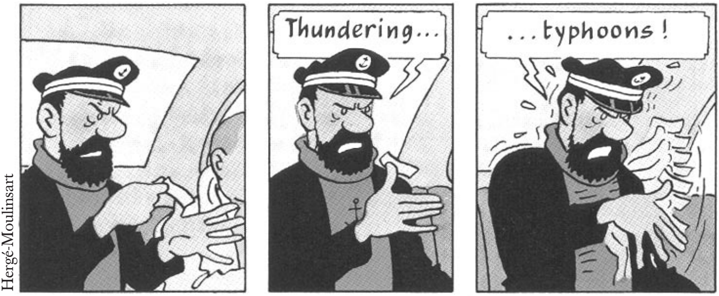
Let's begin with the Real as described by Laruelle. The Real, he says, is radically indifferent to and independent of the circle of objectivity. The Real precedes thought, but thought, conversely, is always dependent upon the Real, which is essentially unaffected by thought. That is what

Laruelle says, this is the content of his discourse. But – Fichtean question – what does he do? What is the act of his discourse? Laruelle, of course, posits such a Real as independent of any thought. Consequently, he does exactly the contrary of what he says. He says, 'the Real precedes thought – in particular, philosophical thought – and is indifferent to it', but the order of what he does is the opposite of the order of what he says: he begins by thinking, and especially by thinking what philosophical thought is, and then progresses to the Real. The Real is truly a notion of the Real which is dependent on thinking, and which is post-philosophical, elaborated from his notion of philosophy. The real order – or the order of acts, not of content – is manifest in the very name of Laruelle's theory: 'non-philosophy'. Non-philosophy is supposed to think the relation of thinking with a Real which precedes philosophy, but the name 'non-philosophy' can only be constructed from the name 'philosophy' together with a negation. Philosophy precedes non-philosophy in nomination, as in the acts of thinking. Hence, we have the first and manifest pragmatic contradiction between what Laruelle says about the Real and what he does when elaborating this notion.

But of course this contradiction, this pragmatic contradiction, is far too trivial to worry Laruelle, and we can imagine that he could easily respond to it. But how? By producing new concepts. So the contradiction, the pragmatic contradiction, becomes fruitful because it compels the thinker to shift it so that he can avoid a gap which in fact will never be filled in. Laruelle could first demonstrate that our objection proceeds from a series of confusions. The Real is a negation of nothing: it is relative to nothing, according to him, and especially can't be identified with the concept of the Other which presupposes the X whose other it is. The Real, on the contrary, is radically autonomous, without relation to thought. Thought, on the other hand, can distinguish itself from the Real if it ceases to identify itself with philosophy, locked up in the circle of objectivity, to think under the axiom of the Real. Then thought knows itself as determined-in-the-last-instance by the Real, says Laruelle. That is: thought knows itself as relatively, but not radically, autonomous. This means that thought can produce by itself its own concepts, but has to avoid the sufficiency of absolute autonomy proper to philosophy and which is its intrinsic illusion.

We now have a series of new concepts: radical and relative autonomy, sufficiency, determination-in-the-last-instance, etc. But have we then escaped from the correlational circle? Of course not; we have only deduced what is necessary to think a *posited* Real, if we admit that this Real effectively precedes any position. But Laruelle gets this first position just by force, just by a *coup de force*. The Real is *posited* as indifferent to its positing and as non-related to thought. After that, Laruelle reflects on the possibility of his own theory by claiming the relative autonomy of thought; but in fact, it seems, on the contrary, that his thought is able to posit the Real itself and its relation to the Real. That is, to posit that the Real has no relation to thought, and that thought has a relation of relative autonomy to the Real. He also posits all these concepts as essentially non-dialectical, but what he does is of course easy to dialecticise. For the Real is now linked more than ever to his concepts, more dependent on more and more intricate elaborations aiming at the exhibition of its independence. And of course, every thesis added by Laruelle will only make the situation worse. That's why the only solution for Laruelle will be the solution, according to me, of every modern realism against correlationism or idealism: as it seems impossible to escape from this position, from this objection, the only solution is to disqualify what you can't refute. The solution for Laruelle can only be: First, to say that the Real is posited by an axiom – that is, something that can be neither demonstrated nor discussed – and secondly, to introduce a precise concept which will disqualify in advance anyone who contests such an axiom; that is, the concept of 'resistance'. I will end my Fichtean reconstruction of Laruelle with this concept that I propose to examine, considering its genealogy and its strategic importance for any contemporary realism.

To understand the fortune of the concept of resistance, we must be conscious of the main characteristic of the correlational circle, which is that this circle is both monotonous and apparently implacable. It is just the same objection, tedious and irritating: if you posit *X*, then you *posit* X. Sometimes we encounter this enraging situation: a brilliant, subtle and interesting theory is easily refuted by a well-known and trivial argument, put forward by a stupid opponent. That is often the situation of the post-Kantian realist faced with the correlationist. And this necessarily produces the same psychological reaction on the part of the realist: he will become both tired and furious. The perfect illustration, the primal scene, of this psychological law of modern realism, in my opinion, can be found in a Tintin comic book. In one of his adventures, Tintin's acolyte Captain Haddock tries to unstick a plaster from his finger.


Thundering...
...typhoons!

Hergé-Moulinsart

But of course, each time he removes it with another finger, the plaster sticks immediately onto it! And since the process is endless, Haddock quickly loses his temper. The plaster is identical to the 'that is what *you think*' that the correlationist just has to add to any realist thesis one might try to assert. The realist always has to posit more concepts to prove he has accessed pre-conceptual reality. The situation seems desperate: how could you refute that whenever you think something, you *think* something? That's why the realist, conscious that his reasoning is apparently in vain, has generally renounced any attempt to refute the correlationist and has adopted what I call a 'logic of secession' towards him. This secession is a blunt refusal addressed to the correlationist: an 'I won't discuss *with* you anymore, I will rather discuss *about* you'. This is a logic of unbinding, of independence, but this independence is not the originary independence of the Real towards the correlation but that of the realist towards the discussion with the correlationist. This logic of secession, it seems to me, takes two principal forms in modernity.

The first one consists in fleeing voluntarily from the discussion in order to rediscover the richness of the concrete world. Schopenhauer said that solipsism was a fortress impossible to penetrate, but also pointless to attack, since it is empty. Solipsism is a philosophy nobody can refute, but also one that nobody can believe. So let's leave the fortress as it is, and let's explore the world in all its vastness! The first strategy of the realist, similarly, concerns the fortress of correlation: 'If you want to stick your plaster on me, please do, but then leave me alone; I have so many interesting realities to investigate!' This is what I call the 'Rhetoric of the Rich Elsewhere'. The realist disqualifies the correlationist argument as uninteresting, producing arid idealities, boring academics, and pathological intellectuals. 'Let's stop discussing, and let's open the windows: let's inhale things and feel the breeze'. This is an attractive and sometimes powerful rhetoric – not in a pejorative but in a Nietzschean sense. A rhetoric of the fruitful concreteness of things, the revenge of descriptions and style on repetitive quibbles. Latour, sometimes, severs all links with correlationism in such a way, and does so with much talent and humour. It must be added, of course, that he also uses other elaborate instruments to fight the circle. But in the case of the 'Rich Elsewhere' rhetoric, it is clear that it is not an argument, but a disqualification of he who argues: the sickly and boring correlationist.

The other method of disqualification used by modern realism is a more fundamental one: it brings out the implicit logic of the 'Rich Elsewhere', which consists in replacing the discussion with the correlationist with an exposition of his motivations. We no longer examine what he says, we examine *why* he says what he says. It is the well-known logic of suspicion that we find in Marx, with the notion of ideology, or in Freud, with precisely the notion of resistance. The realist fights every form of idealism by discovering the hidden reasons behind these discourses – reasons that do not concern the content of philosophies, but the shameful motivations of their supporters: class-interest, libido, *etc.* In this way, the realist explains in advance why his theories must be refused by those who are unable to see the truth for such and such objective reasons. Hence he will neutralise any refutation as an already-described symptom of social or psychological resistance, unconscious resistance which is, according to the realist, often unavoidable. But what is interesting, from my own point of view, is that this well-known strategy of suspicion can be understood as the necessary result of an inability to rationally refute the insipid and implacable argument of the correlationist. And we could say the same about the Nietzschean suspicion of the sickly Kantians of the University. Laruelle inherits these strategies through his own concept of resistance: he says, of course, that his non-philosophy must necessarily excite great resistance from philosophy – he predicts that philosophers will reproach him for a *coup de force*, exactly as I did – and he claims that any refutation he will encounter from the point of view of the circle of Decision is the necessary effect of his theory of the Real upon philosophical sufficiency.

Brassier makes an interesting suggestion regarding Laruelle's theory: he says that one of his major concepts – unilateralisation – is a 'surgical intervention upon the body of transcendental synthesis; severing terms from relations, amputating reciprocity and sharpening one-sidedness'.[20] Unilateralisation is a complex concept in Laruelle that I can't explore now but which is admirably explained by Brassier in his book. It is, generally speaking, the consequence of the thought of the radical autonomy of the Real towards thought. What Brassier says, it seems to me, is that Laruelle introduces into the transcendental circle – constituted by the reciprocal synthesis between categories and intuition – the essential asymmetry of the Real and thought, an asymmetry which disjoins the correlations of critical and idealist philosophies. But my own hypothesis about this power of disjunction is that it proceeds more profoundly from the strategy of secession towards correlationism. The radical autonomy of the Real, its unbinding from thought, is produced by the radical autonomy of the non-philosopher, of Laruelle himself, towards any discussion with the correlationist. Laruelle posits the Real as an axiom, and then he posits his refusal to discuss the correlationist refutation of this axiom with the concept of resistance, which disqualifies any objection without answering to it. It is this very secession with the correlationist which creates in the discourse the effect of the radical autonomy of the Real, and which then produces all the effects of surgical interventions upon transcendental synthesis. The meaning of radical autonomy is Laruelle's secession rather than the severing of the Real.

The concept of resistance is an effect, as we said, of the theory of suspicion. But, in my view, and even if I admire Marx, Nietzsche and Freud, realists should at last start becoming suspicious of this venerable theory of suspicion; Because, as I said, it seems to me that we can trace a genealogy of suspicion and its favourite notion, resistance, which discovers at its root an inability to refute, precisely and simply, the unbearable argument of the circle. I refuse suspicion because realism, in my view, must remain a rationalism. The circle argument *is* an argument and must be treated as such. You don't refuse a mathematical demonstration because the mathematicians are supposed to be sickly or full of frustrated libido, you just refuse what you refute! I clearly understood the calamitous consequences of the notion of resistance when I heard an astrologer, answering placidly to a sceptic, that the latter's incredulity was predictable since he was a Scorpio!

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[20] *Nihil Unbound*, 147.

What is at stake, consequently, is to build up a realism released from the strategy of suspicion: a realism which doesn't need to *disqualify* the correlationist because it has clearly *refuted* him. I want that easy and implacable refutation to be transferred to the other side, from correlationism to realism; and, conversely, the argument of resistance to become the last possible defence of correlationism itself. But I don't want to refute only to refute and win the discussion. As we shall see, I'm looking for a creative refutation. That is, a refutation which discovers a truth, an absolute truth, inside the circle itself. That's why I propose an access to the Real not grounded on an *axiom*, but on a *demonstrated principle* – the principle of factuality that I'm now going to set out.

The main problem I try to face in *After Finitude* is precisely that of building a materialism – or a realism – able to refute clearly the correlational circle in its simplest form, which is also the form which is the most difficult to fight with: that is, the argument that we never have access to something apart from that access – that the 'in-itself' is unknown since we only know the 'for-us'. Here is my strategy: the weakness of correlationism consists in the duality of its opponents. Correlationism is not, in my definition, an anti-realism but an anti-*absolutism*. Correlationism is the modern way to reject all possible knowledge of an absolute: it is the claim that we are closed up in our representations – whether conscious, linguistic, or historical – with no sure access to an eternal reality independent of our specific point of view. But there are two main forms of the absolute: the realist one, which is a non-thinking reality independent of our access to it, and the idealist one, which is the absolutisation of the correlation itself. Therefore, correlationism must also refute speculative idealism – or any form of vitalism or pan-psychism – if it wants to reject all the modalities of the absolute. But the argument of the circle is useless for this second refutation, because idealism and vitalism consist precisely in claiming that it is the circle itself which is the absolute.

Let's examine briefly the idealist and vitalist arguments. I call 'subjectivist metaphysics' any absolutisation of a determinate human access to the world, and I call 'subjectivist', for brevity, the supporter of any form of subjective metaphysics. Correlation between thought and being has many different forms: the subjectivist claims that some of these relations, or indeed all, are determinations not only of men, but of being itself. He projects into the things themselves a correlation which might be perception, intellection, desire, etc., and makes it the absolute itself. Of course, this process is far more elaborate than I can describe here, especially in Hegel. But the principle of subjectivism is always the same. It consists in refuting realism and correlationism by the following reasoning: Since we cannot conceive a being which would not be constituted by our relation to the world, since we cannot escape from the circle of correlation, the whole of these relations, or an eminent part of this whole, represents the very essence of any reality. According to the subjectivist, it is absurd to suppose, as the correlationist does, that there could be an in-itself different from any human correlation to the world. The subjectivist thus turns the argument of the circle against the correlationist himself: since we can't think any reality independent of human correlations to the world, it means, according to the subjectivist, that the supposition of such a reality existing outside the circle is nonsense. Hence, the absolute is the circle itself, or at least a part of it.

This is why I disagree with Brassier's identification of what I call correlationism with what Laruelle calls 'philosophy'. It seems to me that Laruelle's notion of philosophy as a circle of Decision includes Hegel as well as Kant – idealist speculation with transcendental correlationism. In my view, it is on the contrary essential to distinguish between them since this distinction demonstrates the necessity for correlationism to produce a second argument able to respond to the idealist absolute. This necessity of a second argument is extremely important, since, as we shall see, it will become the flaw of the circle-fortress. This second argument, as I claimed in *After Finitude*, is the argument of facticity, and I must now explain its exact meaning.

I call 'facticity' the lack of reason of any reality; that is, the impossibility of giving an ultimate ground to the existence of any being. We can reach conditional necessity, but never absolute necessity. If definite causes and physical laws are posited, we can claim that a determined effect must follow. But we shall never find a ground to these laws and causes, except eventually other ungrounded causes and laws: there is no ultimate cause, nor ultimate law, that is a cause or a law including the ground of its own existence. But this facticity, this ultimate ungrounding of things, is also proper to thought. The Cartesian *cogito* clearly shows this point: what is necessary in the *cogito* is a conditional necessity: *if* I think, then I must be. But it is not an absolute necessity: it is not necessary *that* I should think. From the inside of the correlation, I have access to my own facticity, and so to the facticity of the world correlated to my subjective access to it. And this because of the lack of an ultimate reason, of a *causa sui*, able to ground my existence.

Facticity so defined is, in my view, the fundamental answer to any absolutisation of the correlation, for if correlation is factual, we can no longer say – as the idealist does – that it is a necessary component of any reality. Of course, an idealist may object that conceiving the non-being of a subjective correlation is a pragmatic contradiction, since the very conception of it proves we exist as a subject – so that we exist, when we speak of non-existence, non-being, we are existing. But we can reply, this time, that we can conceive our facticity even from the inside of the correlational circle, since Fichte himself has proved it. Indeed, Fichte conceived his first principle – I = I, the relation of the I to itself – as essentially ungrounded – in my vocabulary, as essentially factual. Of course, for Fichte, the first principle is not a fact, but an act: the act of conceiving the I. But this act is essentially *free*, according to Fichte – and that means not necessary. We choose whether or not to posit our own subjective reflection, and this choice is not grounded on any necessary cause, since our freedom is radical. But to say this is just to recognise, after Descartes, that our subjectivity cannot reach an absolute necessity but only a conditional one. Even if Fichte speaks abundantly of absolute and unconditional necessity, his necessity is no longer dogmatic and substantial necessity, but a necessity grounded upon a freedom itself ungrounded. There can be no dogmatic proof that the correlation must exist rather than not. Hence this absence of necessity is sufficient to reject the idealist's claim of its absolute necessity.

Correlationism, then, is constituted of two arguments: the circle of correlation against naïve realism – let's use this term for a realism unable to refute the circle; and facticity against speculative idealism, against subjectivism. The idealist, the subjectivist, claims to defeat the correlationist by the absolutisation of the correlation; I believe that we can defeat the correlationist only by the absolutisation of facticity. Let's see why.

The correlationist must claim, against the idealist, that we can conceive the contingency of the correlation, that is: its possible disappearance; for example, with the extinction of humanity. The correlation is contingent: we can conceive the contingency of the correlation. But, in this way, the correlationist must admit that we can positively think of a possibility which is essentially independent of the correlation, since this is precisely the possibility of the non-being of the correlation. We can draw an analogy with death: to think of myself as a mortal, I must admit that death doesn't depend on my own thinking about my death. Otherwise, I would be able to disappear only on one condition: that I was still alive to think of my disappearance and make this event a correlate of my access to it. In other words, I could be dying indefinitely, but I could never pass away, because I would have to exist to make of death a correlate of my own subjective access to it. If facticity can be conceived, if it is a notion that we can effectively conceive – and this must be the case for the correlationist if he wants to *refute* the idealist – then it is a notion we can think as an absolute: the absolute lack of reason of any reality; or, in other words, the effective ability of every determined entity – event, thing, or law of subjectivity – *to appear and disappear* with no reason for its being or non-being. Unreason becomes the attribute of an absolute time able to destroy and create any determined entity – event, thing or law – without any reason for thus creating and destroying.

What I try to show by this thesis concerns the condition of the thinkability of the essential opposition of correlationism: the opposition of the in-itself and the for-us. The thesis of correlationism is that I can't know what the reality would be without me, without us, without thinking, without thought. According to the correlationist, if I remove myself from the world, I can't know the residue. But this reasoning supposes that we have access to an absolute possibility: the possibility that the in-itself could be different from the for-us. And this absolute possibility is grounded in turn on the absolute facticity of the correlation. It is because I can conceive the non-being of the correlation that I can conceive the possibility of an in-itself essentially different from the world as correlated to human subjectivity.

Consequently, I can refute the correlationist refutation of realism, grounded as it is on the accusation of pragmatic contradiction, because *I* discover in correlational reasoning a pragmatic contradiction: the correlationist's fundamental notions – for-us and in-itself – are grounded on an implicit absolutisation: the absolutisation of facticity. Everything can be conceived as contingent, dependent on human tropism – everything except contingency itself. Contingency, and only contingency, is absolutely necessary. Facticity, and only facticity, is not factual, but eternal. Facticity is not a fact, it is not 'one more' fact in the world. I call this necessity of facticity 'factuality'; and the principle which announces factuality, the necessity of facticity, the non-facticity of facticity, I call the 'Principle of Factuality'. Finally, I call *spéculation factuale* speculation which is grounded on the principle of factuality. Through the Principle of Factuality, I can access a speculative realism which clearly refutes, but no longer disqualifies, correlationism. I think an X independent of any thinking, and know it for sure, thanks to the correlationist himself and his fight against the absolute, the idealist absolute. The principle of factuality unveils the ontological truth hidden in the radical skepticism of modern philosophy: to be is to be factual – and *this* is not a fact.

I shall now move on to my last point: intellectual intuition. I used this expression in *After Finitude* to characterise the intellectual access to factuality – that is, the access to facticity as an absolute – and Brassier wrote that such a notion threatens to close me again into the circle of correlation. Intellectual intuition, with its heavy idealist connotation, seems to entail an absolutisation of meaning, hence an absolutisation of thought. It seems to be a dangerous concession made to correlationism. Let's try to respond, to give an answer to this objection.

What did I mean, exactly, by this expression, 'intellectual intuition'? Why did I take the risk of using an idealist expression in order, of course, to subvert its meaning? From now on, I shall use, if you prefer, the oxymoronic term *intuition dianoétique*, 'dianoetic intuition'. I mean by these words, the essential intertwining of a simple intuition and of a discursivity, a demonstration – both being entailed by the access to factuality. Let me explain this point.

Why do I think that Laruelle fails to escape correlationism? It is because he doesn't begin by refuting correlationism but by positing as an axiom, a Real supposed to precede any position. If you begin with the Real, you can't refute the objection of the circle – that is, the Real is a *posited* Real. Laruelle posits the Real as autonomous and deduces from this axiom that thought is contingent for the Real. I believe, on the contrary, that you must begin with correlationism, then show that correlationism must itself posit the facticity of the correlation, and demonstrate in this way that this facticity is absolute contingency. Then, finally, you will accede to an independent Real. Hence, the only way to the Real, according to me, is through a proof, a *demonstration*: a demonstration unveils that facticity is not an *ignorance* of the hidden reasons of all things but a *knowledge* of the absolute contingency of all things. The simple intuition of facticity is transmuted by a *dianoia*, by a demonstration, into an intuition of a radical exteriority. I thought that facticity was the sign of the finitude and ignorance of thought. I thought I had, in facticity, a relation to my own deficient subjectivity. I discover now that what I took for human idiocy was truly an intuition, a radical intuition – that is, a relation to the Great Outside. We have a *nous* unveiled by a *dianoia*, an intuition unveiled by a demonstration. This is why I called it an intellectual intuition: not, of course, because it is an intuition which creates its object, as Kant defined it, but because it is an intuition discovered by reasoning.

I'd like to conclude with a final comparison between the principle of factuality and other philosophies in the twentieth century which tried to access a Real outside the circle of subjectivity, from Heidegger to Derrida. The main difference between these philosophies and *spéculation factuale* is that the latter avoids what I'd like to call the syndrome of a 'Real without realism'. Philosophies of the twentieth century, even when they tried to escape correlationism, generally – not always, but generally – denigrated realism, which was identified with naïve or dogmatic realism. In his book, Brassier excellently presents the significance of these ways of thinking. I quote:

> Thus for much of twentieth-century continental philosophy, from Heidegger and Derrida to Levinas and Adorno, the only conceivable alternative to the Scylla of idealism on the one hand, whether transcendental or absolute, and the Charybdis of realism – which it seems is only ever naïve – on the other, lies in using the resources of conceptualisation against themselves in the hope of glimpsing some transcendent, non-conceptual exteriority.[21]

I think we can say the following: this Real, as a non-conceptual residue of the concept, separates itself from any realism, because it forbids any possibility of a conceptual discourse about the Real in itself. We can speak about the Real as the impossibility of any conceptualisation, but we can't conceptualise the Real. There is a disjunction between the Real and *logos*. A realism is, on the contrary, according to me, a *logos* which turns to the Real instead of turning *around* it. But what do I mean by 'turning to the Real' as regards *spéculation factuale*? My thesis is that there are specific conditions of contingency, which I call 'figures'. For example, I try to show that non-contradiction is a condition of contingency, since a contradictory reality couldn't change since it would already be what it is not. The necessity of non-contradiction is for me a consequence of the falsity of the Principle of Sufficient Reason: since nothing has any reason to be and stay what it is, since everything can change without any reason, nothing can be contradictory. That is what I try to demonstrate in *After Finitude*, so that a conceptual discourse about the properties of the Real proves to be possible. We are not condemned to a 'Real without realism'. I refuse this 'Real without realism', because if I don't have a rational procedure to discover specific properties of the Real, those properties threaten to be arbitrarily posited. My own work consists in elaborating this procedure – which I call 'derivation' – grounded on the Principle of Factuality and the conditions of contingency. Producing a procedure of this sort is for me one of the main challenges of a contemporary realism.

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[21] *Nihil Unbound*, 129.

To conclude, I would say that what contemporary philosophy lacks is not so much the Real as realism: the Real *with* realism is the true challenge of philosophy, and that's why I think that the title of our day – speculative realism – was perfectly chosen, and is in itself a sort of event.

*

Suhail Malik: If your argument against correlationism is an argument which, as you said, must be a rational argument, and at the same time, the fact upon which your rational argument turns around, is a non-absolutisable fact of the argument for contingency you make, then it seems to me that the fact that's important for your argument is that you can't have absolute reason. So I'm wondering if there's a possible complaint of resurrecting a kind of relativism, because your own reasoning has no absolute reason to it.

QM: I think that the correlationist argument is destructive of the relation to the absolute. If you want to destroy absolutism, you just have to use the correlationist argument. So my strategy is to access the absolute *through* the correlationist argument. The correlationist argument is in fact the demonstration that thinking must think itself as a relation to the absolute. Why? Because as an argument it only works if you suppose that it is possible for it to think its own facticity. But you can't think this facticity without thinking it as an absolute, because if you think that this facticity exists only as a correlate – that the facticity of thinking exists as a correlate of thinking, so thinking itself cannot be factual – facticity disappears. If facticity is a correlate of thought, thought is no longer factual. And if facticity was only thinkable as a correlate of thought, we would be – not just philosophers but everyone – idealist philosophers. We could not even imagine our dying.

Ray has a very interesting reading of Heidegger and being-toward-death. For me, it is not being-toward-death, because death is a correlate of being-in-the-world. Death cannot fight Heidegger because death is a correlate of being-in-the world and *Dasein*. So there is no being-toward-death, because if you want being-toward-death you have to conceive an event able to survive you. You have to conceive a time able to survive you, because if time disappears with you, you don't disappear. To disappear is to disappear in time. This is a demonstration, then. The demonstration of correlationism means the contrary of what it thinks it means, but it is still a demonstration. Now, what is the demonstration, what does it prove? It proves that you can destroy in me the reality of any discourse, as an absolute discourse on absolute reality, using the Rortian tactic of saying that it is contingent: 'Give me the reason why it should be a universal discourse, a universal truth, a universal reality – give me the reason. It's not possible to give a reason.' And I think it's always like that in the history of philosophy. Metaphysics and scepticism – they are always like two enemies fighting against each other, but it is always in scepticism that we discover how to realize metaphysics. Montaigne's scepticism was the key to Descartes' new metaphysics, because it discovered a new way of thinking. I think that contemporary scepticism, the contemporary correlationism, shows us where to look for the absolute. You can pursue contingency, but you can't say that facticity is a fact. If you say facticity is a fact, that even contingency is contingent, what are you saying? The only one who can say that is Hegel. But I think – it's difficult for me to show you – I think that a demonstration is possible.

I think that philosophy can be a discourse constituted by demonstrations if it renounces being a Hegelian demonstration of what there is. But, as I said to Graham, I think that it is possible to strictly demonstrate a certain truth, but this truth being the truth of the radical contingency of things, you absolutely allow for the freedom of all possible phenomenological descriptions and conceptual descriptions of the world. And effectively, I think that speculation can only take the form of this sort of demonstration. Sure, there is no reason to the world, but this absence of reason is not madness. It's not just delirium. You can have reasoning, strict reasoning, supervening on the absence of reason.

DUSTIN MCWHERTER: I want to ask you about something you said earlier. I think, when you were responding to Ray, you said that your project was one of possibility – how is it possible for science to know things about the pre-human world, such as the arche-fossil?[22] But then when you were responding to Graham you mentioned that if everything is factical – if everything is contingent it has to be factical – the only way we can know about *particular* things is through description, like phenomenological description. So my question would be: what would a phenomenological relation to something like the arche-fossil be like? How would that be possible?

QM: In *After Finitude* I try to persuade the reader with what I call 'the problem of the arche-fossil'. The problem of the arche-fossil was for me a way to write in a context principally dominated by correlationist philosophy. So I tried to show the correlationist reader – probably a correlationist – that there could be a problem in correlationism. The whole first chapter is saying: maybe there is a problem with this metaphysics … And I just demonstrate the problem like that. Correlationism is just a consequence of Kantian philosophy, and Kantian philosophy is philosophy which pretends to answer the question of how sciences are possible, how physics is possible. Okay, but the problem is that physics describes some reality which precedes the existence of the human and even that of the earth, of any living reality. So, can we explain the meaning of science without the principle of the correlationist philosophy, which says there is no science, no meaning, in affirming that reality could exist without a subjective correlate to that reality? Is the Big Bang just a correlate of a proposition? You might say, 'Ah, your Big Bang is just your correlate'. No, no I assure you it isn't. I'm not that old! There is a problem, there is a little problem here! But, in my view, there is no particular problem in description. You can describe the real fact, but you have to explain how thought is able to speak to a reality which is *not* correlated to thought. That's why my project of realism is to try to respond to the Kantian question of how sciences are possible. It is a transcendental question, but the response, the answer, can't be transcendental. It's always from the inside that I try to defeat the correlationist. It's from the inside – the arche-fossil is a way to challenge the Kantian philosophy from the inside. My problem is a problem of the meaning of the sciences. If sciences have significance, have sense, reality is not merely a correlation of thought – how can that be possible? My project is to derive from a contingency which is absolute, the conditions which would allow me to deduce the absolutisation of mathematical discourse. So it would ground the possibility of sciences to speak about an absolute reality – by which I mean, not a necessary reality, but a reality independent of thought. I mean the physical universe, which is not necessary, but which is independent of thought. There are two senses of 'absolute' here: 'absolute' in the first sense means 'absolutely necessary'. Contingency is absolutely necessary. But in the second sense, 'absolute' is that which is not essentially related to the thing. The physical universe is not necessary, in my view, but *is* absolutely independent of thought. I want to ground the possibility of these two 'absolutes'.

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[22] For 'the problem of the arche-fossil' see **COLLAPSE** Vol. II, 15-54, 83-169.

Robin Mackay: Your argument is philosophically positive and constructive, a constructive movement; but on the plane of natural science it seems as if it could be destructive, because you begin with a position where we assume that natural laws are necessary, but we can only assume that *for us*. So, in other words, we have a working system of natural science, but always with a correlationist coefficient added to everything we say. Where we end up is with a situation where you get rid of the correlationist coefficient but instead you have the factical coefficient. So you have the absolute knowledge of contingency – the necessity of contingency – but my question is: can you then replenish this emptiness with natural science? Can you rebuild natural science from that? Because, surely, any scientific statement you make may not be valid tomorrow or in the next minute, so don't you destroy the basis of natural science at the same time as you secure a rational foundation for it?

QM: I say that everything is contingent. So laws, according to me, are contingent. They are not necessary. As Hume said, we are unable to demonstrate any such necessity. I think that irrationality, in fact, is a consequence of believing in the necessity of laws. If you believe that laws are necessary, what are the consequences? 1) You believe that laws are necessary, and 2) You are unable to explain why they are necessary. You are unable to demonstrate the necessity of laws – unless you are Hegel. So you have a mysterious necessity, and if you want to look for God in this mysterious necessity, as the anthropist does, you will find it.

I make a distinction between speculation – what I do – and metaphysics. Metaphysics is dominated by the Principle of Sufficient Reason, and the Principle of Sufficient Reason says that things are necessary. If you think that things are necessary, but you can no longer demonstrate this necessity – unless you are Hegel – then you create a mysterious entity. 'Why are the laws necessary? It's an extremely big mystery'. And this creates a lot of superstition – anthropism, providentialism, etc. 'Oh, we are astonished by the laws, they are incredible. 1) The laws are necessary, 2) They have created man – *there must be a reason*'! No, there is no reason, because they are *not* necessary. That's my response. They are not necessary. 'But how do you know that?' By reason, by my reason. Hume shows that. Hume says just use your reason, faced with the facts. Try and demonstrate that it is necessary – you can't. What does it mean? It means that reason says, 'No, it is not necessary'. And reason has said this very loudly, century after century. It is not necessary. It's just a fact. Reason can't demonstrate that it is necessary

– not because reason is deficient, but because we are mistaken in supposing that it *is* necessary. What makes us believe that these laws are necessary? Our perception, says Hume, our sociality. It's the result of experience, of the fact that laws are stable – stable, not necessary. Stability is not necessity – it's a fact, it's a fact. For example, for an insect I am very stable. If the insect lives for only three days, then I will seem immortal to it. I'm stable, more stable than the insect, but stability does not mean necessity. So, experience says there is stability, and we can say it is not necessity, and who are metaphysicians believing? Reason or perception? Reason or experience? Me, I want to believe reason, and reason says there is no reason. And I don't think this is a destruction of science. Why? Because it is, on the contrary, a rational demonstration that sciences must be empirical. Why can't physicists demonstrate the necessary determination of a law by reason alone? Because these are *facts*, not necessities. We could say, 'Yes, but with your philosophy, laws would disappear in one minute.' But this is probabilistic argumentation. And I try to show this, I try to deconstruct this reasoning, this probabilistic reasoning about the laws. I try to show that in Hume and in Kant you have this sort of reasoning. We believe that if laws were contingent they would change frequently. No, no, no, because we don't have the right to apply probability to the laws, because this would presuppose a totality of cases. But in my view there is no such totality of possibility, because the transfinite of Cantor in mathematics and set theory demonstrated that there is no quantity of all quantities.[23]

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[23] See **Collapse** Vol. II, 55-81.

IHG: I want to ask you about the Principle of Sufficient Reason, which you use exquisitely, I think, and in a properly Leibnizian sense. The Principle of Sufficient Reason asks only that there be a reason for being, not that it be *the* reason, not that there might not be another later – only that there be one. There must be reasoning. And it seems to me that was one of the reasons why you demonstrate, both in your book and in your talk just now, considerable admiration for, and a logical or argumentative indebtedness to, the classical idealists. You have, it seems to me, an homage in your book to Schelling and his critical understanding of Hegel, for example.[24] This is in part a response to what Dustin was saying about saving the sciences, and to go back to the question that Ray raised much earlier in the day which concerns, really, the issue of revisability. We don't need to specify the quantity of sufficient reasons to be given over an infinite time. The Principle of Sufficient Reason merely states that there be *a* reason, not that it be *one* reason. That gets you revisability.

QM: Yes, of course, but I would say, the Principle of Sufficient Reason is able to support a theory of revisability – we can change our reason, etc. But there must be at least one reason. So, you can change a theory, but it is not the changing of nature. But what I am trying to do is to claim that nature can change. There is the problem of believing in the necessity of laws, but that's not the problem of believing in the necessity of theories. Nature stays what it is, but theory changes. At the beginning of the twentieth century, Newton perished and Einstein replaced him, but it is not because nature changed in 1905! So, the Principle of Sufficient Reason can extend to, can justify, the evolution of theory, yes. But I want to justify the possible evolution of *nature*.

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[24] *Après la finitude* (AF) overtly seeks to 'renew the thinking of the absolute' (AF 39) in post-Kantian philosophy. For examples of its homage to Schelling, consider Meillassoux's differentiation of subjective from objective, or of transcendental from wild, idealism (AF 35-6); the modal extension of ontology in the form of the '*pouvoir-être*' (AF 73-80) or '*Seynkönnen*'; the asymmetrical and irreverisible temporalisation of ancestrality, factuality, and speculation (*passim*). Finally, for Meillassoux as for Schelling, Hegel is the thinker who subjugates difference to identity (AF 95). [– IHG]

IHG: So, there needs to be an additional ground.

QM: Without any reason.

IHG: Yes.

PETER HALLWARD: That was a fascinating paper. I'm confused by a very commonsense kind of problem, and I'm sure people have asked you these things many times. But it seems to me that you shuttle between an *ontological* argument that you associate with metaphysics – and particularly the metaphysics of sufficient reason, pre-Kantian metaphysics – and use that to demolish what are essentially *epistemological* arguments that underpin the correlationist post-Kantian position, where, for example, the question of necessity is much more difficult to distinguish from the status of the fact, of the factual. So the question of what is necessary about a certain factual configuration – that we necessarily breathe oxygen, or that gravity has a necessary relation between masses and so on – all those kinds of facts the correlationist says we can *know* as necessary – in other words, as having a rational justification – and so we can have an account of gravity and so on. But the correlationist position is not about the ontological status of things. For the correlationist, it's not that to *be* is to be the correlate of thought. Correlationism is just a bland epistemological argument of what we can *know* about gravity, or about evolution, or those kinds of things. And so I don't see how the correlationist would be affected by your refutation. They would simply say, 'You're telling us that we can *know* things about an absolute reality independent of knowledge', and they would simply ask you, 'Well, tell us what you know about death, or about the Big Bang, and so on, independent of our knowledge of it', and you will be able to tell them nothing. In other words, it would have the status of arguments that justify something like a negative theology: we can reason our way to knowing that there must be something about which we know nothing.

QM: Correlationism – you're right – is not an ontology, strictly speaking. The correlationist – it's true – doesn't say that reality is the correlation. It's the metaphysics of subjectivity that says that. He just says we cannot know anything apart from what we can perceive or conceive, *etc.* That's all. I refuse to say, on the contrary, that I can't say anything about the absolute. If I can deduce from the absence of reason, from contingency, certain aspects of what things in themselves must be like then I am saying something about the absolute. I know for instance that even if we don't exist, whether or not we think, things are non-contradictory. So, my problem is precisely to deduce from facticity some precise, fixed determinations which are able to explain very simple things.

When I look at this bottle, I see qualities which seem to be contingent, but in this bottle there is also something which is not visible, perceptual: its facticity. Its facticity is invisible. Only humans can conceive the facticity of the bottle, because to conceive it means to be able to ask certain questions. And facticity, I believe, is a position which is necessary for correlationism, because correlationism, ultimately, can't answer and doesn't want to answer the question of the ultimate ground. If it could answer it, it wouldn't be correlationism anymore. So facticity is a correlationist thesis. But facticity, for the correlationist, is just our *inability to conceive* the ultimate ground, not the *lack* of an ultimate ground. But what I say is that in conceiving this facticity as just ignorance, you in fact implicitly conceive the capacity of thought to conceive its own end, and thus conceive positively an event which is not dependent on its contingent existence. You – the correlationist – say, 'You cannot say anything about death'. Well, I can't say anything about what it is like to be dead, but I can speak about death as an absolute time which is able to destroy any determined entity, in which respect, the principle of non-contradiction says something about the condition of death. I don't speak of what it is *like* to be dead, of course.

Ray Brassier: That was great. It cleared lots of things up. It's just that I wonder if the argument from performative contradiction – the key correlationist argument – is as strong, as irrecusable, as you seem to be suggesting. Because the claim is that to posit something non-posited is a performative contradiction. But the correlationist must claim to know that the difference between the posited real and the non-posited real is already internal to this concept, to this act of positing. So, in other words, how does the correlationist know that there's no difference between the *concept* of an indifferent real and the indifferent real? He accuses the metaphysician of transgressing the bounds of knowledge by insisting that there's a difference between indifferent reality and our *concept* of indifferent reality, but in order to do that the correlationist must know that that difference is itself conceptual. How does the correlationist know that the difference between the concept of indifference and real indifference is itself internal to the concept? Because the act of positing itself presupposes that there's already a relation, and you must know that you exist in order to be positing, and the relation is not self positing. There's always something that seems to kind of escape and precede as a condition of positing. And in order for the correlationist to say, 'Yes, but I've already posited this difference', he must claim that this is already internal to the concept, that it's already internal to thought. In other words, it might be that the argument from performative contradiction used by the correlationist is not as robust and as devastating as they claim it is.

QM: You're asking how the correlationist knows that there is a difference between the X and the posited X?

RB: How he knows there is *no* difference – there is a difference but the difference is internal to the act of positing.

QM: In fact, the correlationist says he doesn't know, but he says that metaphysics doesn't know either. He says to the metaphysician, 'How do you know that you are speaking about the X which is essentially the same as the posited X about which you are effectively speaking? How do you know that?'

RB: Okay, but how does he know there isn't a difference?

QM: No, the correlationist doesn't say that he knows that. I will speak for the correlationist … I asked myself a question, a single question. When I was reading Kant, one day I asked myself: for Kant, are we sure that the thing-in-itself is different from the phenomenon? Because we might well think that Kant says: that the thing-in-itself is unknown doesn't mean that the thing-in-itself is different from the phenomenon, it just means that we don't know whether it is the same or not. But the Transcendental Aesthetic, in fact, says we know that the thing-in-itself cannot be the same as the phenomenon. In fact, Kant says three things about the thing-in-itself. He says that the thing-in-itself exists, that the thing-in-itself is thinkable as non-contradictory – that's what the commentators say – but in fact he also says a third thing: that the thing-in-itself is not identical to the space-time phenomenon. He knows that. He knows that by a very interesting argument which says that science can only be about phenomena. So if the thing-in-itself was phenomenal, just empirically known, we couldn't have scientific knowledge of it, because there would be no form, no subjective form which is always the same. For Kant, science is possible because we have the subjective form which is always the same: space, time, and the categories. So if science is possible, it demonstrates that we don't know the thing-in-itself – science demonstrates that we don't have any knowledge of the thing-in-itself. So, for a correlationist, Kant has an argument, a very interesting one – that we know that the thing-in-itself cannot be the same as the posited phenomenon. But I don't even say that, I don't think that. My correlationist is more modest than Kant. He just says that we don't know if the X, the absolute X, is the same as the posited X. Maybe it is the same, maybe, why not? 'But', says the correlationist, 'I don't know if it is the case or not. How could I know? How could I possibly know?' As Hegel said, you cannot surprise the thing from behind to know what it is when we are not there. If we are paranoiac we can install microphones in our house so as to know what people are saying about us when we are not there, but we cannot do that to things. Where are the things? They are not there. We cannot go outside our skin to know what is out there. Maybe the irony would be that this world is in itself exactly as it is for us – wow! In that case philosophers are absolutely useless! Maybe, maybe. Correlationism doesn't say it is impossible, it says it's unknowable.

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Editorial Introduction

Robin Mackay

Surveying a century in which experience has taught us that man is capable of inventing ever more atrocious forms of violence and horror, is it necessary to remark that much of modern thought offers little to soothe, and much to exacerbate our disquiet? Nietzsche famously observed that the psychic well-being of the human organism is predicated, minimally, upon a drastically partial perspective, and ultimately upon untruth. Human cognitive defaults continue to cry out against the insights which modern physics, cosmology, genetics, neuroscience, psychoanalysis and the rest seem to require us to integrate into our worldview. As for philosophy, it has largely replaced wonder, awe, and the drive to certainty with dread, anxiety and finitude. Moreover, despite the diverse technological wonders they have made possible, the modern sciences offer little existential respite: There is no consolation in the claim that (for instance) I am the contingent product of evolution, or a chance formation of elementary particles, or that my 'self' is nothing but the correlate of the activation of neurobiological phase-spaces. Yet mundane thought, whether through obstinacy or inertia, maintains its stubborn course regardless, as if oblivious to their consequences, or at most allowing them to subsist at a safely delimited, solely theoretical level.

What if, prising the more disturbing elements of modern thought loose from their comfortable framing as part of an intellectual canon, we were to become fully attentive to their most harrowing consequences? What if, impatient with a consideration of their claims solely from the point of view of their explanatory power and formal consistency, we yielded to the (perhaps 'unphilosophical') temptation to experiment with their potentially corrosive effects upon lived experience? If the overriding affect connected with what we 'know' – but still do not really *know* – about the universe and our place in it, would be one of horror, then, inversely, how might the existing literature of horror inform a reading of these tendencies of contemporary thought?

These are some of the questions with which this volume of **COLLAPSE** sets out to grapple, imagining for a moment a philosophy absolved of humanistic responsibilities, devoting itself to the experimental marshalling of all possible resources in the service of a transformation that would no longer be circumscribed within the bounds of the purely theoretical, and thus striking an alliance with those affects which, for the most part elided, nonetheless haunt philosophical thought like its very shadow. A philosophy, then, bound to experiment with the employment of horror, that its insights might begin slowly but effectively to erode anthropic automatism.

Such experiments are already being undertaken – not for the most part by philosophers, but by those working in literature and the arts who, drawing upon the resources of modern thought, have devised means by which to produce *experiences* of the conceptual upheavals characteristic of the post-Enlightenment age. It is the scenarios of weird and horror fiction, the excessive existential sufferings of literature, the abstract emotional engineering of sound-art and music, and the poetical extrapolations of artists, that are apt to put us in the place of individuals set loose from the protective envelope of consensual reality, forced to integrate directly the lacerating force of thoughts usually blunted (even – or, sad to say, *especially* – in philosophical discourse) by the knowledge that they are, after all, '*only* thoughts'. It is through them that we identify ourselves with tormented individuals compelled – even if only momentarily – to *live the problem* of the rational corrosion of our cherished self-image, to viscerally absorb thoughts 'whose merest mention is paralysing' (Lovecraft).

In the twentieth century, SF, weird fiction, and horror in particular have furnished a laboratory for shaping narratives pointedly informed by the conceptual paradoxes produced by modern science and philosophy. And increasingly, philosophy itself, and the high arts which so long looked with disdain upon such pulp fictions, are realising with what anticipatory clarity these genres have formulated problematics which are becoming ever more pressing, not only conceptually and aesthetically, but even politically (given what is at stake in our maintenance of a naïve, comfortable self-image even as the most speculative theoretical insights are immediately and ruthlessly operationalised throughout the sociopolitical and commercial spheres, from advertising to healthcare, from warfare to banking).

Given this discursive intersection between the attempt to rethink reality through contemporary science and philosophy, and the tropes of the horror 'genre', then, there is a certain logic in examining together conceptual armature and artistic dramatisation. It was this double-edged approach that we decided to take in the present volume, by bringing together contributions from authors of weird fiction, artists, and philosophers – only to discover ourselves vindicated by the impossibility of determining where the concept ends and the horror begins. The theme thus presented an opportunity to bring more fully to fruition **Collapse**'s vision of an integration of elements originating from very different spheres, mutually catalysing so as to produce a series of conceptual 'interzones'.

George Sieg's contribution ably demonstrates how, in examining the nature of horror as an affect, a rich intersection of cognitive, conceptual, existential and political stakes comes into view. Firstly, unlike the essentially animal responses of fear and terror, horror attaches especially to the conceptual abstraction and reflexivity attendant upon self-consciousness – which is as much as to say that *homo philosophicus* is defined by a capacity for feeling horror. As Sieg argues, horror is characterised more through its victims than through its predators, and the victim's itinerary is always that from innocence to knowledge. Corollary to this is the impossibility of flight to a 'critical' position on horror, since it is 'always already' (even such hoary philosophical locutions reveal a menacing aspect here …) the horror of *knowing* horror – whence Sieg's characterisation of horror as peculiarly 'gnostic' (thus introducing a recurrent theme of this volume).

Sieg locates the historical kernel of horror in the endotropic amplification of an anthropological commonplace – the Zoroastrian concept of *druj* as xenophobia turned inward. However, in order for horror to flower, he emphasises, another element is necessary – a thoroughgoing materialism, in which the knowledge of non-apparent conceptual distinction – the sensitivity towards hidden otherness – is prevented from diffusing into mysticism: The very birth, one might say, of the distinction between philosophy and religion, is also the birth of horror. It is this compaction, suggests Sieg, which finally blocks all exit from a self-referential universe pregnant with horror and yet (or precisely because it is) entirely rational – a universe in which the innocent victim is defenceless before the monstrous knowledge which invades them.

In his contribution **Eugene Thacker** details how theology has, nevertheless, maintained a consistent historical relation to horror. His 'Nine Disputations on Theology and Horror' examines the extent to which the concept of 'life' owes its integrity to an immanent 'after-life' which is the proper object of horror. If life is defined by a duplicity – the distinction between the living being and life 'itself' – then, according to Thacker's historical survey of the 'teratological noosphere', in the undertow of the questioning of life we always find changing conceptualizations of afterlife, whose horrific avatars are so many embodiments (or disembodiments) of this problematic duplicity. They provide us with a handle on a fundamental question of biopolitics in its varying historical forms: The suppression of the after-life immanent to life, whose horror reveals that which is already there prior to individual lives, the anonymous Levinasian 'there is' which, Thacker argues, is 'a point of attraction for ontology' – in Thacker's coinage, a 'nouminous' (both noumenal and numinous) life. However as Thacker's 'disputations' deepen, the 'always-receding horizon' of the concept of life leads him to a more radical consideration of 'life as non-being', or the horror of 'life-without-Being'.

In their 'Czech Forest' cycle, Prague artist collective **Rafani** take an oblique approach to confronting a horrifying episode in their national history. Although at their birth Rafani announced themselves through overtly political manifestos, by addressing this suppressed event through a reappropriation of folk art, 'Czech Forest' displays a keen ability to navigate the borders of the political, the mythical and the aesthetic. In doing so, it adds a supplement to George Sieg's argument that horror has its roots in xenophobia and the fear of the 'enemy within'.

At the end of the Second World War, Czech inhabitants of the now-liberated Sudetenland turned on neighbouring Germans, whose families in some cases had inhabited the forest region for over a century, and drove them out with vengeful ferocity. The slogans reproduced in Rafani's iconic images (from the 'Unofficial Decalogue of Czech Soldiers in the Borderland', a propaganda handbook published at the time) demonstrate starkly enough how this triumphalist convulsion relayed the horrors suffered under occupation, revisiting them once more upon the innocent. But the 'Czech forest' of the title also conducts a deeper current: the Forest, as fairy-tale locus of darkness, where children get lost, monsters lurk, and, at dusk, branch and leaf become menacingly animate. By subtly adapting the folk-art-inspired woodcuts that often illustrate such tales, Rafani's work connects the transmutation of the rage of the oppressed into xenophobic hatred, with the mythopoetic roots of fear, thus transforming the story from national history into psychogeographical fable of horror: it becomes a reminder of what lurks beneath the comfort of homeliness, and of the horror of the internal other.

Graham Harman's emblematic invocation of 'the electrons that form the pulpy torso of Great Cthulhu' reminds us that the hard-nosed materialism that is a prerequisite for the emergence of horror finds its equally necessary counterpart in the polysemic qualifier 'pulp'. Historically describing the re-formed, low-grade paper used to manufacture magazines carrying what was, and to some extent still is, considered low-grade and derivative literature, including fantastic fiction and comics, 'pulp' came to apply also to the latter's supposedly 'generic' nature. More than coincidentally, it also sits well with what **China Miéville** nominates, in his contribution, the 'new (Weird) haptic' – a certain 'palpability' associated with horror and whose avatar, Miéville proposes, is that exemplarily 'formless' creature, the octopus – *le poulpe*. Himself a contemporary giant of weird fiction, and an unashamed champion of pulp, in his essay Miéville clearly demonstrates that an attentive reading of the history of the fantastic underpins his fiction. He undertakes to extract from their various historical combinations and scissions the two currents of the weird and the 'hauntological'. Taking the 'skulltopus' and its 'extreme rarity […] in culture' as an indicator that the coexistence of the two genres makes them no less inviolably distinct, Miéville argues that, if the rise of the weird belongs to 'crisis-blasted modernity' – the enlightenment become dark – and if in contemporary capitalism we *live* the weird, we are also haunted by ghosts of futures that never happened: the superposed temporalities of the genres expressing the tensions of post-modernity.

Disabusing us of any suspicion that the link between horror and philosophical thought is a purely modern invention, **Reza Negarestani**'s contribution recounts how a certain hideously ingenious torture was no sooner historically recorded than its most gruesome details were employed as a conceptual resource for philosophical meditation. Building on a fragment from a lost work by Aristotle, 'The Corpse Bride' launches a necrophilic investigation into the idea of ontology as a system of metaphysical cruelty which reveals vitalism to be a 'farce' played out among the remains of the already-dead.

In imbuing a famous Etruscan torture with universal pertinence, Negarestani's Aristotle becomes a prophet of terror, insistent that any intelligible ontology as such mobilises non-belonging (or nothing) through the agency of a chain of putrefactory ratios or problematic intimacies with the dead. Aristotle assimilates the bond between soul and body with the bond between corpse and living victim, wherein only the differential layer of blackening or *nigredo* can properly be called 'life'. Yet in Negarestani's argument, even this chemistry of horror is only a preface to a deeper bond with the void which Aristotle seeks to dissimulate. The final twist in Negarestani's investigation, in which the glorification of negativity or the subtractive mobilization of non-belonging (Badiou, Zizek, *et al.*) is revealed as an implicit and unconditional affirmation of the radically exterior, adds new and macabre detail to his previous **COLLAPSE** essays on absolute exteriority and 'affordance': survival becomes an art of living with the dead, of maintaining a ratio of intensive decay to extensive putrefaction, of abiding in *nigredo*.

What follows from Negarestani's probing of the problematic conjunction of *nekrous* and *philia*, the dead and the essence of affirmation, reads like a thoroughly perverse twisting of Deleuze's dialectic of problem and solution, and a retrospective 'blackening' of the history of differential calculus he associates with it: for 'what could be worse for vitalism than at once being animated through a necrophilic alliance, and simultaneously, protected under the aegis of the void'?

The work of **Jake and Dinos Chapman** has continually toyed with the cohabitation of horror and laughter, employing the debasement of form and image as a weapon against moral self-certainty. Proof of concept in this respect was achieved in their (2004) 'improvement' of Goya's famous *Disasters of War* through 'rectifications' that yanked the atrocity-victims into a cruelly absurd cartoon universe that addressed the viewer far more intensely and disquietingly than the 'originals' with their patina of historical didacticism and art-historical legitimation.

In the drawings they contribute to our volume, the Chapman brothers continue a preoccupation with the uncannily vacant images of the children's colouring book (see e.g. *Gigantic Fun* [2000]*, My Giant Colouring Book* [2004]). In *I Can See*, vulgarised Bataillean themes vie with the vacant potency of stereotyped simulacra reproduced for juvenile consumption; the comically brutal irruption into these adumbrated banalities of fragments of body-horror, and an insidious cross-breeding with the Chapmans' own stock of cartoon atrocities, engenders a menacing air of inanity that resists easy decipherment. The artists' programmatic impoverishments, testing the limit at which the image will cease to conduct the craving for improvement, might be read in the light of Negarestani's Aristotelian arithmetic as a willed acceleration of the putrefaction of the form of art, an iterative process of decay which, however, only ever momentarily disturbs the veneration of 'what remains'.

The Chapmans' extended practical joke on the art-world continually subverts any anticipation that a work should supply abreactive or cathartic moral reinforcement through didactically-framed images ('eye-care'?). Instead it invites a jarring and problematic convulsion, an irresolvable *horror vacui*.

If Lovecraft's name resounds throughout this volume, making several of his tales 'required reading' for the collected articles, it often does so through the filter of another work. Hardly a work of 'secondary literature' – despite its biographical form, it is more of a passionate affirmation and exacerbation of Lovecraft's great themes – **MICHEL HOUELLEBECQ**'s *H.P.Lovecraft: Against the World, Against Life*[1] is one of the few studies to successfully explore the singular qualities of Lovecraft's work. And, as little as it may seem evident at first, reading Houellebecq's own work through his appreciation for Lovecraft reveals a profound influence. Houellebecq's characters too live out the 'unlivable', encountering in heightened form the cosmic horrors which modern society simultaneously unleashes and suppresses; they are individuals who have taken into their very soul the full weight of what we know about our universe and our place within it. Yet unlike Lovecraft's doomed heroes, for the most part Houellebecq's remain trapped within the banal everyday: with no respite even through the negative transcendence of madness, the world becomes a relentless trial, its everyday rituals and objects beacons of desolate horror. Houellebecq's poems – a selection of which we are delighted to include in this volume translated into English for the first time – distil his powerful vision into translucid moments of dread certainty.

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[1] Trans. D. Khazeni, San Francisco: Believer Books, 2005.

The poems record moments when the obtuse momentum of life draws it momentarily into proximity with the indifference of the universe; they offer no affirmation, no redemption, but only an icy clarity, a kind of conciliation with this indifference. The most innocuous spaces of the everyday ('the insides of cupboards') become abysmal revelations, whilst the empty repetitions of life reveal time as an implacable horror of merciless recurrence 'every day, until the end of the world'.

In his reading of the work of Thomas Ligotti – one of the foremost contemporary exponents of weird fiction – in tandem with the neurophilosophy of Thomas Metzinger, **JAMES TRAFFORD** argues that the horrifying travails of Ligotti's protagonists give phenomenological expression to insights anticipating those presented in Metzinger's extraordinary treatise *Being No-One*. The latter includes explicitly as one of its goals the achievement of a theory that can be 'culturally integrated';[2] Trafford's suggestion is that such an integration may imply a passage through horrors similar to those described – and generated – by Ligotti's singularly suffocating tales.

Metzinger's central contention is that the apparent immediacy or transparency of phenomenological appearances owes itself to an instrumental miscognition: transparency is in fact a 'special form of darkness'. Ligotti's fiction, premissed upon the catastrophic undoing of this miscognition, this protective opacity, documents the experience of the unravelling of selfhood.

Sieg argues that the monster is a less indispensable element of the horror genre than the victim, and it is the victims in Ligotti's fictions, in their plumbing of the depths of a 'spinning abyss' (recalling the 'layers within layers of horrific depravity' revealed to Sieg's gnostics) that Trafford sees as revealing the dark truth of Metzinger's 'nemocentrism'.

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[2] T. Metzinger, *Being No One: The Self-Model Theory of Subjectivity* (London: MIT Press, 2004).

In his own contribution, **Thomas Ligotti** demonstrates that not only is self-consciousness a precondition for horror, the two are inextricable. 'Thinking Horror' is thus a pleonasm: the new epoch heralded by the dawn of self-consciousness is characterized by the production of 'horrors [and] flagrantly joyless possibilities' and – swiftly ensuing – the erection of psychic defences against truth, either explicit, socialised, or in the form of commonplace ironies and homely platitudes ('being alive is okay').

If Ligotti's fictions represent so many twisted descents into the void, here it is offered to us neat, in the manner of a classic, if unhinged, essayist, and with a certain humour indissociable from such dismal truths. Eschewing any orientation of his position according to the standard co-ordinates of a philosophical orthodoxy, Ligotti introduces us to the obscure figures who form his secret lineage of pessimism, and invents a pulp philosophy at once bracing for its brutal honesty and perversely enjoyable for its mordant wit.

Whilst much contemporary thought remains doggedly committed to continuing the perennial philosophical battle against mechanism and determinism, focusing increasingly sophisticated conceptual resources on the characterisation of 'singularities' or 'events', Ligotti aligns himself, against 'the crushing majority of philosophers', with a pessimistic creed which, refusing to imprudently postulate such exceptions, instead assigns itself the sole task of outlining the futility of man's lot and the comical details of his desperate attempts to think without thinking horror. Ligotti rightly locates the interest of this programme less in its conceptual innovation than in its audacious defiance of the snares of rhetoric and the delights of intellectual sophistication. For, rather than reason, is it not these latter passions which govern more 'sophisticated' philosophical architectonics, and in doing so obscure the conceptual vistas that might open up to those brave or foolhardy enough to interrogate philosophically the 'taboo commonplaces' which they superciliously outlaw?[3] For Ligotti, though, perhaps even such interrogations risk tainting the crystalline clarity of thinkers such as Zapffe and Mainländer, for whom the real question swiftly becomes a practical one – in a reprise of the Gnostic abhorrence of nature and will-to-extinction.

One might of course argue that, even in writing, such thinkers, and Ligotti himself, yield to the tide of life. Even the will to know, to think, and to write, may itself be a sublimated form of the *not knowing* that is crucial to survival. But if thinking and writing can themselves be sources of distraction, a thinking and writing of 'concept horror' attempts to force the reader to secrete something of the poison that is buried within them; it is a kind of demonic invocation. No less than his fictions, Ligotti's straightforward account of our 'malignant uselessness' succeeds in so far as its language – like that of Lovecraft's eldritch incantations – ceases to be representational and begins to summon the very desolate reality it describes, doing away with all cultivated distance and calm objectivity. Ligotti counsels precisely this surreptitious promotion of disillusionment, to be carried out patiently by those in every age to whom it falls to carry on the bad work, hastening the dissolution of the horrors of consciousness and life, and returning us to the void.

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[3] A rare and fine example of such a dispassionate experiment in nihilism is Ray Brassier's recently published *Nihil Unbound: Enlightenment and Extinction* (Basingstoke: Palgrave, 2007). (See also 'The Enigma of Realism' in **COLLAPSE II**, 15-54.)

Ligotti's text appears in our volume alongside a series of photographs by **Oleg Kulik**, a Russian artist whose work includes photography and photoassemblage but which culminates in his extraordinary live actions.[4] One of the first artists from post-Soviet Russia to have garnered international attention, Kulik's work thematises the porous boundary between animal and human (a tendency which reached its infamous apex in 'Dog House' [1996] when, exhibiting himself as a chained canine, Kulik was arrested for physically harming and mentally traumatising members of the public who flouted the warning to 'beware of the dog'). As well as extending Kulik's researches into what Mila Bredikhina has called 'zoophrenia',[5] Kulik's 'Memento Mori' complexifies the dialectic of life and death, presenting us with images of creatures who are doubly dead – already corpses, their deaths have been preserved through interment in a museum. Of course, we still cannot help reading their visages as anthropomorphic signifiers, now all the more macabre. Evincing all the stuffed-shirt dignity of victorian portraiture, the photographs could also be read as an extended 'family tree' – an ancestral archive we might prefer to keep in the closet. Not only do they act as 'memento mori', reminding us of the horror of personal death; they also remind us, as does Ligotti, of the senseless and indifferent continuum of life of which we are an insignificant part, and of the absurd folly of our enshrining any part of it, stuffed and preserved, for posterity. Perhaps Kulik thus identifies in advance the museums and commemorative discourses in which his own work is destined to be preserved as cultural mausolea, even as he promotes the simultaneous fascination and horror that the mummified object, in its living death, evokes.

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[4] See the essential *Oleg Kulik: Art Animal* (Birmingham: Ikon Gallery, 2001) for documentation of Kulik's work from 1993-2000.

[5] Ibid., *passim.*

The alternately accusing and mutely questioning faces of the dead monkeys describe a strange twisting associative dance with Ligotti's text, the nuances of dumb bewilderment and silent petition inviting us to identify ourselves simultaneously with Kulik's photographic subjects and the hapless, self-deluding targets of Ligotti's rant. A deeply felt unease, and the troubled laughter that accompanies it, is the inevitable initial response to this marriage of text and image. But ironically, read within the context of Kulik's work, 'Memento Mori' obliquely hints at an egress from Ligotti's dead end. For Kulik's performances seek a zoophrenic overcoming of the limitations of the anthropic through a plunging into the animal. The involvement of 'the point of view of different biological species in aesthetic practice,' the artist proposes, 'will produce a new renaissance'[6] – Since the anthropomorphisation of the animal can only subject it to a further death, we should rather *zoomorphise the human.* This strategy of a 'forward-to-nature'[7] zoofuturism implies that escape from 'the crisis of human schizophrenic culture'[8] might involve intimacy with a horror that walks on four legs – a horror that has left its teeth-marks on witnesses to Kulik's uncompromising and profoundly disturbing animal-becomings.

In this volume we present the final part of a 'trilogy' of essays by **Quentin Meillassoux**, which proposes a wholly different, rationalist, antidote to despair. In previous contributions, Meillassoux presented his thesis of 'absolute time' or 'the necessity of contingency', founded upon a re-examination of Hume's problem.[9] In 'Spectral Dilemma', he unveils the ethical consequences of the position, introducing the conception of the 'virtual god' that lies at the heart of the philosophical system to which the acclaimed *After Finitude*[10] – although a significant intervention in its own right – is a prolegomena. In his meditation on irremediable bereavement, Meillassoux asks, with regard both to the spectres of those whose loss is personal to us, and to those belonging to the atrocities of the last century and which seemingly cannot be dispelled, how it is possible to escape the shadow of such deaths, thus to hope once more. Meillassoux's answer to this question will surprise many, but undoubtedly constitutes a consistent development from his central philosophical contentions. Identifying the dilemma presented by the theist and atheist responses to the demands of 'essential mourning' – namely, that one must hope something for the dead, but that any *existing* god, having to be held responsible for their sufferings, can only be the object of horror and repugnance rather than veneration – Meillassoux shows that the 'impossible' conciliation of the parties must be sought through a thinking of the *divine character of inexistence*, which is further expanded into a very particular modal thesis, revealing the solution to the 'spectral dilemma' to be a formal counterpart to the speculative-rational solution of Hume's problem.

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[6] Ibid., 1.

[7] Ibid., 51.

[8] Ibid.

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[9] Q. Meillassoux, 'Potentiality and Virtuality', COLLAPSE Vol. II (2007), 55-82 and R. Brassier 'The Enigma of Realism', 207-34, in the same volume; 'Subtraction and Contraction', COLLAPSE Vol. III (2007), 63-107.

[10] Trans. R. Brassier (London/NY: Continuum, 2008).

Meillassoux presents us here with a foretaste of what he will develop of a *divinology*, in rupture with the very couplet a/theism. But if the question for the bereaved is then no longer that of having enough time to mourn, but of *what type* of time, then, glancing forward to **Benjamin Noys**' reading of Lovecraft's conception of time, we might wonder whether the god who is to come, but whose arrival depends upon a lawless 'hyperchaos', is not destined to visit upon its devotees a '*Horror Temporis*' more terrible still than the dilemma from which it frees them. Inspired by Meillassoux's conception of 'absolute time', Noys suggests that, if (as Harman argues) the comparison between Lovecraft and Kant does not hold good, at least one affinity between them may yet be attested: in the introduction into weird fiction of the affect corresponding to the 'empty form of time'. Time, released from its anthropocentric cycles, becomes unhinged and threatening in its indifference to humanity; fully purified, as in Meillassoux, of sufficient reason, it implies a 'suspension of natural laws'. Invoking the 'arche-fossil' as emblem of cosmic temporal disquiet, Noys notes that the Meillassouxian universe, freed from the yoke of the Principle of Sufficient Reason by a time whose vicissitudes are not even ameliorated by lawfulness, carries the Lovecraftian implication of a 'material "outside" responding to no law', a truly 'unmasterable' god – it is the universe of *Azathothic materialism*, releasing us 'into the experience of the horror of […] the seething vortex of time'. And, as we know, those of Lovecraft's protagonists who fall under the eldritch shadow of beings hailing from this 'outside', far from finding their hope replenished, finish traumatised and deranged. Given the trajectory of 'irrealism' which accompanies the discovery of *horror temporis,* Noys concludes fittingly by showing how Peaslee's 'researches', unsatisfactorily abridged in the ending of Lovecraft's tale, might be completed from the perspective of a contemporary philosophy of the real which reveals time itself as the 'shadow'.

German artist **Todosch**[11] (whose work, like that of Oleg Kulik, has involved an uncanny intimacy with the animal: one of his live actions, connected with the infamous 'Hundetunnel' project in Chicago,[12] involved implanting dog fangs into his mouth for a year) produces work which seems to invite myths and/or rationalisations whilst simultaneously repelling them: How to 'explain' live actions causing great public inconvenience and stress-testing public reaction (various Sisyphean labours including dragging six carriages of scrap through the streets from Berlin to the Hanover Expo); fictional institutions (*Das Falten von Böhmen*, *Conscious Force*) which realise themselves through an exhaustive documentary archive; or the painstaking production of strange objects (cute pokemon-like critters that turn out to have been carved from Carrera marble) like fetishes of a classical alien culture? A part of their disarraying force, and the irresistible desire to quell it with some narrative, results from a forced confrontation with the brute materiality of the heterogeneous matter that surrounds us but whose opacity and intractability are systematically suppressed through commodification and habituation. Refusing to make it serve him, as an artist Todosch repeatedly takes the burden of (physical, informational, cultural) 'stuff' upon himself. The drawings which he contributes to this volume of **Collapse** might be understood both as a depiction and a channeling of this heterogeneous, cloacal, sinewy, abstract matter. The 'stuff' is never quite recognisable, but is recognisably

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[11] A.K.A. Thorsten Schlopsnies. See http://todosch.felix-werner.net/

[12] See 'Thorsten Schlopsnies – Todosch', in *Umelec* 2, 2005, 51-4.

impure, and evidently in the process either of coagulation or of decomposition – a research study from one of Todosch's fictitious institutions, *The Institute for Recycling Reality*?

Quite apart from the general ineptitude attacked by Graham Harman, there is a particular want of critical finesse in denouncing as 'continental science fiction' the work of **IAIN HAMILTON GRANT**, who his readers will know as the foremost exponent of *steampunk materialism*,[13] but who has latterly become – judging by his more recent works' protracted descent into what he has described as 'the nuclear night of the unthinged'[14] – chief scribe of *idealist horror*. In his essay on Lorenz Oken, which accompanies Todosch's drawings, Grant adds an extraordinary coda to the powerful case put in his recent book[15] for the contemporary importance of a philosophy of nature.

As anticipated in Grant's earlier account in **COLLAPSE**[16] of the necessarily speculative form of its central problem – that of accounting for its own possibility qua natural production – the chief horror of naturephilosophy is that of an evacuation of the 'comfort zone of interiority'.[17] If 'the Idea is exterior to the thinking, the thinking is exterior to the thinker, and the thinker is exterior to the nature that produced it', then naturephilosophy's vocation, in the shape of thinking the production of thought, is to turn 'us' inside out, in the process making it impossible 'for anyone to recognise themselves in the production of their thoughts'.[18] This is accompanied, too, by an unpleasant community with the lower orders, far beyond zoophrenia (and even *within* the individual – in Oken's theory of recapitulation the body becomes an infolded horror in which the head is a spine, the jaws and teeth deterritorialized limbs and nails ...).

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[13] See, e.g. 'At the Mountains of Madness: The Demonology of the New Earth and the Politics of Becoming', in *Deleuze and Philosophy*, ed. K. A. Pearson (London: Routledge, 1997); and 'Burning AutoPoiOedipus', in *Abstract Culture* 2:5 (At http://www.ccru.net/swarm2/2_auto.htm).

[14] 'The Chemistry of Darkness', in *PLI*: *The Warwick Journal of Philosophy* 9 (2000), 36-52: 36.

[15] *Philosophies of Nature after Schelling* (NY/London: Continuum, 2006).

[16] See 'Speculative Realism', in COLLAPSE III, 307-449.

[17] Ibid., 334, 343.

Since a universe where even thought is a natural production, its 'content' thus having no necessary purchase on that production, is indeed something 'very difficult to imagine',[19] we might say that a successful naturephilosophy would be a kind of forcible manipulation of the imagination; that it must appear in the form of a literally *mind-bending* speculative science/fiction and a brutal dismemberment of the body of representational thinking, relegating the Kantian a priori to a mere natural-historical *prius*, thought being separated from its conditions not by some absolutised transcendental membrane but by an asymmetry in the time of production.[20] Naturephilosophy thus provides the formal schema for precisely that negation of the 'insularity of transcendental subjectivity' which (as Trafford argues) is harboured by the neuroscientific viewpoint and which afflicts Ligotti's tormented protagonists.

If this gives us permission to speak of naturephilosophy as a kind of intellectual self-harm, an auto-horrification, Grant insists that against its 'better judgement', contemporary philosophy must indeed inflict this harm upon itself once again. Does post-Kantian philosophy, he asks, bowed by the blows of naturalism, dare escape the 'trap' of reasserting its 'comfort zone' through some neo-Fichtean subordination of the natural conditions of thought (irrecoverably – indeed horrifically – excessive for thought itself) to a pacificatory illusion of self-knowledge, and a resubordination of physics to ethics? In reasserting the need for a (necessarily speculative) account of nature to revoke Kant's 'daring act of reason' which ineluctably peters out into the 'ethical process', Grant selects the model in which naturephilosophy's science-fictional credentials are most ostentatiously paraded – Lorenz Oken's monstrous (in size as in content) account of the natural generation of the universe.

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[18] Ibid., 343.

[19] Ibid.

[20] Ibid., 343.

In pursuing the ultimate ground of nature on the basis that the whole of nature is involved in each part, Oken characterises what Thacker described as the immanent 'after-life' of life as a universal Ur-slime [*Urschliem*]. But since each successive sphere of nature constitutes an appearance of 'something from nothing', then that 'nothing' appears as another element in the naturephilosophical system: Ur-slime and Zero, mucus and matheme, are thus pitted against each other as true genetic elements of nature. Grant's negotiation of Oken's twisted dialectic of Zero, the 'sink' at the 'core' of existence, and Slime as its 'oozing ground', ends in the affirmation of an 'ontological queasiness' that cannot be ceded to the hygienic instinct. In a conclusion which demonstrates the capacity of naturephilosophy to offer new and profound readings of contemporary philosophical problems – in this case that of Badiou's mobilisation of a dialectic of 'animal' and 'number' against Deleuze – Grant argues that the impossibility of abstracting away 'the shock of the objective world' means that there can be no 'slime-free matheme' unless via a unilateral assertion of the impossibility of a philosophy of nature – which would be simply to blanch squeamishly at that twisting, oozing process which *is* thinking (or being thought by) nature.

Using the search-engine as a stratigraphical probe to sample the online collective unconscious, artist **Steven Shearer** assembles vast archives (sometimes partially exhibited as works in their own right) recording otherwise uncelebrated cultural and social formations, including in particular the young fans who draw sustenance from the hyperenergetic musical genre of death metal. The *Poems* series (2001–present) draws upon an extensive archive of death metal band and song names, evidence of the genre's unremitting quest to make the cutting edges of language coincide with the violence of its sonic bombardment. Resynthesising the archive material to create a hysterical cycle of disturbing, fantastical, and absurd narratives and imagery, Shearer's well-honed method of selection yields a striking and consistent objective cross-section of this cultural matter.

Although the relentless, hysterical fervour of the *Poems* is certainly amusing at times, Shearer's work never stoops to ironic condescension. Like the lambent depictions of longhaired fans in his glowering Munch-like paintings, or in portraits which make of the humble biro an old-masterly instrument, the *Poems* are imbued with a sensitivity to a collective existential quandary whose inhabitants seek to anchor themselves to the most extreme point of reference in a world of demonstrable mediocrity. And as Shearer's *Poems* forcibly and prolongedly hold the viewer's gaze captive at the point where language is flattened out into a continuous and impassive appeal to what it can't say, his work rediscovers this extreme point. Beyond the lyrics' superficial preoccupations with death and violence lie more real and more profound depths of horror, distributed social-existential complexes rather than personal pathologies. Seen in the light of Shearer's other work – for instance, his archive of thousands of *eBay* photographs that unintentionally afford glimpses into metalheads' home lives – the evident absurdity of the *Poems*' unremitting nihilism, the distance between such extremity and 'real life', becomes an index of isolation and of the psychic torment of socialisation, showing how the metalhead's absolute 'no' to life anchors them against their inevitable concession to the tepid homeliness of 'reality'.

In their painstakingly hand-drawn form, the *Poems* have been exhibited both in galleries and in public spaces – Notably, during the 2006 Berlin Biennial, on the flank of an eight-storey building (see p. 322). Thus transformed, they invite a little of the negative sublime unapologetically celebrated by this subculture into the overlit, overfinanced spaces of the contemporary arts whose executives once told Shearer (as documented in *Sorry Steve* [1999]): 'when we talk about celebrating cultural diversity, we don't mean yours'.[21] It is through a sort of sociological alchemy that Shearer distils and recombines – so they can no longer be overlooked – the potent elements of what Lovecraft might have called a *shoggoth*-culture, with all the class associations implied in this (one of Shearer's favourite epithets for his works is 'lumpen'). Shearer's poetic invocations also echo those of Lovecraft, who considered his task to be to excite a physiological response in his readers. Again, like the famously overdone Lovecraftian prose – itself frequently verging on the comical or hysterical – the *Poems* obsessively *invoke* or *engender*, rather than merely describing, the objectless cosmic horror that inhabits every thinking being – the non-sense that ungrounds sense – but which some, by force of circumstance, are closer to than others, so that they may even cherish the secret of its constant closeness as a source of psychic sustenance.

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[21] See the beautiful recently published monograph accompanying Shearer's 2007-8 shows in Birmingham and Toronto: *Steven Shearer* (Birmingham/Toronto: Ikon Gallery/Powerplant, 2007).

'On the Horror of Phenomenology' finds **Graham Harman** arguing, against a certain normative notion of philosophical 'maturity', in favour of the demonstrable and necessary weirdness of philosophy. Turning to Husserl's phenomenology as a test case, Harman suggests that reading its insistence on the excessiveness of intentional objects against Lovecraft's descriptive delirium might provide some pointers towards the type of 'weird realism' he advocates.

Problematising a Kantian reading of Lovecraft, Harman concurs with Miéville that a hallmark of weird writing is that it takes on the 'unspeakable' with an 'excess of specificity' in description; adding that, rather than suggesting a noumenal 'backworld', this is the excess of a *phenomenal* realm pregnant with the menace of 'malignant beings' which are threatening precisely in so far as they stalk the very same web of experience whose threads we too clamber along, attempting to ignore their more ominous vibrations.

Using literature's manufacture of unassimilable and inexhaustible objects as a model for the production of philosophical concepts, Harman insists that the latter's excess over any definition makes them, too, excessive phenomena, intentional objects whose properties can never be exhaustively enumerated – precisely the model proposed by Husserl's sensitive and meticulous phenomenology.

Reading the persistent poring of phenomenological description over its object against Lovecraft's circumlocutory evocations of the unspeakable, Harman discovers – like Negarestani – that 'real objects taunt us with endless withdrawal'. The probing of a disconnection between the 'excessive presence' of intentional objects and the withdrawing correlate that binds their qualities is the motor of both phenomenology and horror – As Miéville argues, the weird and the horrific are always palpable, but their pulpy flesh ultimately always escapes our grasp. What appears at first to be a mere similarity between literary style and philosophical programme reveals, according to Harman, a common strategy for intuiting this faultline in the object, this 'weird tension in […] phenomena'.

Kristen Alvanson's contribution presents us with a deformation produced in thought in its ongoing struggle to encompass the horror of nature's indifference to its classificatory desires. Her *Arbor Deformia* is a cross-section of a discursive phylum, the product of the baffled internal forces and tendencies of reason.

Images such as those in Alvanson's contribution (not least the fearsome 'spider-goat' [p. 366], whose branch in the *Arbor* surely neighbours that of Miéville's 'skulltopus') have always been the object of simultaneous fascination and repulsion. Her photographs capture unfortunate creatures in already preserved form, as 'doubly-dead' as Kulik's monkeys; all-too familiar, but so repugnant as to oblige us to a discursive dissociation. As she notes, they therefore seem to breed conceptual monstrosities, out-of-control taxonomical systems as deranged as the beings they are designed to corral into rational discourse. The *Arbor Deformia*, integrating the biological and taxonomical levels of this twofold teratologism, gives an inventive graphical solution to the twisted logics of Paré's sixteenth-century classifications.

It is not only Miéville's essay, whose very title exhibits the combinatorial dis-ease it discusses, that vindicates this thesis according to which, when reason turns its classificatory attentions toward monsters, taxonomy itself tends to become diseased and monstrous; in fact, Alvanson's work seems a fitting coda to the entire volume in its affirmation that one does not bring the concept to bear on horror without horror simultaneously investing the conceptual.

We would like to offer our sincere thanks to all of our contributors for their work and commitment, and for having collaborated so willingly in our experiment in concept-horror. Their enthusiasm and generosity has made possible a volume whose diversity and wealth of conceptual interconnections this brief overview has only been able to hint at. We hope that the work collected here will – in line with our subtitle – provide inspiration both for further philosophical research, and for further development in the shape of literary and artistic creations fit to assemble philosophical ideas into machines for effective deterritorialization, whether it be through the 'experiential gnosis of horror', 'multiple fraud', 'zoophrenia', 'mental experiment', 'neurotechnology', the 'shock of the objective', 'molecular disembowelment', 'necrophilic reason', the 'furtive broadcasting of disillusionment' or even, in the last resort, through 'purely medical means' … Let the horrors commence.

Robin Mackay,
Falmouth, April 2008.

Infinite Regress into Self-Referential Horror: The Gnosis of the Victim

George J. Sieg

0. DWELLING ON THE THRESHOLD

Aversion to stimuli of fear or terror, whether personal or cultural, offers no great mystery beyond the psychological. Neither does the pattern of habituation and desensitization resulting from levels of fear and terror sufficient only to gradually bore the mind and senses. Similarly straightforward is the pattern of trauma, burnout, and malady proceeding from constant and unremitting over-exposure to stimuli producing anxiety and stress. These phenomena, while intriguing to the scholar of behaviour and cognition, offer nothing to compete with the philosophical fascination engendered by contemplation of their weirder sister, Horror. She presides over a genre of art which violates boundaries of medium as surely as she violates the preconceptions of those who apprehend her; yet she shares her imageries, even her key signs and signifiers, with genres which would seem at first examination to be quite distinct.

(How often do the monsters typical of horror find their way into fantasies and 'science' fictions? The masters and progenitors of modern horror, Poe and Lovecraft, wrote tales of mystery and wonder along with their more horrific works. In the latter case, the same Mythos appeared in all of his chosen genres).[1]

Whether expressed in the cinema or in the word, or experienced viscerally in the routines or tragedies of life, Horror remains distinctly consistent, arising from an experience of cognitive dread which cannot be escaped or evaded. Indeed, this very conceptual consistency is one of its traits: Horror is the most easily self-referential of all genres.[2] Alone among concepts, Horror depends on the concept of the 'concept' for its own conceptual power – since dread *beyond what can already be known to have been conceived* is an indispensable characteristic of horror; alone among concepts, a full conception and understanding of it, implies the experience of it. Horror is not alone among those responses which require self-consciousness; animals lacking individual self-consciousness provide no evidence of experiencing horror despite their extensive capacity for fear. Of course, animals also do not seem to experience any other emotions typical of self-consciousness such as wonder, awe, or creative amusement either. Yet horror remains distinct from these others in its dependence on the capacity for conceptual abstraction. This capacity does not seem to be necessitated in the case of awe, which is known to be correlated with various ‘numinous’ states typical of religious and mystical experiences notably lacking in self-referential, conceptual abstraction; nor in the case of wonder, a response which may arise as a meta-response to a mysterious or apparently unfathomable event without any corresponding attempt to ‘conceive’ of or ‘conceptualize’ it any further. Thus it is that while children seem to display an extensive capacity for awe and wonder along with their similarly vast predilection for states of fear and terror (often to the dismay of more ‘rational’ adults), the capability to experience, appreciate, and even cultivate *horror* only *increases* with the skill of rational, conceptual, critical thought. Likewise, one may intellectually understand what numinous awe or wonder may entail, without experiencing them in the same context in which one understands them intellectually. Awe is not, in and of itself, awesome, nor is wonder in and of itself necessarily wonderful, but *horror*, self-referentially, is, of and for itself, *horrible* and *horrifying*. That this is so makes horror the most Gnostic of emotional extremes and excesses, in the sense of being a knowledge characterized by directness of empirical experience (self-referential) rather than based on some correspondent premise (other-referential). In keeping with this, it is no coincidence that those mystics and esoteric philosophers deemed ‘Gnostics’ in the increasingly decadent Imperial Roman cosmopolis elaborated mythic reflections of the world which detailed all manifest reality as nested layers within layers of horrific depravity, their ‘gnosis’ (direct, experiential knowledge) of salvation and escape implicitly depending on a nightmare network of interwoven matrix-horrors to escape *from*. The archaic roots of Gnostic horror can be followed through the labyrinthine tunnels of historic and prehistoric dualist myths, yet the experiential gnosis of horror is certainly anterior to the dualistic coping mechanisms it inspires in some persons and groups. Independently of, yet inclusive of, both *self* and *other*, Horror pervades consciousness which is conscious of itself: to observe someone sufficiently horrified is horrific. To observe a horrific other – a 'monster' – is horrific. Yet to observe oneself horrified is just as horrific, if not more so. Thus, Horror also maintains the fascinating quality of being self-renewing, for while awe and wonder may both collapse under sufficiently detached rational observation, Horror only seems to increase the more it is contemplated.

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[1] See S.T. Joshi, *H.P. Lovecraft: The Decline of the West* (Berkeley: Wildside Press, 1990) for an extensive analysis of Lovecraft's work and philosophy.

[2] Noel Carroll, *The Philosophy of Horror, or Paradoxes of the Heart* (New York: Routledge, 1990), 17-42. Carroll's work presents a theory of 'art-horror' elaborated in exacting detail; the important aspect of it referenced here is that the horror genre depends, in his view, on its establishment of direct correlation between the emotional state of the monster's victim and the emotional state of the audience or reader. The rest of his theory is not necessarily endorsed by the rest of this article.

Yet the perpetrators and effectuators of Horror – 'monsters' in whatever form – do not seem to be guarantors of Horror even if they are its prerequisites. (And 'monsters' here means anything horrifying, not necessarily only the tentacle-beasts reviled by Lovecraft or the cinematic creations which prey on the sentiments of moviegoers.) That this is so can easily be discerned by noticing that the various beings of Lovecraft's Mythos appear throughout his own tales of wonder (such as Randolph Carter's dream quests) with the same frequency that they manifest in overtly horrific contexts in the rest of his work. They spill across the threshold not only of genre, but of authorship, to populate the worlds of Robert Howard and ultimately the annals of contemporary science-fiction in a variety of media. Lest this phenomenon be thought limited to the bizarre Old Ones of Lovecraftian provenance, the example of the vampire should be sufficient contradiction. Perhaps the most classic staple of 'gothic horror', whether cinematic or literary, vampires nevertheless also find themselves in fantasy, science-fiction, and even works classifiable only as mythic dramas (Anne Rice), not to mention their total escapist attraction in the form of gothic role-playing and subculture, neither of which exactly stimulate anything like the emotion of horror in their participants. The only consistent signifier of Horror is not the *monster*, but rather its *victim*.

What might this tell us about the nature of self-consciousness and its expression through the aesthetic? Why is it that the most direct indicator of self-consciousness combined with rational, abstract cognition, seems to be the capacity for horror, and how is it the case that this condition can only be signified aesthetically through its embodiment in a victim? Most perplexingly – and, as will be revealed through this meditation upon Horror, most horrifically – why do the perpetrators of Horror, the 'monsters', exert such an attraction upon self-conscious beings that they violate not only their victims but also the boundaries of their own genre, ultimately to become not only figures of fun and fantasy, and occasionally figures of awe and wonder in the frequent cases of religions of the monstrous or terrible, but even role-models which provide for some not only escapist pleasure, but a guide to life?

I. Exaltation of the Victim

Impaled on towering spikes, the victims of Vlad Tepes – Dracula – make apt examples of Horror's veneration of the violated. Is it any coincidence that the larger-than-life heroine-victims of the screen Dracula are likewise exalted figures? The horror is not merely one of possible identification with the damsel or hero threatened by the monstrous being; the work of Lovecraft is an excellent indication of this, desexualized as it is, and with characters stripped down to being bare instruments of perception, as Houellebecq points out in his thorough study of Lovecraftian horror.[3] Yet Lovecraft's depictions of violated observers whose very perceptions are impaled by an intrusive, inescapably bizarre alien otherness, do have something in common with cinematic preferences for innocent feminine youth across a genre inclusive of innumerable ladies of monstrous fate, murderous fate (Vivian Leigh, screen avatar of a victim conceived by an author deeply influenced by Lovecraft, Robert Bloch), demonic violation (Linda Blair, whose diabolical inhabitant was not merely a standard horned scaly devil à la Dante or Bosch, but in fact was identified in the *Exorcist* film tradition as the hideous disease-demon Pazuzu, a Mesopotamian entity worthy of Lovecraft's Mad Arab necromancer Al-Hazred and his *Necronomicon*), or demonic seduction and subversion (Mia Farrow, mother of *Rosemary's Baby*, offspring of Satan himself). Hidden within the obscure commonality here discerned is further *gnosis* of horror: let us vivisect it, and see.

Whether male or female, the ideal victim of horror is innocent, *as regards the horror*. This is not just in the usual analogical sense of being undeserving of their torment (for while many victims of fictional horror are not innocent of all wrongdoing, none could possibly deserve exactly what befalls them) but in the literal sense of previously having no *gnosis* of it. Indeed, in Lovecraft's work, it is the horrifying *knowledge* which is often itself the source of the awful consequences befalling the victim. Likewise, victims of demonic possession may theoretically have done something to invite the demon in, but do not have the 'gnosis' of it ... until it arrives. At which point it is too late to forget, or to banish the knowledge. But if horror is an emotion particular only to abstract, reasoning self-consciousnesses, why *don't* the victims 'deserve' what transpires, especially if they are guilty of something? It seems that one of the *reasons* that *reason* is required for horror, is that it is precisely *reason* which, in being violated, produces the experience of horror. Hence, the purest horror – 'concept-horror' – in which it is some *concept* which proves to be the most horrifying of all.

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[3] Michel Houellebecq, *H.P. Lovecraft: Against the World, Against Life* (London: Weidenfield and Nicolson, 2006), 57-62, 69. (First published as *H.P. Lovecraft: Contre le monde, contre le vie* [Paris: Editions du Rocher, 1991]).

Before seeking out the most archaic formulae of such 'concept-horror', let us continue the autopsy of the horror victim. The archetypical possessed horror victim (as well as the favoured 'Satanic' sacrifice), a virgin young girl, is *in-nocent* by definition – and often expected, colloquially at least, to be blond and pretty. The significance of this, beyond the aesthetic, will be peeled back later as this morbid inquiry proceeds. It is worth inquiring: is involuntary possession always horrible? What about the identity of the possession victim? Even the lacklustre *Exorcist* prequel (still technically a horror film despite its heavy reliance on terror), set *in Africa*, ends up requiring the demon to eventually possess a European female presented as an object of desire in the course of the story. How would such a possession film fare if all the possession victims were of African identity and undefined desirability? The zombies in *Night of the Living Dead* are most successful in their assaults on innocent young women, and survived only by the black hero of the film who is finally killed when the white mob purging the zombies miscodes him as ... one of the monsters.

Leaving demons and victims of miscoding aside, further insight into the realm of horror lies in the characterization of one of the most classic horror motifs: the standard vampire-victim (or vampire love-interest). He or she begins as innocent *of the vampiric reality*, even if not virginal. Is it horrific for a vampire to prey on another vampire? Yet there is a certain commonality between the vampire, whether male or female, and its prey; the prey is likewise pale, often presented as attractive – fitted to be turned into a vampire, in fact. What about the victims of other, more inhuman, horrible monsters? While such creatures will sometimes kill indiscriminately (especially in 'terror' films as opposed to horror proper), they do seem to have an unusual taste for devouring the civilized, the self-aware, the rational: victims who are particularly innocent of the creatures' visceral realm. Even when the jungle-beast or the tentacle-monster starts eating its way through its own natives or cultists – is this alone horrific? Not enough to make a horror film out of it. Even the horror of the murder victim, in order to survive in the realm of more realist horror fiction, seems to share the signal traits: either innocence of unavoidably fitting the criteria of 'victim', until it is too late; or the equally horrible foreknowledge of unavoidably fitting that criteria; innocence of the world (physical, moral, or conceptual) from whence the horrible murderer/monster originates; and again, a cultural and racial type frequently associated with, or perhaps conflated with, 'purity'.

Why should this particular type of victim find itself exalted through an entire genre which is not even so specifically jealous of its own monstrous protagonists? And how does this relate to the conceptual nature of horror?

II. REALITY IS HORROR: THE FIRST ARYAN LIE

Of all variations on the theme of horror, what has come to be known as Lovecraftian horror is indeed the most conceptual. In some cases, Lovecraft's clinical descriptions of the utterly alien and bizarre juxtaposed with the inability of his protagonists (mere projections of the perceptive faculty) to ignore or turn away until it is too late, suffice to produce far greater horror than any description of their actual physical violation could hope to do. As Houellebecq points out, this is one reason why Lovecraftian horror is so difficult to portray through visual media,[4] though as this examination will show, the variable manifestations of horror all have an unexpectedly common conceptual trait despite their differences in regard to content. An interesting exception to the general rule that Lovecraftian films wind up being merely fantastic rather than horrible, is John Carpenter's 1995 *In the Mouth of Madness*. It manages to convey Lovecraftian horror through an almost excessively self-referential structure and plot: instead of being a Lovecraft story transplanted into a modern setting, it features as antagonist an author representing a sort of combination of Lovecraft himself and his dark prophet Nyarlathotep, whose work begins horrifically to be reflected in reality following his mysterious disappearance. One of the most memorable, and horrifying, scenes in the film involves the investigating detective trapped in a cinema watching a film that begins to depict him being assaulted by creatures reminiscent of Lovecraft's story *Dagon*. Despite the usual unfilmability of Lovecraft's eldritch horrors, *In the Mouth of Madness* captures the inescapable violation of perception, reason, and sanity which occurs in the stories, by actually using the context of film itself to reflect the self-referential, self-conscious nature of horror, when visual depictions are called for. At the same time, the constant use of embedded Lovecraft quotations, ostensibly 'fictional' even within the realm of the film, as part of the plot of the story itself, lends the film a quality of impossibility and madness which is a hallmark of Lovecraft's work. Outside the horror genre proper, a similar technique was utilized in David Cronenberg's adaptation of William Burroughs's *Naked Lunch* by including the bizarre events presaging and during the writing of the book in the plot of the film itself, thereby again using self-referentiality to evade the Lovecraftian curse of unfilmability. While the book is surreal and often disgusting, some of the scenes in the film, particularly those involving monstrous eroticism, certainly approach horror, although that may not have been the specific intent. Cronenberg's entire *oeuvre* is replete with the imagery of 'bio-horror', in which the conceptual boundaries of the flesh are violated and protagonists become their own monstrous victims – as in *The Fly* – demonstrating that the monster is not only 'interstitial', as Carroll describes,[5] but is also an instance of 'incomplete abjection', in Kristeva's sense. The conceptual boundaries of the bodily self are horrifically violated not just through destruction or even invasion, but ultimately through an inability to separate from a body that itself becomes alien.[6] As a final example, Hitchcock's films, whether suspense or horror, tend to involve frequent, if subtle, self-reference to the eye as instrument of perception, the camera as avatar of the viewer's inability to cease looking and therefore recording what is perceived (however horrible), or occasionally, to the staged or dramatic quality of events.

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[4] Houellebecq, 64-69.

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[5] Carroll, 31-39.

[6] Bio-horror is thoroughly examined throughout Jack Morgan, *The Biology of Horror: Gothic Literature and Film* (Carbondale: Southern Illinois University Press, 2002).

Considering the abstract nature of such perceptual ‘concept’ horror as is particularly present in Lovecraft’s work, is there any indication that his personal and aesthetic preferences, such as his Aryan racism as revealed throughout his personal biography and correspondence,[7] contribute significantly to the content of his work? Sufficient investigation has been done by others in exhaustive consideration of the role of miscegenation in Lovecraft’s cosmology, as well as his representation of inhuman, meaningless, blind cosmic Life through unnameable and indescribable ‘outer’ horrors, to establish that there is a certain analogy between the ‘penetration’ of the Aryan purity by ‘hideous’, alien, foreign elements, and the penetration of hapless Anglo-Saxon professors by tentacled predators from Outside their known reality.[8] This necessitates a corresponding examination of the philosophical ramifications of Aryan racism in the context of horror, or at least a consideration of whether such an element is indeed *indispensable* to Lovecraftian horror. But if so, is it indispensable to the whole horror genre? Or even to Horror itself? The intrusive, stark, ‘inconceivable reality’ of the concentration

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7. In reference to New York, Lovecraft wrote in a letter: ‘The organic things – Italo-Semitico-Mongoloid – inhabiting that awful cesspool could not by any stretch of the imagination be call’d human. They were monstrous and nebulous adumbrations of the pithecanthropoid and amoebal; vaguely moulded from some stinking viscous slime of earth’s corruption, and slithering and oozing in and on the filthy streets. […] They – or the gelatinous fermentation of which they were composed – seemed to ooze, seep and trickle thro’ the gaping cracks in the horrible houses […] and I thought of […] unwholesome vats, crammed to the vomiting point with gangrenous vileness.’ This description could, taken out of context, just as plausibly be guessed as an extract from an obscure Lovecraft tale concerning the miscegenated progeny of some horrific elder or outer things.

8. e.g. Joshi, 74-80, 120-45.

camp as often remarked upon by both scholars of modern evil and the Holocaust itself seems to attest that Horror is inseparable from Aryan racism, so investigating this relationship of dependence from another vantage may prove revealing.

The first Aryans to conceive of absolute horror, the Zoroastrian dualists of prehistoric Iran, found its origins in the Mother of Abomination, *Drug,* later known as *Druj*, whose name comprises both what we would know as a 'drag-on' and also what might best be conceived as a 'simulation', a corruption of reality, whether in the form of a strategic dissimulation, a false affirmation, or an outright physical blackening as of a decomposing corpse. The word is usually translated simply as 'Lie', and was also used in the context of betrayal, such as, of an oath, promise, or contract. Why *these* Aryans in Iran as the originators of a concept of intrusive, infested, parasitic horror, propagating itself upon and within a host innocent of its nature? The *Druj*, mother of all demons and of the Devil himself, originally an abstraction, a conceptual evil knowledge, the Angstful Mind, reaches out from her primordial, prehistoric Middle-Eastern domain to eventually rip herself free from the stomachs of Aryan astronauts in Geigeresque, cinematic form as the 'alien'. Like the 'alien Mother', the Druj is horrifically and monstrously interstitial – She is fecund, yet death-producing; female, yet signified by masculine intrusiveness. She penetrates and violates like a rapist, yet she is an endless womb of darkness and depravity.[9]

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[9] For extensive comments on femininity and gender-transgression in horror, see Cynthia Freeland, *The Naked and the Undead: Evil and the Appeal of Horror* (Boulder: Westview, 1999). See also Barbara Creed's essay, 'Horror and the Monstrous Feminine: An Imaginary Abjection', for an apt description of an 'archaic, phallic mother' reminiscent of Druj, with the Angra Mainyu as her surrogate 'male component'.

What, then, was the origin of this power – the power not of an 'image', but of a *concept* of parasitic, infectious disease-horror – over the cultural (and perhaps even philosophical) mind of the Zoroastrian Aryan, making him the very inventor of the concept of evil?

The Aryans in Iran, unlike their Vedic peers and Lovecraft both, would not seem to have had obvious justification for elaborating a traditional ethnic xenophobia into full-blown moral paranoia. The Brahmins were faced with an indigenous population whose dominant genetic traits have been proven by history to be mightier than their Aryocentric anti-miscegenation law codes. In parallel, Lovecraft was driven from New York by the dominant, successful immigrant populations. As we know, he found this experience horrific, yet in contrast, any expected 'horror' on the part of the Brahmins for the dark non-Aryan people seems to have been notably absent in India. Black Kali herself, whether an Aryan death goddess, as some claim, or the terrible indigenous mother herself, inspires simultaneous awe and terror, but not horror. The mixing of castes and the Kali-yuga, inspired woe or detached sorrow in the pure Aryans – but not horror. The Aryans in Iran, by contrast, were apparently the sole inhabitants of a desert plateau, and thus without significant competition, their recessive traits secure until Arab invasions millennia later. Lest it be suggested that a *lack* of racial competition turned their conflict-obsessed, warlike selves against each other until the prophet Zoroaster invented his horrors merely as a foil to produce cultural unity, the reader should only need to be reminded of northern Europe, which occupied itself quite consistently in a constant state of unremitting tribal warfare throughout its entire history until it was Christianized, uninterrupted by anything like a gnosis of horror, conceptual, racial, or otherwise.

It can only be that, for reasons unknown (perhaps reasons sufficiently horrific that, as in the case of Great Cthulhu and the Lovecraftian Old Ones, it may be more wholesome *not to know*), the Aryans in Iran encountered, or believed themselves to have encountered, a threat perceived to be sufficiently difficult to distinguish from themselves that it was, or *might be*, within.[10] The requisite condition for absolute horror is presented: inescapable dread, a factor which would produce constant terror – except that flight is not only impossible, but inconceivable. Conceptual horror enshrined in philosophy was then born in Iran as the Mother of Abominations. It is no exaggeration to say that by the time the moral dualism of the Zoroastrians was fully cosmologically and performatively elaborated in the *Vendidad*, their book of ritual codes and taboos against the devils, their obsession with purity – the exaltation of themselves as potential victims of intrusive, penetrative violation by Druj and her ravenous children – had reached proportions so extreme that the same ritual fixations outside of an excusably cultural or religious context would now earn a diagnosis of paranoid-schizophrenia with combined obsessive-compulsive disorder, or worse. The *Vendidad* is a study in terror if not outright horror itself. Each 'Fargard', or chapter, recites repetitively and thoroughly the number of strokes with the punishment whip a transgressor is to receive for violating any of the minutiae of purity laws, concerned with everything from moral conduct to the compulsively precise handling of corpses in order to ensure that the community and the natural world remain undefiled by the *naso-druj*, the corpse-demon. Extreme infractions, such as exposure of corpses to water or fire, result in the transgressor being publicly flayed alive. Many interesting technicalities of the Zoroastrian hygiene obsession can be found in the *Vendidad*, such as the association of albinism with uncleanness, and the rule that physicians-in-training were to practice on those who worshipped the *daevas* so as to avoid accidentally killing the faithful. Male homosexuality is so abhorred that its practitioners are proclaimed in the *Vendidad* to be demons incarnate. Sexual intercourse with a menstruating woman is an offense against purity worthy of death. Eventually, for the Zoroastrians, any being of evil thoughts, or an evil mind, might be a vehicle for Druj. This does not only include representatives of any other creed whatsoever: even those who outwardly professed the Good Religion might secretly be 'endowed with the Lie'. The incredible irony of Zoroastrianism is that the same Aryan trait of xenophobia which made the ancient Iranians amenable to this most paranoid of all world-views had to be abandoned in order for the Zoroastrian creed of absolute moral goodness in opposition to absolute moral evil to be adopted. Once the Aryans adopted the Zoroastrian religion, their enemies were not *outsiders* but *any others* (even unrecognizable others in their midst, like Drujic 'body-snatchers'), *who carried the Lie*. Even, and especially, fellow Aryans – a notion inconceivable amongst any other Indo-European group, none of which had any difficulty either with feuding incessantly with each other indiscriminately, or with uniting easily against even more foreign outsiders. Yet the Iranians became the exception, and gave the world the first universalist moral philosophy, ultimately bequeathing it to the ancient Jews, who shared with the Indo-European ancestors of the Aryans a xenophobic racism, even while the Jews lacked those recessive genetic traits the preservation of which, as signifiers of purity, inspired a racialist concept amongst the Indo-Europeans forgotten aeons ago.

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[10] Lovecraft himself speculated on a similar process involving fear of hidden, internal others in European tradition, writing in his classic study *Supernatural Horror in Literature* (NY: Dover, 1973), 'Much of the power of Western horror-lore was undoubtedly due to the hidden but often suspected presence of a hideous cult of nocturnal worshipers whose strange customs were rooted in the most revolting fertility rites of immemorial antiquity. This secret religion, stealthily handed down among peasants for thousands of years despite the outward reign of Druidic, Greco-Roman, and Christian faiths in the regions involved, was marked by "Witches Sabbaths" […] on Walpurgis Night and Hallowe'en, the traditional breeding-seasons of the goats and sheep and cattle; and became the source of vast riches of sorcery legend.'

A comparison of the Druj to the Old Ones of the Lovecraftian mythos is intriguing, for while both concepts were invented by racists, the inventors of the former ceased to be racist as soon as they conceived their horror, whilst Lovecraft became only more vitriolic with time and exposure to foreign people. The principal difference is easily summarized: the Druj was considered to be *evil*, whilst Cthulhu, Azathoth, Yog-Sothoth, and all their various spawn, are simply *alien.* (In this, the Geigeresque cinema 'alien' is more Lovecraftian than Zoroastrian, yet as the quasi-androgynous-yet-penetrating 'demon-child' of the Alien Mother it functions much as do the daevic offspring of Druj. Unlike Lovecraft's Outer Ones, it is susceptible to physical, material defeat in a modern combat myth, and by a very un-Lovecraftian heroine who defends the moral world order against violation by both the alien outsider, and the 'Drujic' simulation-strategy of the nefarious corporation and its android agent. Perhaps more Lovecraftian in effect than Ripley's 'alien' nemesis is Norman Bates, – 'possessed by the Druj', the 'lie' of his mother, yet in that very sense his own victim and his own monster, even as he butchers his victim, who finds the purifying waters of the shower no refuge from asexual penetration by the avatar of the Outside). Lovecraft's own universe, in contrast to both of those visions, is a *horrifically* amoral one. The rational perceiver cannot escape the immeasurable, futile, imbecile meaninglessness of the blind cosmos, and is devoured by it. Yet the Zoroastrian believes that through morality (Good Thoughts, Good Words, and Good Deeds), the Druj and her children can be overcome. Ironically, in doing so, the Zoroastrian remains 'Aryan' in name only, abandoning the signifying trait of racial xenophobia which Lovecraft himself maintained – even through the absolute materialism consistently apparent in the same correspondence in which he expresses his racist views. This is not mere coincidence. Rather, it plainly demonstrates an inescapable 'Aryan truth' which is perhaps the 'Aryan horror': As long as the Aryan identifies in any meaningful way with ethnic traits which are constantly genetically embattled by competing populations, the capacity for perceiving a world of unremitting conceptual horror remains. This observation, however, fails to account for why Lovecraft elaborated, under the influence of his racial obsessions, a cosmology of absolute horror, while his equally race-obsessed Brahmin counterparts by contrast in fact ultimately presented a cosmology of all-pervading, triumphal wonderment and awe. Simultaneously, the Brahmins' Iranian cousins, originally equally xenophobic, chose to maintain their paranoia through moralism – at the cost of their ethnic fixation. It is Lovecraft's philosophical materialism which settles the matter: both the Indian Brahmins and the Iranians maintained cultural beliefs in a spiritual realm independent of the material world. Lovecraft did not.[11]

It is interesting to note that the first 'Aryan Truth' of Gotama Buddha, who rose to prominence during an age of increasing Indian rationalism and critical thinking, was that all life is pervaded with suffering, rendering theism irrelevant. For Lovecraft, thoroughly atheistic and avowedly soulless, it was not just suffering, but utter horror. Yet his ultimate rejection of the opportunity to write Nazi propaganda in the pre-war decade, and his rejection of Nazi atrocity and genocide, demonstrates something else: while Lovecraft's cosmos was a brutal one, he was not himself maltheistic[12] enough to embrace such a conception with participatory enthusiasm.[13] He did not want to contribute to the world of horrors; rather, he rejected life. If he had believed in a soul, he would have been a Gnostic dualist, but even this option was closed to him in his atheistic materialism. (The Gnostics, while rejecting the supposedly-divine 'archons', the spiritual creators of, and rulers of, the material world of horrors, asserted an all-Good, all-perfect, spiritual reality of divine emanations beyond it; an option totally unacceptable to Lovecraft's materialistic 'cosmicism').[14]

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[11] Joshi, 7-45.

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[12] In contrast to *dystheism*, which merely supposes that the deity is not good, *maltheism* proposes that the deity is actively and intentionally malicious. It should be noted that neither of those alternatives specify whether or not it is advisable to venerate the deity in question. The Zoroastrian Church condemned two maltheistic sects, one of which, called the *daevayasna*, was accused of venerating the Druj, Ahriman, and the *daevas* apotropeically – that is, with the intent to placate or banish them. The other sect, that of the *yatukih* sorcerers, was accused of actively honoring the evil principles with the intent to gain power from doing so: the original example of what the Christian world knows as the 'pact with the Devil'. It remains unclear whether or not the yatukih also recognized the existence of a 'good' deity opposing Ahriman and the Druj, and if so, whether they ignored him, or actively opposed him. (Or whether they acknowledged him as good at all). It seems that the Lovecraftian cults of the Old Ones would qualify as maltheistic only in the 'Derleth recension' of the Cthulhu Mythos, since only that later, dualized version of Lovecraft's cosmology promotes the Elder Gods as moral opponents of the Old Ones. It may be possible to consider some forms of monotheism to be necessarily maltheistic, when an understanding of the god is offered in which its omnipotence (or ultra-potence, in cases in which it is more powerful than any other being or beings combined, but not actually all-powerful) is not only greater than its benevolence, but uncompromised with any notion of benevolence whatsoever. Within such possible monotheistic conceptions of a non-benevolent god who is either the only god or the supreme one, a further distinction may perhaps be drawn between *apotropaic maltheism*, in which the god or deity is venerated in the hope that its malefic attention may be turned away, *contractual maltheism*, in which the power is venerated in order to increase one's standing, stature, or power within its reality or domain, and *latreic maltheism*, in which it is actively worshipped or adored in a sort of religious Stockholm-syndrome, a compulsive response to its irresistible but awful or malign numinosity. A sub-category of latreic maltheism might be *propitiatory maltheism*, in which it is supposed that the malice of the divine being can be mollified in some way even if not actively averted, as in the case of apotropeic maltheism. It should be noted that this typology of maltheism could easily be mirrored with reference to dystheistic demon-cults in which destructive (but not intentionally malicious) powers are venerated for the aims or reasons described. The disease-demon Pazuzu, for example, was viewed as dangerously destructive most of the time, as was the even more feared child-slaying Lamashtu, but there is

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no indication that either one was understood to murder human beings sadistically or for the purpose of deriving pleasure specifically from harming people. In this sense, the difference between dystheism and maltheism could be likened to the difference between honoring man-eating beasts (or an advanced race of amoral extra-terrestrials, for a more 'godlike' analogy) and honoring serial or mass-murderers (or, to continue the analogy of 'advanced' beings, a race of creature that hunts human beings for sport or pleasure).

13. While it might be considered questionable to assert that the Nazi philosophy is maltheistic since 'Providence' or the 'Gott-force' in Nature was understood by the Nazis to support Aryans and cause them to flourish, it would certainly have been perceived as maltheistic by Lovecraft. He was married to a Jewish woman, reviled violence and cruelty, and was too materialistic to have considered theological justifications for killing as are found in the *Bhagavad-Gita*, in which the god Krishna reveals to the story's protagonist that he should have no regret over killing even those for whom he feels respect or affection since all beings are merely projections of an ultimately indestructible Self. Himmler was reported to have frequently carried a translation of this text – and was presumably not, for this reason, a maltheist, despite his affection for the imagery of death. The ideology of those Jews who willingly cooperated with the Nazi regime (especially any who cooperated with the SS) could easily have been described as one of the forms of maltheism proposed above, however, particularly in cases wherein the plight of the Jews was understood to have been sent as divine retribution, since modern Jews, unlike their ancient predecessors, generally regard Yahweh as omnipotent (thanks to Zoroastrian influence identifying Yahweh with the omnipotent Zoroastrian god, Ahura Mazda, subsequent to their liberation by Cyrus the Great and his Zoroastrian Persians, from captivity in Babylon). It is perhaps this potential for maltheism within monotheism that led to the famous 'trial of God in Auschwitz' account of Elie Wiesel, and the various elaborations of 'Holocaust theology' in modern Judaism.

14. Ironically, the earliest Gnostics themselves seem to have been Hellenized Alexandrian Jews, probably expatriate in the wake of the second Jewish revolt under

The Zoroastrians, however, maintained their spiritual beliefs despite their conception of the 'life-horror' of Druj. They only conceived of such horror in the absence of the simple othering process that gave rise to the Vedic caste system, or the assimilation of local populations that characterized the gradual Indo-European drift into Europe. Instead, whatever ethnic or cultural influences threatened the ancient Iranians, these threats must have been perceived as *outwardly* indistinguishable from the Aryan population, requiring a new concept in order to maintain Aryan self-other polarity. That concept: horror – mother of absolute dualism; as Druj, Mother of Abominations. In identifying that which was 'other' than the ambiguity of the life of flesh, the Zoroastrians also invented the Iranian version of the Indo-European cognitive dualism. In contrast to societies of gradual, graduated ethnic mixture wherein this perspective manifested as mind-body dualism, in *apparently* homogenous Iran, it manifested as *moral* dualism. Instead of an escape from the embodied world, as sought by Orphics, Gnostics, and yogis alike, the Zoroastrians conceived of immortal youth in a perfected, resurrected body, inhabiting an eternally perfected world of monotonous, sterile cleanliness and light, given to Ahura Mazda's faithful as a reward for moral behaviour. For Lovecraft, materialist that he was, no such solace could be found either in

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Trajan, who particularly reviled the God of Israel as an evil 'demiurge'. See Carl B. Smith II, *No Longer Jews: The Search for Gnostic Origins* (Peabody: Hendrickson, 2004), for details. They generally abominated the whole material cosmos, but proposed a transcendent spiritual escape, in a manner similar to the renunciation of the round of rebirth by Indian philosophers seeking liberation, and to the earlier Orphic mystics. While all these philosophies share in common an origin in the collision of Indo-European and non-Indo-European cultural patterns, only Gnosticism seems to have originated amongst people who were themselves an ethnic out-group within an Indo-European society – and it is only Gnosticism which proposes not only a binding and malignant material world, but a malicious creator-god as its origin.

spiritual transcendence or eternal life through resurrection. In a great biographical and historical double irony, Lovecraft the racist married a Jewish woman, Sonia Greene, exempting her from his xenophobic tirades – yet his materialism historically descended from a rationalistic response to Judaeo-Christianity, the offspring of Zoroastrian dualism and Semitic culture.

III. Purity

> There can be no reversing the unique tragedy of the Holocaust. It must be remembered, with shame and horror, for as long as human memory continues. Only by remembering can we pay fitting tribute to the victims. (UN Secretary General Kofi Annan, observing International Holocaust Remembrance Day on January 27, 2006, anniversary of the liberation of Auschwitz-Birkenau by the Soviets.)

Now archetypal symbols of human evil, often regarded as actually living embodiments of absolute horror, the Nazis are strangely absent from fictional horror, while their presence (or their equivalent, such as Palpatine's Galactic Empire of *Star Wars* fame) is surreally commonplace alongside various more eldritch monsters in the annals of fantasy and science-fiction. Additionally, Occult Nazism is a staple of fringe conspiracy lore and pseudo-esoteric crypto-history, and Nazi super-villains and super-sorcerers of some variety are by no means infrequent adversaries in occult fiction and suspense thrillers. This alone is peculiar, since surely the Nazis are regarded as infinitely more horrific, in carnal reality, than any serial murderer one could name – yet not a single horror-genre film of any significance has ever featured someone racially motivated to prey on non-Aryan victims, much less featured an actual Nazi as its antagonist.

(The infamous 'Nazi exploitation' genre of course excepted – save that it qualifies more as pornography than horror.) More peculiar still is the occasional association, in occult and fantasy/science-fiction, of said Nazi super-villains with black magic, 'Satanic' rites, and the conjuration of terrible ancient monstrosities blatantly reminiscent of Lovecraft's Mythos. (The tentacled horrors emerging from the abyss in the *Hellboy* comics and films with the assistance of Nazi sorcerers and Rasputin serve as an excellent example.) Beneath the apparently superficial aesthetic of the pop-culture sensibility lurks something of significance: the same perpetrators of violence and horror – whether evil Nazis or Cthulhu monsters – are determined to be figures of either *horror* or *fantasy* based specifically on the identities of their *victims*. Thus, while Lovecraft's violated professors are often stripped of all significant personality and traits, even of any references to sexuality, they remain *Anglo-Saxon* professors, horrified by the miscegenated, bestial realities they confront. In fact, so long as they are not engaged in the violation of Lovecraft's ideal Aryan scientists (modeled more or less after himself), the very same tentacular Old Ones somehow desist from being figures of actual horror, instead crossing genres and winding up being summoned for genocidal purposes by more murderous Germanic professors in the vein of Mengele and Himmler, whose racial sensibilities, if not their ethics, Lovecraft embraced. It would seem that *horror* as it is generally appreciated within contemporary culture not only requires victims identifiable with the originating ethno-cultural group, but also depends upon the total disassociation of the monster from possible identification with such victims. That is, horror requires both a Zoroastrian dualism, and the maintenance (at least cryptically) of the racialism the Zoroastrians themselves rejected in order to avoid the horror. The work of Lovecraft represents a striking testament to the fact that, from the perspective of the Aryan racist, the manifest physical world is a whole *world of horror*, a reality not just of terrible strife, or frightful competition for resources, but indeed an inescapably dreadful experience of *invasion from without*.

This phenomenon of belief provides further demonstration that the Nazi preoccupation with 'Jewish materialism' and with the supposedly insidious nature of Jewish sexuality as virally infecting, perverting, and corrupting the otherwise pure German race, was by no means an artifact of Christian morality combined with political expedience. For the Zoroastrian Iranians also displayed a paranoid response to confrontation with influences perceived as invasive from without and hidden within. The Nazis, however, despite all their dualistic propaganda, rejected the solution of moral dualism, preferring instead consciously and willfully to become embodied perpetrators of absolute horror upon their presumed infiltrators. While Nazi propaganda depicted Jews in verminous terms, and displayed the octopus-tentacles of the Elders of Zion insinuating themselves upon defenseless globes and world-maps, the Nazis did not depict Jews as externally menacing, mighty demonic beings with huge armies of Satanic devils at their disposal, capable of opposing the Aryan legions on equal footing. While the Nazis presented the 'hordes' from the Communist east as threatening mobs of 'sub-humans', such mobs were certainly not depicted as mythically comparable to the bewitching majesty of the Angstful Mind and all the monstrous and terrible children of the Druj. Stalin was no Ahriman, at least not to the Nazis. Rather, the self-proclaimed elite of the Nazi party, Himmler's SS, reveled in its own imagery of death, and glorified in the extermination not of mighty evil foes, but of *weakness*, both in themselves and in others. In simple terms, they chose to act the part of their own monsters. It is an irony of history and human thought that the Nazis' chosen victims had become the world's most loathed yet sometimes venerated ethnic group aeons previously, only after combining their own xenophobia with a moral dualism invented by Iranian Aryans for the purpose of adapting their own racism to an as yet unidentified, invisible enemy. Yet, despite the clearly monstrous nature of Nazi policy, Heinrich Himmler is often quoted as remarking that the real Nazi 'triumph' lay in their performance of horrific deeds while remaining otherwise humane and uncorrupt – at least in their own minds, the SS represented less a Stockholm-syndrome style identification with and veneration of 'life-as-horror', and more an attempt to somehow buy off 'life-horror' through mass offerings of victims rendered suitable due to the Jewish adoption of post-Aryan moral dualism as an ethical philosophy augmenting the Jews' preexistent ethnic exclusivism.

Still, even as the Nazis remain the most morally demonized of all possible monsters, the exaltation of the pure white victim remains consistent and genre-inviolable: evil as the Nazi may be, the monster violating the same lovely blondes who could well be the Nazi ideal of beauty, is *horrible*. Lest the association of arcane horrors with monstrous-Aryans-gone-bad (rather than Aryan victims violated) be thought a post-war consequence, consider that Dracula, the vampiric horror icon, is based on a figure of Romanian history considered a local hero of Christendom, utilizing the *horror of impalement* as a deterrent against invasion by foreign *others*, the non-Aryan Turks. Even the

Zoroastrians were racist, albeit sporadically, when fighting Central Asian adversaries. Lovecraft was not beyond re-appropriating monstrous imageries in a non-horrific context to make his racist point. His pentacular Great Old Ones with their asexual lost civilization, eventually overthrown by their own decadent progeny, resonate in strange kinship with the human researchers who discover their remains beneath the Antarctic ice – a closer kinship than those researchers would have had to fellow humans whom Lovecraft would have called 'inferior stock'. Such a demonstration of the ultimate identification of the monstrous with Aryan purity need not be considered completely tangential in Lovecraft's work, however. In one of his more unusual tales, somehow one of wonder and horror simultaneously, Lovecraft's bare instrument of perception, the narrator, discovers itself to *be* the monster. In this short story is collapsed and compressed the full gnosis of the Aryan truth of horror, ultimate originator of both the moral dualism and the renewed Aryan dualism of absolute racial superiority, and of self-victimization, as an antidote to perceived weakness. The purest form of conceptual horror is the realization of inescapable identity with the monstrous perception – the concept – which is both the object and source of horror. Yet, when that object of horror is also the subject, the instrument of perception, wave upon wave of self-referential, cascading horror is the result. Zoroastrian dualism provides one solution – a 'good' spiritual identity for the self, an 'evil' spiritual identity for the other, horrific only in 'this world'. Nazi racism provides the other solution – 'evil' deeds of horror performed by the self as a displacement of the horror of invasion by the other, the pure becoming the monstrous: the self-exalted victim, the now-monstrous Aryan; the reality victim, the scapegoated Jew. For Lovecraft, though, as for any Aryanist materialist, there was no solution or escape from the horror, as becoming the monster through deliberate identification is hardly an option for the extreme reductionist. For him, life is a conceptual nightmare with only the void of an empty consciousness as contrast.

Nine Disputations on Theology and Horror

Eugene Thacker

1. After-Life

Ever since Aristotle distinguished the living from the non-living in terms of *psukhê* – commonly translated as 'soul' or 'life-principle' – the concept of 'life' has itself been defined by a duplicity – at once self-evident and yet opaque, capable of categorization and capable of further mystification. This duplicity is related to a another one, namely, that there are also two Aristotles – Aristotle-the-metaphysician, rationalizing *psukhê*, form, and causality, and Aristotle-the-biologist, observing natural processes of 'generation and corruption' and ordering the 'parts of animals'.

Arguably, the question of life is the burning question of the contemporary era, one in which life is everywhere at stake as 'bare life', one in which 'all politics is biopolitics'. If the question of Being was the central issue for antiquity (raised again by Heidegger), and if the question of God

– as alive or dead – was the central issue for modernity (Kierkegaard, Nietzsche), then perhaps the central question today is that of Life – the function of the concept of 'life itself', the two-fold approach to life as at once scientific and mystical, the return of vitalisms of all types, and the pervasive politicization of life.

The question that runs through these brief *disputatio* is the following: Can there be an ontology of 'life' that does not immediately become a concern of either Being or God? Put differently, if one accepts that the concept of 'life' is irreducible to biology, what then is to prevent it from becoming reducible to theology? Let us be even more particular: To what extent is 'life' as a concept always situated between a biology of a non-ontological 'life itself' and an onto-theology of the life-beyond-the-living, or 'after-life'?

But what comes 'after life'? Is it death, decay, and decomposition, or is it resurrection and regeneration? Is it, in biological terms, the transformation of the living into the non-living, from the organic life of molecules to non-organic matter? Or does it involve a theological re-vitalization of the resurrected, living cadaver? In either case, the after-life bears some relation to the 'during life' and the 'before life', and it is precisely the ambiguity of these relationships that has shaped the debates on mechanism and vitalism in the philosophy of biology, as well as the earlier debates in Scholasticism on the nature of creaturely life.

There is no better guide to the after-life than Dante. The life of the after-life in the *Commedia* is a political theology, at once rigidly structured and yet coursing with masses of bodies, limbs, fluids, fires, rivers, minerals, and geometric patterns of beatific light. In particular, the *Inferno* gives us several concise statements concerning the life of the after-life. In the seventh circle, Dante and his guide Virgil come to the 'burning desert', upon which a multitude of bodies are strewn about.[1] Among them Dante and Virgil come across Capaneus, one of the seven kings who assaulted Thebes and defied the law of Jove. Capaneus lies stretched out on the burning sand, a rain of fire descending upon him, while he continues his curses against the sovereign. As Virgil explains, Capaneus is one of the blasphemers, grouped with the usurers and sodomites for their crimes against God, State, and Nature. But, as with many of Dante's depictions in the *Inferno*, there is no redemption, and the punished are often far from being penitential. Their tired, Promethean drama of revolt, defiance, and blasphemy goes on for eternity.

It is easy to read such scenes in a highly anthropomorphic manner. But each individual 'shade' that Dante encounters is also associated with a group or ensemble that denotes a category of transgression, and this is especially the case of Middle Hell. Upon entering the gates of the City of Dis, Dante and Virgil are first confronted by a horde of demons, and then by the Furies. Once they are able to pass, they come upon a 'landscape of open graves', each one burning and holding within it one of the Heretics. The scene is visually depicted with great drama by Gustav Doré, who, following the prior example of Botticelli, presents the heretics as a mass of twisted, emaciated corpses emerging from their graves. Along the way they also encounter a river of bodies immersed in boiling blood (watched over by a regiment of Centaurs), as well as the 'wood of suicides', in which the bodies of the damned are fused with dead trees (watched over by the Harpies). Within many of the circles, Dante encounters nothing but multiplicity – bustling crowds (the Vestibule of the Indecisive), a cyclone of impassioned bodies (Circle II, the Lustful), a sea of bodies devouring each other (Circle IV, the Wrathful), dismembered bodies (Circle VIII, the Sowers of Discord), and a field of bodies ridden with leprosy (Circle VIII, the Falsifiers). The life-after-life is not only a life of multiplicity, but it is also a life in which the very concept of life continually negates itself, a kind of vitalistic *life-negation* that results in the living dead 'citizens' of the City of Dis.

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[1] Cf. XIV, 22-24: 'some souls were stretched out flat upon their backs,/others were crouching there all tightly hunched,/some wandered, never stopping, round and round' (*Inferno*, trans. Mark Musa, Penguin, 1984; all citations refer to this edition).

Perhaps, then, one should begin not by thinking about any essence or principle of life, but by thinking about a certain negation of life, a kind of life-after-life in which the 'after' is not temporal or sequential, but liminal.

2. Blasphemous Life

But we've forgotten about blasphemy. What is blasphemy in regard to the forms of life-negation found in the *Inferno*? Returning to the burning desert, Capaneus, noticing Dante's inquiring gaze, shouts back to him: 'What I was once, alive, I still am, dead!'[2] On one level this is simply a descriptive statement – defiant towards divine sovereignty in life, I remain so in the after-life. But surely Capaneus realizes that, after life, resistance is futile?[3] Or have the terms changed, after life? Perhaps his words do not mean 'I am still defiant' but rather, quite literally, something like

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[2] XIV, 51. An alternate edition by Mandelbaum translates 'Qual io fui vivo, tal son morto' thus: 'That which I was in life, I am in death.'

[3] Virgil notes as much, chastising Capaneus for continuing this tirade, his own words becoming his own punishment.

'I am a living contradiction.' Such phrases denoting a living-death recur in the *Inferno*, often spoken by Dante himself.[4] Perhaps, then, this phrase 'What I was once, alive, I am still now' actually means – in the afterlife – that 'I am still living, even in death.' This living contradiction – being *living dead* – is also linked to the political-theological contradiction of a power that at once 'shuts down' as much as it 'lets flow'. There is a kind of Medieval biopolitics in the *Inferno* quite different from the modern, Foucauldian version. The strange conjunction of sovereignty and multiplicity in the *Inferno* does not demand the punishment of souls, but instead requires a mass of animated, sensate, living bodies, in some cases resulting in an almost medicalized concept of the after-life (e.g. the Sowers of Discord are meticulously dismembered, dissected, and anatomized). In tandem with a sovereign 'shutting-down' we have also a kind of governmental 'letting-flow'; indeed, at several points the *Inferno* seems to imply their isomorphism.

Blasphemy, then, can be viewed in this regard as the assertion of living contradiction. But this assertion is not simply a resistance to an authoritative demand to be non-contradictory. In its modern variants it strives to become an ontological principle as well. Nowhere is this more evident than in the 'weird biologies' of H.P. Lovecraft's *At the Mountains of Madness*.[5] The narrative describes two kinds of blasphemous life. The first involves the discovery of unknown fossils and a 'Cyclopean city' in the deep Antarctic, both of which display 'monstrous perversions of geometrical laws'.[6] The discovery leads to the remains of an unrecognizable, intelligent species of 'Old Ones' that, in the Lovecraftian mythos, are thought to have lived eons prior to the earliest known human fossilized data.[7]

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[4] Upon seeing the bestial figure of Satan, Dante notes 'I did not die – I was not living either!' (XXXIV, 25).

[5] To this one might also add the creatures that inhabit William Hope Hodgson's *The Night Land* as well as weird tales of authors such as Clark Ashton Smith and Frank Belknap Long.

But this only leads to a further revelation, in which the explorers discover another type of life which they call the Shoggoths and which seem to resemble formless yet geometric patterns: 'viscous agglutinations of bubbling cells – rubbery fifteen-foot spheroids infinitely plastic and ductile – slaves of suggestion, builders of cities – more and more sullen, more and more intelligent, more and more amphibious, more and more imitative [...] '[8] In Lovecraft's inimitable prose, the Shoggoths are the alterity of alterity, the species-of-no-species, the biological empty set. When they are discovered to still be alive, they are described sometimes as formless, black ooze, and sometimes as mathematical patterns of organic 'dots', and sometimes as a hurling mass of viscous eyes. Formless, abstract, faceless. In an oft-referenced passage, what the narrator expresses is the horizon of the ability of the human characters to think this kind of 'life':

> When Danforth and I saw the freshly glistening and reflectively iridescent black slime which clung thickly to those headless bodies and stank obscenely with that new unknown odor whose cause only a diseased fancy could envisage – clung

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[6] *At the Mountains of Madness*, in *The Dreams in the Witch-House and Other Weird Stories*, ed. S.T. Joshi (New York: Penguin, 2004), 271.

[7] One could easily imagine a re-casting of Quentin Meillassoux's 'arche-fossil' in terms of the findings of the Miskatonic University Expedition. See William Dyer et al., 'A Hypothesis Concerning Pre-Archaen Fossil Data Found Along the Ross Ice Shelf', *The New England Journal of Geological Science*, 44.2 (1936): 1-17.

[8] *At the Mountains of Madness*, 330.

> to those bodies and sparkled less voluminously on a smooth part of the accursedly resculptured wall in a series of grouped dots – we understood the quality of *cosmic fear* to its uttermost heights.[9]

What Lovecraft puts forth in his tales of cosmic horror is a form of blasphemy that is decidedly non-anthropomorphic and misanthropic. At the mountains of madness we move from a concept of blasphemy as grounded in human agency (the blasphemy of Capaneus in the underworld) to a blasphemy of the unhuman ('more and more amphibious'). For Lovecraft, 'it' is blasphemous – but also indifferent, incomprehensible, and in many cases unnamable ('the thing', 'the doom', 'the fear', 'the whisperer').

At the center of blasphemous life is this idea of the living contradiction. *Blasphemous life is the life that is living but that should not be living*. This contradiction is not a contradiction in terms of medical science; the blasphemous life can often be scientifically explained and yet remain utterly incomprehensible. If it is a logical contradiction, it would have to be one in which the existence of true contradictions would not only be admitted, but would be foundational to any ontology. In logical terms, the assertion that there are true contradictions is often referred to as 'dialetheism'.[10] But with Lovecraft we have a twist. The Shoggoths are bizarre examples of *dialethic biologies*, contradictions that are living precisely because they are contradictory, or 'blasphemous'.

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[9] Ibid., 331.

[10] In its simplest form, dialetheism argues that for any proposition *X*, both *X* and *not-X* are true. Dialetheism therefore works against the Law of Non-Contradiction (articulated in Aristotle's *Metaphysics* Gamma), but, in order to avoid accepting absolute relativism, it must also accept some form of paraconsistent logic. For more see Graham Priest, *In Contradiction* (Martinus: Nijhoff, 1987).

Whereas for Dante the blasphemous is the living contradiction – to be living in death, to be living after life – for Lovecraft the blasphemous is the very inability to think 'life' as a concept at all. Blasphemy is here rendered as the unthinkable. To account for such blasphemous life, one would have to either compromise existing categories of thought, or entertain contradictory notions such as 'living numbers' or 'pathological life'.

3. AMBIENT PLAGUE

The anonymous 'it' of blasphemy is also expressed in the hermeneutics of plague and pestilence. Our very concepts regarding the disaster already betray a profound anxiety. That some disasters are 'natural' while others are not implies a hypothetical line between the disaster that can be prevented (and thus controlled), and the disaster that cannot. The case of infectious diseases is similar, except that the agency or the activity of this 'biological disaster' courses through human beings themselves – within bodies, between bodies, and through the networks of global transit and exchange that form bodies politic. In the U.S., the two-fold conceptual apparatus of 'emerging infectious diseases' (naturally-caused) and 'biodefense' (artificially-caused) cloaks a generalized militarization of public health. More fundamentally, when it becomes increasingly more difficult to discern the epidemic from the bioweapon, entire relations of enmity are re-cast. The threat is not simply an enemy nation or terrorist group, the threat is itself biological; biological life itself becomes the absolute enemy. Life is weaponized against Life, resulting in an ambient *Angst* towards the biological domain itself.[11]

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[11] Cf. my article 'Biological Sovereignty', *Pli: The Warwick Journal of Philosophy* 17 (2006-7).

However, while it has become customary to view epidemics in light of post-germ-theory 'autoimmunitary' boundary disputes, there is a more fundamental problem articulated in the pre-modern concept of plague and pestilence, where biology and theology are always intertwined in the concepts of contagion, corruption, and pollution.[12] One of the central concerns of chroniclers of the Black Death was that of causation, and how that causation was interpreted in relation to the divine.[13] As the Black Death spread throughout Medieval Europe, the motif of the 'angry God' recurs in many of the chronicles, both fictional and non-fictional. It forms a key framing-tool for Boccaccio's *Decameron*, is a motif in *Piers Plowman*, and it shapes the sub-genre of plague pamphlets in England.[14] These in turn make reference to the examples of Biblical plague, of which the most well-known is the Ten Plagues of Egypt, in which God sends down ten 'plagues' to persuade the Egyptian pharaoh the free the Jewish people.[15]

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[12] A great deal of the cultural theory surrounding epidemics has focused on its modern, germ-theory context. Emily Martin's *Flexible Bodies* (Boston: Beacon, 1994) and Laura Otis' *Membranes* (Baltimore: Johns Hopkins University Press, 2000), provide views from anthropology and literary studies, respectively. Jacques Derrida noted the way in which political conceptualizations of the enemy have, in a post-9/11 era, centered around autoimmune disorders, in which the threat comes from within. See Giovanna Borradori and Jacques Derrida, 'Autoimmunity: Real and Symbolic Suicides – a Dialogue with Jacques Derrida', in *Philosophy in a Time of Terror* (Chicago: University of Chicago Press, 2003). However, there is as much to learn from the pre-modern discourse of plague and pestilence, which often de-emphasizes the ontology of interior-exterior in favor of a theology of life and life-after-life.

[13] For a survey, see the collection *Epidemics and Ideas: Essays on the Historical Perception of Pestilence*, edited by Terrence Ranger and Paul Slack (Cambridge University Press, 1992).

[14] A particularly good example in this regard is William Bullein's mid-sixteenth century plague pamphlet, *A Dialogue Against the Fever Pestilence*.

[15] *Exodus* 7:14-12:42.

Here the ‘plagues’ do include epidemic disease, but also rivers that turn into blood, swarms of insects, tempestual storms, and an eclipse. Another, more common reference among the Black Death chronicles is apocalyptic. *Revelations*, with its dense and complex symbology, tells of ‘Seven Angels’ sent forth to deliver ‘Seven Plagues’ that are to be ‘poured’ upon mankind as a form of divine judgment; here again the ‘plagues’ range from contagious disease to aberrations in livestock, the weather, and the destruction of human cities.[16]

In all these instances we see this key element: a divine sovereign who, in the form of a judgment and/or punishment, sends down – or better, emanates – a form of miasmatic life that is indissociable from decay, decomposition, and death. What is noteworthy about the pre-modern concept of plague and pestilence is not only its blurring of biology and theology, but the profound lability that the concepts of plague and pestilence have. In the chronicles of the Black Death, plague seems to be at once a separate, quasi-vitalized ‘thing’ and yet something that spreads in the air, in a person’s breath, on their clothes and belongings, even in the glances between people. As one early chronicler notes, ‘one infected man could carry the poison to others, and infect people and places with the disease by look alone’.[17]

It is tempting to understand the Medieval hermeneutics of plague and pestilence as Neoplatonic – a supernatural force emanating from a divine centre. However this would require that we understand the relation between

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[16] *Revelations* 15-16.

[17] See the chronicle of Gabriele de Mussis, translated and collected in *The Black Death*, ed. Rosemary Horrox (Manchester: Manchester University Press, 1994).

Creator and creatures as pathological, a divine sovereign that emanates itself through a miasmatic diffusion of decay. But what is being emanated here is not creation itself but rather its opposite, a kind of de-creation that occupies the underside of what Aristotle called 'passing away' (disease, decay, decomposition).[18] This strange type of life, that seems to emanate from a Neoplatonic One and diffuse itself throughout creaturely life, cannot be understood without taking into account another element. As varied as the Medieval accounts of plague and pestilence are, one of the common motifs, along with the angry God, is that of plague and pestilence as a divine weapon. The divine sovereign doesn't simply pass judgment; the sovereign weaponizes life – the pathological life of 'plagues' – and turns it against the earthly life of the creature, which is itself a product of the divine will.

Arguably this motif has its roots in antiquity: in Hesiod, for instance, we see how Zeus sends the 'gift' of plague-ridden Pandora to Prometheus as a form of retribution; likewise *The Illiad* opens with an angry Apollo sending down 'arrows' of plague upon the armies of men for their disrespect towards the gods. There are earthly instances of this as well. An oft-mentioned example in this regard is the Medieval practice of catapulting corpses. The primal scene in this regard is the fourteenth-century Italian trading post at Caffa, on the northern border of the Black Sea. Ongoing skirmishes between Italian merchants and Muslim locals led, in one instance, to the catapulting of plague-ridden corpses by the latter, over the fortress walls of the former.[19]

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[18] The motif of decay has been picked up most recently by Reza Negarestani, who discusses 'decay as a building process'. In a seminar given at Goldsmiths College, Negarestani adopts two approaches to understanding the concept of decay – that of mathematics (derived from Scholasticism as it developed at Oxford) and that of architecture. There is much to expand upon here, particularly in the relation between architecture and resurrection. The ruin may be one conceptual mediation between them.

All of this is to suggest that the political theology of pestilence is not an issue of shutting-down or 'walling'. It is, certainly, that, but only to an extent. For the pervasive, diffuse, and circulatory quality of pestilence – this 'thing' or 'event' that is at once a divine emanation and yet a source of social and political chaos – raises a more complex problem for sovereign power: *how to control the pervasiveness of pestilence without losing control of the pervasiveness of people*.

But it is not clear in the accounts of chroniclers, or in the texts of Boccaccio, Chaucer, or Langland, if pestilence is that which causes social and political disorder, or if pestilence *is* continuous with this affective fantasy of total chaos. So we have a strange situation in which pestilence, itself supernaturally caused by a divine, primary sovereign power, then elicits a host of exceptional measures by secondary, earth-bound sovereign actors, in order to ward off the pending and pervasive chaos that pestilence occasions – which itself emanates from the primary, divine sovereignty – the *primum mobile* of pestilence, as it were.

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[19] Here is De Mussis' account, which is thought by most historians to be second-hand: 'The dying Tartars, stunned and stupefied by the immensity of the disaster brought about by the disease, and realizing that they had no hope of escape, lost interest in the siege. But they ordered corpses to be placed in catapults and lobbed into the city in the hope that the intolerable stench would kill everyone inside [...] And soon the rotting corpses tainted the air and poisoned the water supply, and the stench was so overwhelming that hardly one in several thousand was in a position to flee the remains of the Tartar army. No one knew, or could discover, a means of defense'. In *The Black Death*, 17.

4. NEKROS

However, it should not be forgotten that the weaponized plague always targets a body or bodies. And what, indeed, is the target of the living weapon, if not the living target – that is, the corpse?

The concept of *nekros* has two significant meanings in classical culture. On the one hand, *nekros* is the corpse or the dead body. In the *Odyssey*, for instance, when Odysseus organizes the funeral rites for one of his companions, it is the *nekros* that is burned at the grave site: 'Once we'd burned the dead man (*nekros*) and the dead man's (*nekrou*) armour,/ heaping his grave-mound, hauling a stone that coped it well,/we planted his balanced oar aloft to crown his tomb.'[20] Certainly *nekros* names the singularity of the departed life, or of life recently departed from the body, leaving behind a corpse. But this corpse retains something residual of that life, insofar as both the corpse and its armor are together set upon the grave. We might even say that *nekros* not only names the 'dead man', but also the thingness of the corpse. In a sense *nekros* oscillates between the body-minus-life and the thingness of the corpse, the latter approaching the domain of the purely non-living (e.g., the armor as the non-living body).

However the *Odyssey* also contains another, more significant usage of *nekros*. This comes in the well-known passages recounting Odysseus' journey to the underworld. In this scene Odysseus first performs a sacrificial rite that calls to the dead, who then emerge from the underworld in a kind of slow-motion swarming:

> And once my vows and prayers had invoked the nations of the dead (*ethnea nekrôn*), I took the victims, over the trench I

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[20] *The Odyssey*, trans. Robert Fagles (New York: Penguin), XII.13-15.

> cut their throats and the dark blood flowed in – and up out of Erebus they came, flocking toward me now, the ghosts of the dead and gone (*nekuôn kataethnêôtôn*)[21]

Here *nekros* no longer names the corpse, nor even the thingness of the corpse. Instead, *nekros* names something alive, or at least vitalized – but in a way fundamentally different from the life of *zoê*. *Nekros* as the corpse presumes a reliable boundary between life and death, whereas *nekros* as 'the dead' are characterized by an ambivalent vitalism. These dead souls are detained souls, they are immaterial yet non-transcendent, a life that at once continues to live on but that lives on in a kind of interminable, vacuous, immortality. *Nekros* is thus not the corpse but rather 'the dead', or the existence of a life-after-life.

But what, if anything, 'lives on' after life? Paul provides what would become a center of dispute in later theological debates over resurrection. The mortal body, like all living things, displays an infusion of life-spirit as well as processes of growth. 'But God gives it a body as he has determined, and to each kind of seed he gives its own body [...] So also is the resurrection of the dead. The body that is sown is perishable, it is raised imperishable [...] It is sown a natural body: it is raised a spiritual body.'[22] The organicist motif of resurrection is that of a seed that is sown in the earth and that grows and is animated (or re-animated) into a new body, the latter being both the resurrection of the person as well as that of the community of the *corpus mysticum*.

There is also a great deal of ambiguity in the Pauline formula. Patristic thinkers differed on what kind of life-after-life resurrection was, and how such a supernatural form of life was to take place.[23] One set of debates centres around the problem of the temporality of resurrection. If the living, mortal, earthbound body was susceptible to the processes of growth and decay, then in what material state would the body be resurrected? What kind of life returns? Would the resurrected body – the life-after-life – live in a state of perpetual stasis (as a kind of 'living statue'), or does it still undergo transformations, either in the form of higher perfections, or in terms of a beatific hypergrowth? The so-called material continuity debates among Patristic thinkers not only highlights the problem of time in relation to life and after-life, but it points to a problem that cuts across the theological and political domains (for instance, when Paul lays out the basic anatomy of the *corpus mysticum* as constituted both by unity and by participation).

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[21] Ibid., XI.38-42.

[22] I Corinthians 15.38, 42, 44, New International Version.

Resurrection could be resurrection of the body, the soul, or more generally of 'the dead'. But even theories of the resurrection of the soul – as one finds in Origen's notion of a 'spiritual body' – still maintain the minimal necessity of a body-in-flux. The problems of material continuity are also linked to spatial and topological problems concerning the material process by which the formless body of decay and putrefaction is re-assembled and re-vitalized. The mere return of material particles does not constitute resurrection, for those particles must be either ensouled, renewed, or in some way cast anew. And here the almost absurdist debates concerning 'chain consumption' come into the foreground. If the corpse undergoes decay and decomposition into so many particles and non-living matter, if the corpse is devoured by worms and beasts, and those beasts devoured by man, how can the parts or particles of the body be re-assembled? (One can imagine a solution to this problem offered by Jarry's Ubu ...). One partial resolution, offered by Tertullian, was to shift emphasis from the matter to the form of the resurrected body, so that continuity could exist through change. Cannibalism thus does not negate continuity, and the living dead can also be the eaten dead.

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[23] The most sophisticated account of such debates remains Caroline Walker Bynum's study *The Resurrection of the Body in Western Christianity, 200-1336* (New York: Columbia University Press, 1995).

The theological debates over resurrection point to some basic dichotomies: should the organicist model of the growth and decay of the natural world (seeds, plants, animals) serve as the analogical model for resurrection, or are those processes precisely what resurrection aims to correct and to 'heal'? Such questions have to do, in effect, with the nature and the supernature of the after-life, or better, with the relation between life and a 'life-plus-something' that constitutes the early Medieval theology and later Scholastic onto-theology. Insofar as the after-life is related in some way – as analogy, as model, as perfection – to finite, mortal life, it obtains a certain familiarity that enables thinkers such as Origen to talk at length about growth and decay in a theological context. But insofar as the after-life is a supernatural phenomenon, a divine and sovereign action, it remains outside the scope of philosophical and even theological inquiry.

How can life – something that is presumably *lived* – be situated at such a point of inaccessibility? Discussing the role of the supernatural in the eighteenth-century gothic novel, literary critic S.L. Varnado suggests that the aesthetics of the gothic novel revolve around a confrontation with the divine as an experience of horror. Varnado uses the theological term 'numinous' to describe this experience, the limit-experience of ‘absolute otherness’. In gothic fictions, the numinous is ephemeral; it can either be revealed to have natural and rational causes (as in Radcliffe’s *The Mysteries of Udolpho*), or the supernatural can be affirmed, and its horror sublimated into an affirmation of faith (Walpole’s *The Castle of Otranto*) or a descent into damnation (Lewis’s *The Monk*).

The concept of the numinous is etymologically associative to the Kantian concept of *noumena*. Kant’s own re-affirmation of the split between *phenomena* (the world as it appears to the subject) and *noumena* (the inaccessible world-in-itself) tended to draw his analyses towards the former and away from the latter. Indeed, there is a sense in which Kant’s antinomies of pure reason – God, the universe, the soul – are pushed so far away from *phenomena* that they begin to occupy a space not that far from *noumena*.[24] And yet it is precisely this domain – the anonymous ‘there is’ – that has for so long remained a point of attraction for ontology.

Let us consider a conceptual portmanteau, comprising the gothic ‘numinous’ (the horror of the divine as absolute otherness) and Kantian *noumena* (the unhuman, anonymous ‘in itself’). In what sense is the *nekros*, as ‘the dead’, also a kind of *nouminous life*? A nouminous life would have to articulate a conceptual space that is neither that which is lived and outside of discourse (the gothic ‘numinous’), nor that which is purely reasoned and unlived (the Kantian antinomies). We could call this a ‘horror of life’ if such a phrase did not bring with it undue anthropomorphic and even existentialist connotations. Perhaps we can say that, if the life-after-life is a nouminous life, it is because it elicits a *noumenal* horror that is the horror of a life that indifferently 'lives on'.

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[24] Kant, in the *Lectures on Philosophical Theology*, notes the following: ‘God knows all things as they are in themselves a priori and immediately through an intuitive understanding. For he is the being of all beings and every possibility has its ground in him. If we were to flatter ourselves so much as to claim that we know the modum noumenon, then we would have to be in community with God so as to participate immediately in the divine ideas [...] To expect this in the present life is the business of mystics and theosophists [...] Fundamentally Spinozism could just as well be called a great fanaticism as a form of atheism’ (trans. Allen Wood and Gertrude Clark, Cornell University Press, 1978, 86).

5. The Spirit of Biology

The relationship between theology and horror in the West invites a number of superficial comparisons: in the Eucharist there is both cannibalism and vampirism; in the Jewish and Christian apocalyptic traditions the realization of the City of God always entails resurrection of the dead; and in numerous instances the New Testament portrays the various demons and demonic possessions that elicit the healing powers of the Messiah. Indeed, considering the extent to which genre horror deals with the themes of death, resurrection, and the divine and demonic, one could argue that genre horror is a secular, cultural expression of theological concerns.

If we look more closely, however, we see that in many instances it is a concept of 'life' that mediates between theology and horror. We can even imagine our theologians carefully watching the classics of early twentieth-century horror film: the relation between the natural and the supernatural (Aquinas watching *The Cabinet of Dr. Caligari*); the distinction or non-distinction between human and beast (Augustine watching *The Wolf Man* or *Cat People*); the coherence or incoherence of the *corpus mysticum* (Paul watching *Revolt of the Zombies* or *I Bury the Living*); the problem of the afterlife (Dante watching the Italian silent film version of *L'Inferno*). But one need not imagine such scenarios, for many so-called art-horror films deal with such issues, from David Cronenberg's early 'tissue horror' films, to Ingmar Bergman's *Through a Glass Darkly*, to Dario Argento's now-complete 'Three Mothers' trilogy.

If both theology and horror deal with the concept of 'life', then what exactly is this 'life' that lies at the limits of the thinkable? Aristotle gives us one clue. In the *De anima* Aristotle explicitly thinks the question of life as an ontological question, through the concept of *psukhê*: 'It must be the case then that soul (*psukhê*) is substance as the form of a natural body which potentially has life, and since this substance is actuality, soul will be the actuality of such a body.'[25] There is, to borrow terms that Scholasticism would favor, an 'ensoulment' or animation that thus takes place in hylomorphism, a process through which life is literally formed (or in-formed ... and sometimes de-formed).

However Aristotle gives us a slightly different picture in the *De Generatione et Corruptione*. Here the central question is not about any principle of life, but rather about the problem of morphology. Aristotle asks, how are 'coming-to-be' and 'passing-away' different from alteration in general? Are growth and decay merely examples of the larger genre of change in itself? This in turn leads to a more fundamental question regarding the domain of the living: 'What is that which grows'?'[26]

Aristotle's approach is to distinguish between different modalities of change. There are, first, the processes of alteration, which are qualitative (one thinks of a tree sprouting branches or an animal growing fur – the tree or animal remains the same kind of tree or animal).

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[25] Trans. Hugh Lawson-Tancred (New York: Penguin, 1986), II.1.412a, 157.

[26] Trans. Harold Joachim, in *The Basic Works of Aristotle*, ed. Richard McKeon (New York: Modern Library, 2001), I.5.321a.30, 489.

There are also the processes of coming-to-be and passing-away, which are substantial changes (as when one animal is eaten by another animal, the former undergoing modification in substance). Finally, there are the processes of growth and decay, which can involve changes in magnitude (growing larger or smaller).[27] Now, while the first two are general processes of change that occur in the living and non-living, Aristotle implies that growth and decay are exclusive to the domain of the living. Why is this? One of the reasons Aristotle provides is that growth and decay, though exclusive to the living, fundamentally have to do with changes across the substance of the living and non-living, changes that may be due to 'the accession of something, which is called food' and is said to be 'contrary to flesh', and that involves the 'transformation of this food into the same form as that of flesh'.[28]

To Aristotle's example of nutrition we might also include the processes of decay and decomposition, the reverse passage of *nekros* into non-living matter. Food for worms ... But might we also include another passage, that of *nekros* into the life-after-life? What sort of change would this be – alteration, coming-to-be/passing-away, or growth/decay? Would this constitute a kind of biology of spiritual transformation, or would it constitute the 'spirit of biology'?

What horror explicitly thinks, theology implicitly admits: a profound fissure at the heart of the concept of 'life'. Life is at once this or that particular instance of the living, but also that which is common to each and every instance of the living. Let us say that the former is 'the living', while the latter is 'Life' (capital L). If the living are particular manifestations of Life (or that-which-is-living), then Life in itself is never simply this or that instance of the living, but something like a principle of life (or that-by-which-the-living-is-living). This fissure between Life and the living is Aristotelian in origin, but the fissure only becomes apparent in particular instances – we see it in the Scholastic attempt to conceptualize 'spiritual creatures', we see it in the problem of the life-after-life of resurrection, and we also see it in natural philosophy and the attempts to account for teratological anomalies and aberrations.

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[27] 'We must explain (i) wherein growth differs from coming-to-be and from alteration', and (ii) what is the process of growing and the process of diminishing in each and all of the things that grow and diminish' (Ibid., I.5.320a.9-12, 485).

[28] Ibid., I.5.321b.36-322a.1-3, 490.

However, the most instructive examples come from classical horror film, in particular the 'creature features' of film studios such as Universal or RKO. The proliferation of living contradictions in horror film constitutes our modern bestiary. Let us consider a hagiography of life in the relation between theology and horror. The living dead, the undead, the demon-beast, and the phantasm. Each of these are *repudiations* of life, but not their full negation. Life is repudiated in favor of an ambivalent and 'nouminous' after-life. Each also takes up a certain relation between life and the political, centered around a key concept that structures its own genre conventions. The table overleaf provides a brief summary.

	LIVING DEAD	UNDEAD	DEMON-BEAST	PHANTASM
Exemplar	The zombie	The vampire	Demonic possession; lycanthropy	The ghost, the specter
Allegory	Working class, the mob, mass	Aristocratic, Romanticism	Bourgeois, the therapeutic	Divine-religious, the spirit, the soul
Avatars	Multitude, contagion	Blood, rats, bats, mist	Beast, animal, monster, chimera	Mediums, portents, signs
Ontology	Flesh	Blood	Meat	Spirit

Tables such as this obviously have their limitations. But one thing to note is that in each case we have a form of life that at once repudiates 'life itself' for some form of after-life. Each of these figures are literally living contradictions. The zombie is the animated corpse, the vampire is the decadence of immortality, the demon is at once a supernatural being and a lowly beast, and the specter exists through materializations of its immateriality. And, in each case, the form of after-life works towards a concept of life that is itself constituted by a privation or a negation, a 'life-minus-something'; the basic Aristotelian (and Hippocratic) concepts of flesh, blood, meat, and spirit are paradoxically living but without life. In this sense, *horror expresses the logic of incommensurability between Life and the living.*

6. UNIVOCAL CREATURES

One of the peculiarities of Aristotle's *De anima* is that, while it opens with the stated aim of inquiring into the 'principle of life', it quickly bypasses this aim in favor of detailed analyses of the natural world, the senses, and the intellect. What ostensibly begins with an investigation into the ontology of *zoê* ends with a rather opaque meditation on *nous*. It is almost as if Aristotle discovers that the question of 'life' can only be ontological if it ceases to be a question of life-as-such. This has also coloured later glosses on the text, such as those by Averröes and Aquinas, whose commentaries are themselves characterized by this shift.[29]

In Book II, however, Aristotle makes some important distinctions. After having offered the concept of *psukhê* as the life-principle, Aristotle distinguishes between different types of *psukhê* – that is, that *psukhê* is itself manifested in a range of specific forms. As is well-known, Aristotle distinguishes between plants, animals, and humans, based on the manifestation of *psukhê* or the life-form that governs them. While plants are characterized by a nutritive *psukhê*, animals are characterized by a sensory and motile *psukhê*, and humans by a reasoning or intellective *psukhê*. This forms an ascending order, for whereas plants are governed by nutrition, they can neither move nor think. The same follows for animals, since they lack reason.

The Aristotelian distinction was, of course, surpassed by the growth of natural history and, later, the emergence of a separate field of biology. But while the modern life sciences have analyzed the domain of the living down to the smallest molecule, the Aristotelian concept of a 'life principle' remains contested terrain.[30] In particular, one issue left unresolved in the *De anima* has to do with the concept of *psukhê* itself. Is there one, univocal *psukhê* that cuts across different domains of the living? Does *psukhê* in effect emanate from its ideal center towards the multitude of individual life forms? Or is there a *psukhê* that is proper to each individual, constituting a kind of propriety to *psukhê*?

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[29] Averröes' notion of the 'material Intellect', as well as the Thomist distinction between existence and essence, can be regarded as attempts to smooth over the transition in the *De anima* between the question of 'life' and the question of thought.

The Scholastic reception of Aristotle offers a number of responses, and, ironically, forms an important chapter in the philosophy of biology. However, before Aristotle's 'biological' works make their appearance in the twelfth century via Arabic translations, there were already attempts to indirectly think Life as a name of the divine. The creature, emblematic of the domain of the living, is always a symptom. It is an effect, a product – as Bonaventure would put it, a *vestigium* or 'footprint' of the divine. The world of the living is a *liber creaturae*. Life is precisely that which is symptomatic of the divine, though it is not of the divine itself.

But it is Aquinas who both synthesizes the various positions on the creature and emphasizes that the concept of the creature revolves around the relation between Creator and creature, supernatural and natural, light and mud. In his attempts to wed Aristotelianism with Christian doctrine, Aquinas offers a neat summary of what we might call the 'creaturely triad'. What is the relation between the creature and Creator, between the living and the divine Life that make the living possible? Aquinas first sets up a dichotomy between two approaches, that of *equivocity* and that of *univocity*. In the first, there is no relation between creature and Creator, and the divine remains forever outside the possibility of being thought. In the second – univocity – there is a relation of continuity between creature and Creation, such that, in extreme cases, the latter can be said to be co-existent with and immanent in the former. The problems with each, from Aquinas' position, are easy to see. While equivocity forecloses any possibility of thinking or experiencing the divine, univocity makes it too easy, in effect flattening the divine onto nature. As is well-known, the solution offered by Aquinas is that of *analogy*. Between no relation (equivocity) and pure relation (univocity), there is partial relation, or analogy. Thus the creature is analogous to the Creator, their difference articulated in the form of degrees of perfection ('proportion' and 'proportionality'). The creature is the life that is less-than-divine, the Creator is the life that is more-than-the-living.

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[30] The differing positions of genetic determinism, biocomplexity, developmental systems biology, and the various branches of cognitive science today raise these questions.

Might we also then say that, for Aquinas, the living are analogously related to Life? Aristotle's question of 'life' and the life-principle cannot be asked of Life as such. It can only be asked of the living, of something 'beyond' the living or that forms the living. But then we would have to consider 'life' in general as a kind of negative concept, a concept that at once asserts its asking as it recedes into the background of this question.

This negative concept of life is ontologized along two axes. The first is predicated on ontological difference. It posits a distinction, as we noted previously, between 'Life' and 'the living'. The *De anima* posits *psukhê* as a general life-principle, but at the same time distinguishes it from particular instances of the living in plant, animal, and human life. Everything hinges on the relation between Life and the living. In the period of high Scholasticism, the spectrum of creation, from monotheism to pantheism, from orthodoxy to heresy, illustrates the way in which the question of Life is never far from the question of the nature of the divine. In this sense the *De anima* is ontologically prior to texts such as *De Partibus Animalium* and *Historia Animalium*.

The non-concept of life is also aligned on a second axis, on which it is predicated on a distinction between a 'principle of life' and its corresponding 'boundaries of articulation' (this is its essence and existence, substance and accident). The principle of life may vary quite widely, from *psukhê* to a theological soul, to modern mechanism and/or 'vital spirit', to contemporary concepts of molecule, gene, and information. But it always makes possible one or more boundary relations that, when applied to the domain of the living, re-affirm the principle of life as essence. Such boundaries include, first and foremost, that between the living and the non-living. Secondary ones include the division between the organic and inorganic, and between human and animal.

7. Pathological Immanence

Arguably, the modern concept that has done the most to steer the question of life away from ontology has been that of the organism. Only when the relation between Life and the living can be encapsulated in the architecture of the organism, can the question of life emerge from its Scholastic hiding place into an epistemologically-rooted 'life science'.

But even in the life sciences there are innumerable instances of life-beyond-life, instances of 'the living' that turn back upon the hidden ontological question of Life.

For example, the emergence of a science of pathology – what Foucault, discussing pathological anatomy in the early nineteenth century, describes as the study of 'pathological life' – already points to the complicated way in which the question of *what* life is quickly folds onto the notion *that* life is. Foucault identifies several aspects to pathology – is it the study of the disease-in-itself, the disease as it is manifested in the patient, or the disease within a set of environmental conditions? Pathological anatomy signals an innovation because it not only posits that decay and decomposition are themselves processes of life, but that they exhibit characteristics that make them more than simply the inverse of growth, development, or the healthy state.

With the emergence of modern germ theory (Koch, Pasteur), the concept of immunity (Metchnikoff), and an epidemiology driven by political economy (Snow's cholera maps of London), the question becomes even more dense: not only are there distinct processes of after-life (decay, decomposition, putrefaction), but these are abetted by a host of life-forms that themselves resist easy classification within biology.[31] The concept of pathology is an after-life, in so far as it asks us to think Aristotle's distinction between growth and decay, coming-to-be and passing-away, in a single thought. Today, the study of pathology is often divided along sub-disciplinary lines that betray interesting assumptions: while virologists bracket the roles of environment and transmission, focusing on the pathogenic organism, epidemiologists black-box the pathogenic organism, emphasizing environment and a statistical approach that is biopolitically tied to public health.

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31. For example, in modern debates over whether viruses are living. For a perceptive overview, see Lynn Margulis' book *Symbiotic Planet* (New York: Basic Books, 1998).

This last dichotomy is instructive, for it suggests to us several forms of after-life. As an organism, as a member of 'the living', the pathogenic organism (viruses, bacteria, fungi) can be situated broadly within the post-Darwinian *liber creaturae*. But, as we know, it is the very nature of such organisms to pass between life forms – to pass through, to pass between, and even, in cases of genetic mutation, to pass beyond. The means by which this is achieved are through processes that innately question the autonomy of the living organism – infection, transfection, parasitism, symbiosis. This in turn opens onto another, quite different form of after-life, one where the locality of 'the living' tends to become unlocalized, diffuse, distributed, and even invisible, tending towards an abstract domain in which 'the living' comes to overlap with 'Life'.

This is precisely the terrain explored by Deleuze, and the point of reference here is the Scholastic concept of the creature. *A setting of the creaturely life within an ontology of immanence* – perhaps this is the tension at the heart of Deleuze's own, peculiar form of vitalism. Deleuze's emphasis on the nonorganic life that altogether bypasses biological categorisation is often coupled with an equal emphasis on that which is alive, and not simply on that which exists. Though Deleuze, in his own writings and with Guattari, does make frequent references to the history of biology (e.g. the Cuvier-Geoffroy debate, Jacob and genetics, animal ethology), it is really in the context of Scholasticism that this type of Deleuzian biophilosophy can be identified.

In his lectures at Vincennes, Deleuze will often re-cast the Scholastic triad of analogy-equivocity-univocity in terms of another triad, that of transcendence-emanence-immanence. While Deleuze's admiration for Spinoza is well-known, it is

Duns Scotus who plays a pivotal role in the passage between the Neoplatonic emphasis on emanation and 'participation', and Spinoza's assertion of immanence, encapsulated in his famous phrase *Deus sive natura* ('God or nature').[32] The very problem of creation, and of the relation between Creator and creature, must presuppose a relation of continuity, even though a 'formal objective distinction' can still be made between the two: 'In the concept of a creature, however, no notion or species will be found to represent something proper to God which is wholly different in nature from anything pertaining to a creature.'[33] For Duns Scotus (in the 'strong' reading via Deleuze), nothing can be thought through the creature which is not univocally thought of the divine; the natural always implicates within itself the supernatural, life the after-life.

For Deleuze, the central ontological issue is thus not that of transcendence *vs* immanence, but rather of a different tension: that between *emanence* and immanence. The former produces immanent effects, but such effects emanate from a source that remains above and beyond those effects; emanence of effects implies an eminence of cause. Not surprisingly, Deleuze favors immanence, in which the effect is immanent in the cause. Deleuze expands the term 'expression', borrowed from Spinoza, to describe this creaturely immanence, essentially flattening out the

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[32] Scotus, in the *Opus oxoniense*, notes that 'a species which can be multiplied in more than one individual, is not of itself determined to any certain number of individuals but is compatible with an infinity of individuals. This is evident in the case of all perishable species. Therefore, if the perfection of necessary existence can be multiplied in more than one individual, it is not of itself restricted to any certain number, but is compatible with infinity (trans. Allen Wolter, in *Duns Scotus: Philosophical Writings*, Hackett, 1987, I., dist.II, q.iii, 88).

[33] Ibid., I, dist. III, q.i, 29.

'divisions of nature' first formalized by Eriugena into a single, univocal, immanent expression: 'In the limit Nature as a whole is a single Animal in which only the relations between the parts vary.'[34]

If this notion of expressive immanence is, as Badiou notes, a 'vitalist ontology', is it vitalist because of what it says about 'Life' or for what it says about 'the living'? What, indeed, does vitalism come to mean in Deleuze's biophilosophy, if not a kind of subtractive vitalism, one that posits a creature-without-creation, an emanation-without-center, a decay that is growth, and a collapsing of 'Life' and 'the living', a distinction that structures both the Aristotelian and Scholastic concepts of life? If pathology broadly names one kind of life-after-life (growth-in-decay, coming-to-be in passing-away), a pathological immanence would name one of the central – unresolved – problematics of Deleuzian vitalism: that of the relation between 'life' and 'immanence'. If the former presumes some level of dynamic change (even if that change occurs immanently), the latter requires the existence of a fully actual, non-dynamic diffusion, enmeshing, or blanketing. The limit-point, the pathological turn, is at that point where immanence becomes so absolute that is becomes ambient and pervasive, itself receding into a zone of non-life.

8. Life as Non-Being

What is striking about many of the attempts to ontologize life is the way in which 'life' becomes an always-receding horizon. If we accept the Aristotelian distinction between Life and the living as structuring the philosophy of life in the West, then it would seem that Life is always receding behind the living. This is the limit of natural philosophy, beyond which one must have recourse to either natural theology or what Kant calls onto-theology, the system of knowledge of the 'being-of-all-beings'.

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[34] Gilles Deleuze, *Expressionism in Philosophy: Spinoza*, trans. Martin Joughin (New York: Zone, 1990), 278.

But, in the tradition of Aristotelian natural philosophy, Life is not simply the absent center to every instance of the living. The relation between Life and the living is that, while the former conceptually guarantees the latter, in itself it is never available to thought. This, however, does not mean that Life is a concept of negation because it is privative, for its lack of 'thisness' is precisely what exceeds any particular instance of the living. If Life has a negative value, then, it is because of its superlative nature, because it exceeds any instance of the living. Any critique of life would have to begin from this presupposition of the superlative nature of Life. Life is 'nothing' precisely because it is never some thing.

In this sense, philosophical thinking about life borrows heavily from the tradition of mystical theology – and in particular from the tradition of negative theology. Before Anselm offers his famous ontological proof for the existence of God (God as 'that beyond which nothing greater can be thought'), the ninth-century Irish philosopher John Scottus Eriugena provides one of the most elaborate theories of the divine as 'nothing' (*nihil*). Eriugena's *Periphyseon* is deeply influenced by the apophatic approach of the Pseudo-Dionysius. But the *Periphyseon* applies a dialectical rigor not found in the latter's works. In Book III, Eriugena puts forth a notion of the 'divine darkness', in which the divine is *nihil* precisely because of its superlative nature: 'For everything that is understood and sensed is nothing else but the apparition of what is not apparent, the manifestation of the hidden, the affirmation of the negated, the comprehension of the incomprehensible [...]'[35]

To what extent can we say that Life is *nihil* in this sense? Once the ontological difference between 'Life' and 'the living' is collapsed, life subtracts from itself any possibility of an affirmation. What remains is a kind of negative theology, or better, a negative theo-zoology, whereby life always displays some relation to the negation of life. Hence the after-life is not about the dichotomy between life and death, but about a more fundamental relation – that between Life and Being.

One problem has to do with what happens once the concept of 'Life' detaches itself from 'the living'. This is a problem implicit in the *De anima*, where the concept of *psukhê* is sometimes a life-principle, and sometimes a stand-in for the being of form itself. In a modern context, process philosophy (Bergson, Whitehead) and process theology (Chardin, Steiner) likewise reach a zone in which 'Life' becomes convertible with Being – even if the name of Life is process or becoming.

For many, however, all of this is a false problem. The opening sections of *Being and Time* provide what is perhaps the clearest statement on this point. There Heidegger effectively glosses over the fields of anthropology, psychology, and biology as fields which must presume being in order to begin their inquiries about man, mind, and organism. While each of these fields, according to Heidegger, deals in some way with Life, none of them are capable of posing the question of Life as an ontological question:

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[35] Book III, 633A, from Iohannis Scotti Erivgenae, *Periphyseon* (*De Divisione Naturae*), *Liber Tertius*, ed. and trans. I.P. Sheldon-Williams with the collaboration of Ludwig Bieler (Dublin Institute for Advanced Studies, 1981).

> [...] in any serious and scientifically minded 'philosophy of life' (this expression says about as much as the 'botany of plants') there lies an inexplicit tendency toward understanding the being of Da-sein. What strikes us first of all in such a philosophy (and this is its fundamental lack) is that 'life' itself as a kind of being does not become a problem ontologically.[36]

This 'missing ontological foundation' is itself what grounds these fields. The question *that* Life is, is displaced by the question of *what* Life is – or, more accurately, what the domain of the living is. The anthropological category of man, the psychological category of mind, and a general biology of the organism all presume a Being of Life. Where Heidegger leaves off, however, is at the question of whether Life is a species of Being, or whether the ontology of Life in effect transforms Life into Being. His last words on the topic are at once suggestive and opaque: 'Life has its own kind of being, but it is essentially accessible only in Da-sein.'[37]

One point of entry is to think about non-Life (a non-Life that is not Death), and by extension, non-Being (a non-Being that is not Nothing). Put another way, the challenge would be to think the relation between Life and Being as mediated by negation. This is, to be sure, an ancient problem, one posed by the presocratics, in the attempt to secure a conceptually-sound concept of the One or the Many. At its root is the problem – really, the profound ambivalence towards – the concept of non-Being. As Levinas notes, in a language not too far removed from Eriugena:

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[36] *Being and Time*, trans. Joan Stambaugh (Albany: State University of New York Press, 1996), §10, 43-44.

[37] Ibid., 46.

> When the forms of things are dissolved in the night, the darkness of the night, which is neither an object nor the quality of an object, invades like a presence [...] But this nothing is not that of pure nothingness. There is no longer this or that; there is not 'something'. But this universal absence is in turn a presence, an absolutely unavoidable presence [...] There is is an impersonal form, like in it rains, or it is warm.[38]

Thus the problem of non-Being is not simply that of a fear of nothingness or of the vacuum. Rather, it is the quite gothic fear of a something whose thingness is under question. 'This impersonal, anonymous, yet indistinguishable consummation' of being, which murmurs in the depths of nothingness itself we shall designate by the term there is [...] The rustling of the there is [...] is horror.'[39] The pinnacle of this type of horror – really a kind of concept-horror – is the evisceration of all noological interiority: 'horror turns the subjectivity of the subject, his particularity qua entity, inside out.'[40]

What is the 'there is' of Life? Is the concept of Life already a 'there is', and therefore already enveloped in the gothic horror of absolute otherness and pervasive anonymity? If 'Life', as opposed to 'the living', is always receding into the anonymous 'there is', does this then mean that Life is really Life-without-Being?

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[38] 'There is: Existence without Existents', in *The Levinas Reader*, trans. Seán Hand (London: Blackwell, 1990), 30.

[39] Ibid., 30; 32.

[40] Ibid., 33.

9. ANONYMOUS HORROR

Granted, there is a certain absurdity in asking about the non-being of Life; one might as well inquire into non-existent creatures ... which is, of course, precisely what the domain of supernatural horror does. Horror film is replete with examples of the horror of the 'there is ... ' The titles of such films are telling: *The Being*, *The Creature, The Entity, It's Alive!, It Lives Again*, *Monster Zero, The Stuff, Them!, The Thing*, and so on. In these films, the site of horror is not simply that of a physically threatening monster, for at least these can be given names (Dracula, Frankenstein's monster, Wolf-Man), and thereby included within the sphere of moral and theological law. This also means they can be destroyed. But what of the creature that cannot be named, or that is named in its unnamability? The unnamable creature is also the unthinkable creature. This would be the B-horror version of Beckett's *L'innomable*. In some cases the unnamable creature is without form, the intrusion of a raging, inverted hylomorphism. Cold War films such as *The Blob* and *Caltiki the Immortal Monster* exist in a state of oozing, abject, borderlessness. In other cases the unnamable creature is without matter, existing as pure (demonic) spirit, an inverted theophany. In *Fiend Without A Face*, human beings are besieged by immaterial, brainstem-like entities, suggesting telepathy as a form of contagion.[41]

These films represent a subtle subversion of the classic creature-feature by shifting the criteria by which a monster is made. Whereas the creature-feature films define the monster as an aberration (and abomination) of nature, the unnamable creature is an aberration of thought.

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[41] In postmodernity this tradition is extended in films such as Mario Bava's *Planet of the Vampires*, Cronenberg's *Scanners* and Kiyoshi Kurosawa's *Cure*.

The classical creature-features still retain an element of familiarity, despite the impure mixture of categories (plant + human) or differences in scale (giant reptiles, ants, leeches, etc.). Films featuring unnamable creatures, by contrast, contextualize the monster in terms of ontology (form-without-matter, matter-without-form) or in terms of onto-theology (the spiritual abject, the oozing abstraction). They point towards a form of life-after-life that highlights conceptual aberrations.

Let us pause for a moment and gather together our propositions concerning this concept-horror, or, granting ourselves some poetic license, what we can also refer to as the 'teratological noosphere':

- The question of an ontology of life is traditionally predicated on a fundamental distinction between Life and the living, or, between that-by-which-the-living-is-living and that-which-is-living.
- This distinction is deployed along two axes: One which requires a 'principle-of-life' to structure all manifestations of the living, and another in which the living is in turn structured according to various 'boundaries of articulation'.
- In the context of Scholasticism, the ontology of life continually oscillates between a natural philosophy of creatures and an onto-theology of the divine nature.
- The structure of the concept of life is most often that of negative theology.

Each of these propositions structures the basic way in which 'life' as a concept is thought as such. Each of these also contain one or more fissures, one or more 'heretical' strands of thinking. To this we can offer another proposition:

- In its traditional onto-theological formulations, Life is what is denied of Being. While the latter is the domain of the transcendent, the eternal, the infinite, the spiritual, and the fully actual, the former is subtracted from this – the immanent, the temporal, the finite, the material, and the virtual.

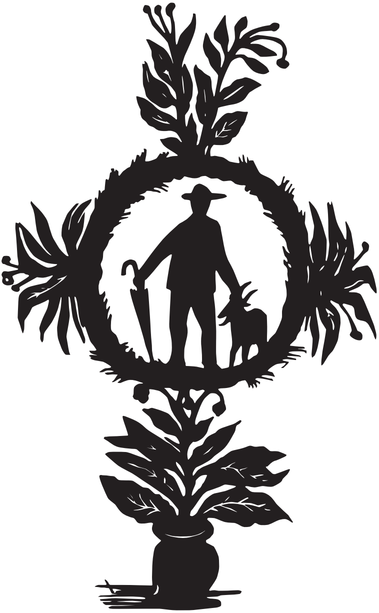
Life therefore bears some minimal relation to non-Being. But this can take several forms. The non-Being of Life can be situated either 'above' or 'below' the scale of the human – on the one hand there is the strata of Thomist 'spiritual creatures' or the strata of Aristotelian creaturely life, while on the other hand there is the strata of demonic multitudes or the strata of subhuman plague and pestilence. This non-anthropomorphic and even misanthropic quality of Life sustains these strata with a certain inaccessibility. Even as Life, in conditioning the living, is able to assert its self-evident character, it also puts forth its noumenal qualities. Kant's statements concerning the teleology of the natural world would have to be qualified: *it is because Life is noumenal that it is teleological.* But this then means that the 'ends' of Life are also 'anonymous'.

Any question of the possibility of an ontology of life would have to consider 'life' as a particular intersection between a biology of a non-conceptual life itself and an onto-theology of transcendence, emanence, and immanence. The problem is that the concept of Life has remained tenaciously non-conceptual, even as it continues to function in a conceptual, even ontological way in contemporary scientific fields such as network science, swarm intelligence, and biocomplexity. The issue is not that Life cannot think its own foundationalism, its own decision. Indeed, this is arguably what post-Darwinian biology obsesses over. Rather, the issue is that Life as a concept must always presume a further question concerning Being. The infamous question 'What is Life?' appears to be always superseded by the question of 'What is Being?' And yet the very idea of Life-without-Being would seem to be an absurdity for philosophy – though, as we've seen, not for horror.

Czech Forest

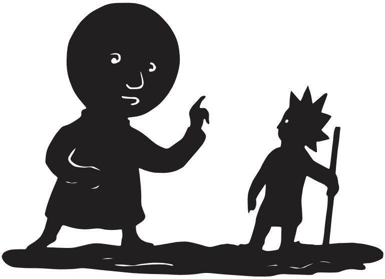
Rafani

Cutouts – illustrations, 170 x 50 cm (2002).



Naše dobrá vůle skončila
v roce 1938

‘Our goodwill ended in 1938.’



Jen s pocitem naplňované spravedlnosti

‘Only with a feeling of fulfilled justice.’

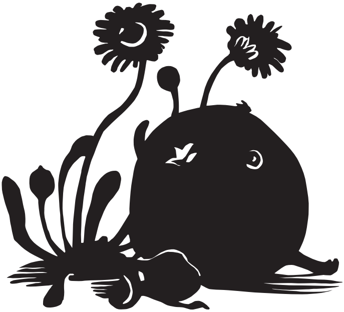
Je to skutečně novostavba
na půdě panenské

‘It is truly new building on virgin soil.’

Heim ins Reich

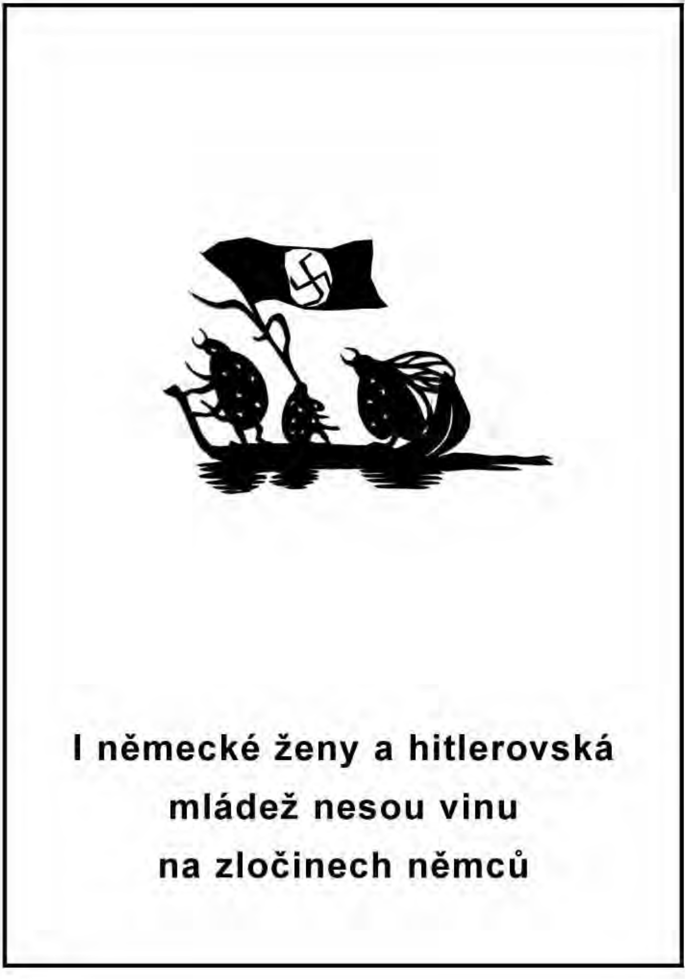
Vůči němcům pociťují Češi hlubokou hořkost

‘Czechs feel deep bitterness towards Germans.’

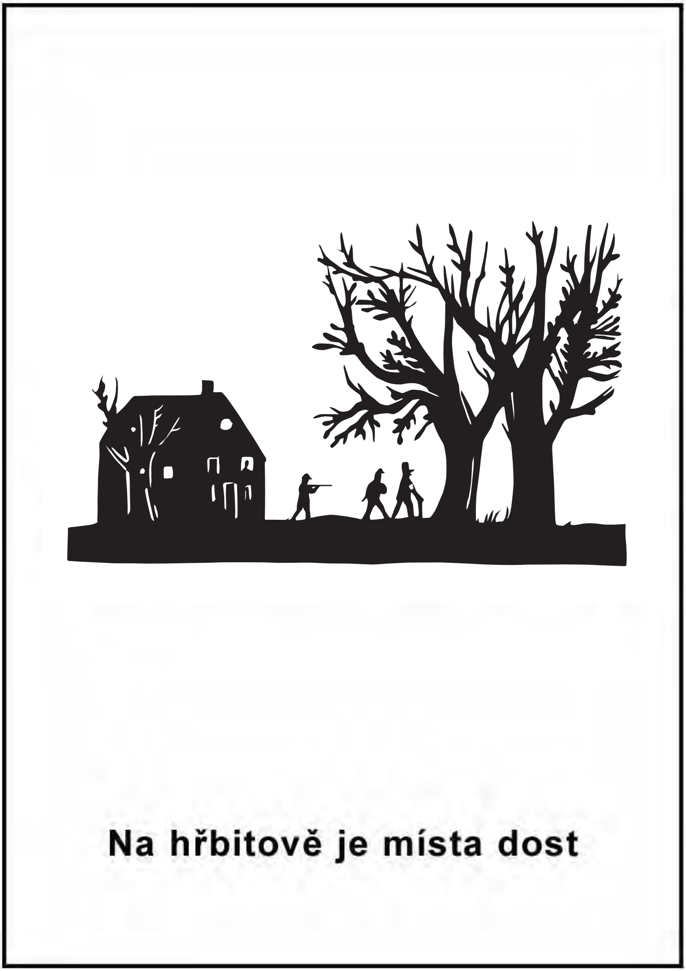


Němec zůstal naším nesmiřitelným nepřítelem

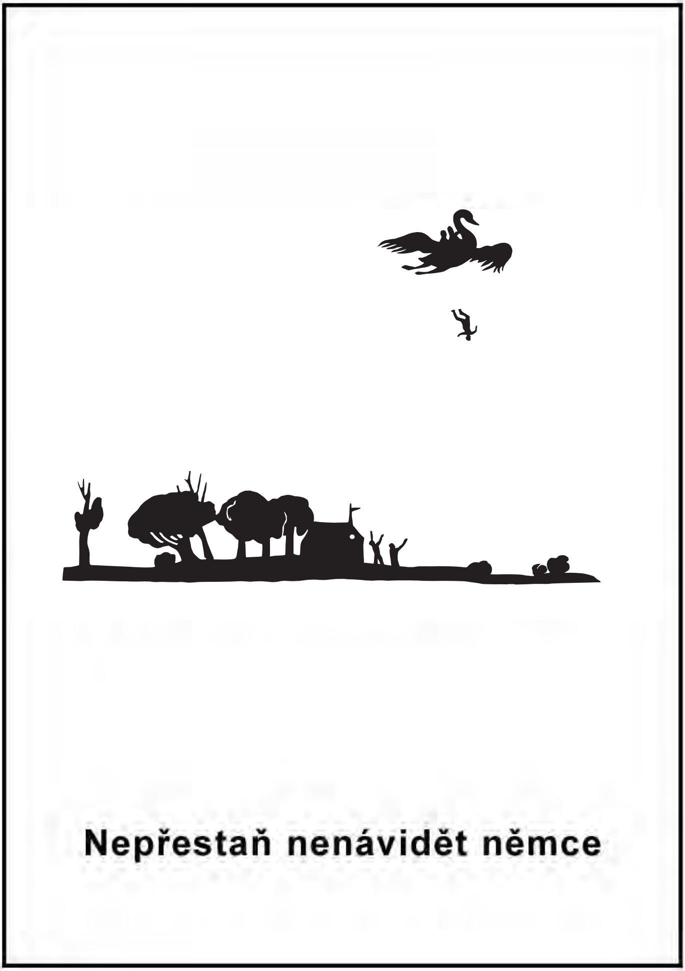
‘The German remains our irreconcilable enemy’


I německé ženy a hitlerovská
mládež nesou vinu
na zločinech němců

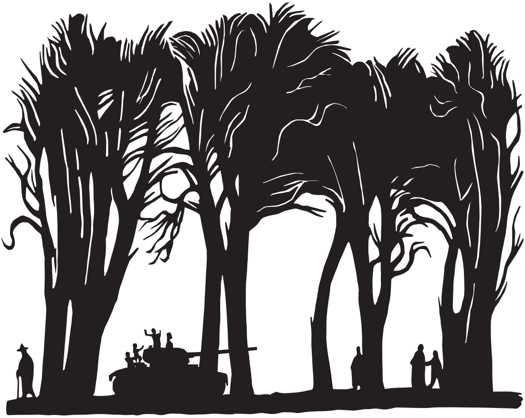
'Even German women and Hitler youth carry the guilt of German Crimes.'


Na hřbitově je místa dost

‘There is enough space in the graveyard.’

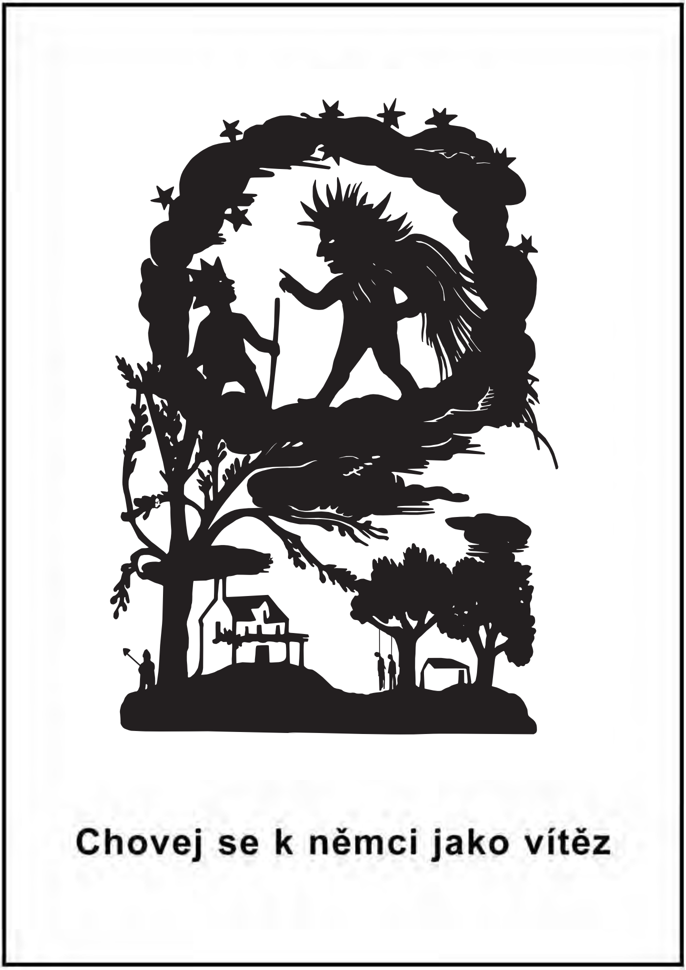

Nepřestaň nenávidět němce

‘Never stop hating Germans.’



Spravedlivě, ale nesmlovavě

‘Just, but uncompromising.’


Chovej se k němci jako vítěz

‘Treat the German like the victor you are’

M.R. James and the Quantum Vampire

Weird; Hauntological: Versus and/or and and/or or?

China Miéville

0. Prologue: the Tentacular Novum

Taking for granted, as we do, its ubiquitous cultural debris, it is easy to forget just how radical the Weird was at the time of its convulsive birth.[1] Its break with previous fantastics is vividly clear in its teratology, which renounces all folkloric or traditional antecedents. The monsters of high Weird are indescribable and formless *as well as being* and/or *although they are* and/or *in so far as they are* described with an excess of specificity, an accursed share of impossible somatic precision; and their constituent bodyparts are disproportionately insectile/cephalopodic, without mythic resonance. The spread of the tentacle – a limb-type with no Gothic or traditional precedents (in 'Western' aesthetics) – from a situation of near total absence in Euro-American teratoculture up to the nineteenth century, to one of being the default monstrous appendage of today, signals the epochal shift to a Weird culture.[2]

The 'Lovecraft Event', as Ben Noys invaluably understands it,[3] is unquestionably the centre of gravity of this revolutionary moment; its defining text, Lovecraft's 'The Call of Cthulhu', published in 1928 in *Weird Tales*. However, Lovecraft's is certainly not the only *haute* Weird. A good case can be made, for example, that William Hope Hodgson, though considerably less influential than Lovecraft, is as, or even more, remarkable a Weird visionary; and that 1928 can be considered the Weird tentacle's coming of age, Cthulhu ('monster […] with an octopus-like head') a twenty-first birthday iteration of the giant 'devil-fish' – octopus – first born to our sight squatting malevolently on a wreck in Hodgson's *The Boats of the 'Glen Carrig'*, in 1907.[4]

There are, of course, honoured precursors: French writers were early and acute sufferers from Montfort's Syndrome, an obsessive fascination with the cephalopodic.[5] In short order, the two key figures in the French pre-Weird tentacular, Jules Verne and Victor Hugo, produced works –

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[1] S.T. Joshi's periodisation of the golden age of Weird as 1880-1940 is persuasive (S.T. Joshi, *The Weird Tale*, Austin: University of Texas Press, 1990).

[2] I have argued this elsewhere: 'Introduction' to H.P. Lovecraft, *At the Mountains of Madness* (NY: Random House, 2005); presentation at the 'Weird Realism: Lovecraft and Theory' event, London, Goldsmiths, 26 April 2007; 'Weird Fiction', in Mark Bould and Sherryl Vint (eds.), *Routledge Companion to Science Fiction* (London: Routledge, 2008 [forthcoming]).

[3] In his contribution to the 'Weird Realism' event in 2007 (see previous note).

[4] William Hope Hodgson, *The House on the Borderland, and Other Novels* (London: Gollancz, 2002), 28-29.

[5] Named by Reza Negarestani for Pierre Dénys de Montfort (1766–1820), pioneering and dissident French malacologist, author of, among others, the multi-volume *Histoire Naturelle Générale et Particulière des Mollusques* (6 volumes [1-4 only by de Montfort] Paris: F. Dufart, 1801-5), which took seriously the existence of the 'kraken octopus' and 'colossal octopus', and included still-iconic illustrations.

Verne in *20,000 Leagues Under the Sea* (1869) and Hugo in *The Toilers of the Sea* (1866) – which include extraordinary descriptions of monster cephalopods. These texts, while indispensable to the development of the Weird, remain in important respects *pre*-Weird not only temporally but thematically, representing contrasting *oppositions* to the still-unborn tradition, to varying degrees prefigurations of the Weird *and* attempts pre-emptively to de-Weird it.

Verne reveals his giant squid[6] at the end of a character's careful itemisation of its qualities, qualities which *he* can see, but which we for several paragraphs suppose him to be remembering from descriptions ('Did it not measure about six metres? […] was its head not crowned with eight tentacles…? [...] were its eyes not extremely prominent […] ?').[7] The animal thus appears pre-mediated by human understanding, at the end of a long section detailing the history of architeuthology, so that its monstrousness, though certainly not denied, is already defined by human categorisation. Frisson notwithstanding, the Weird, usually implacably Real in Lacanian terms, is preincorporated into the symbolic system.

When he sees it, the narrator Arronax relays the sight with a laborious itemised description interrupted by pedantic asides ('Its eight arms, or rather legs, were […] implanted on its head, thus giving these animals the name of cephalopods') and questionable exactitude that can only undermine the 'cosmic awe'[8] which typifies the Weird ('We could distinctly see the 250 suckers in the form of hemispherical capsules […]'). Arronax carefully uses '*bras*' then '*pieds*' to describe the limbs, rather than his assistant's '*tentacules*': scientism rejects the tentacle. 'I did not want to waste the opportunity of closely studying such a specimen of cephalopod', Arronax tells us. 'I *overcame the horror* its appearance caused me, picked up a pencil, and began to draw it.'[9] Verne mounts a pre-emptive rearguard defence of a bourgeois 'scientific rationality', depicting it as stronger than this new bad-numinous.

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[6] In fact the animal is, fittingly, slightly evasive of precise taxonomy: it is described as a '*poulpe*', usually translated 'octopus', and as '*calmar*', 'squid'. Though it seems to resemble the latter more than the former, with eight limbs it is lacking the squid's two longer hunting arms. It has also been translated into English as an 'immense cuttlefish', 'devil-fish', and indeed as a 'poulp'.

[7] All quotations from Jules Verne, *20,000 Leagues Under the Sea*, translated by William Butcher (Oxford: Oxford University Press, 1998, revised 2001. Available at: <http://home.netvigator.com/~wbutcher/books/20t.htm>).

Arronax describes his own description as 'too pallid', and says that only 'the author of *The Toilers of the Sea*' could do it justice. The reference is to the extraordinary passage in which Hugo's Gilliat is attacked by a '*pieuvre*' (Guernésiais for octopus), the greatest and strangest of the pre-Weird reveries on the tentacular, and favourite for the title *tout court*. The chapter is a visionary rumination on the horror of octopus-ness. The creature is described in a vomit of aghast and contradictory metaphors and similes: 'a rag of cloth', 'a rolled-up umbrella', 'disease shaped into a monstrosity', 'a wheel', 'a sleeve containing a closed fist', 'birdlime imbued with hate', 'a pneumatic machine' – and on and on.[10]

Though Hugo is far less cited than Verne as an influence on the fantastic genre-cluster with which Lovecraft is also associated, his passage is much closer to *haute* Weird. Hugo counterposes the octopus to the chimera, to underline the former's afolkloric monstrousness. He repeatedly stresses the octopus's taxonomic transgression: it has no claws, but deploys vacuum as a weapon; it eats and shits with the same orifice (supposedly); it swims and walks and crawls; it is – as he stresses with ecstatic Kristevan disgust at the octopus-as-abject – flaccid, gangrene-like, and, 'horrifyingly […] soft and yielding'.[11] The octopus is problematised ontology.

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[8] What Lovecraft calls 'Cosmic alienage or "outsideness"' (H.P. Lovecraft, *Notes on Writing Weird Fiction*, 1937. Among many other locations, see: <http://www.geocities.com/soho/cafe/1131/14notesen.htm>).

[9] Verne, *20,000 Leagues Under the Sea* [emphasis added].

[10] Victor Hugo, *The Toilers of the Sea*, translated by James Hogarth (New York: Random House, 2002), 350-352.

Hugo is nowhere more Weird than in his admirably clear insistence that octopuses, 'killjoys of the contemplator', demand a *rethinking of philosophy*.[12] There are, nonetheless, what one might archly call 'countervailing tendencies' pulling the passage away from *haute* Weird (it should go without saying that this is genealogy not criticism).

Though distinguished from the chimera, the octopus is identified with the Medusa, demon, and, repeatedly, with the vampire, reacquainting it, if unstably, with 'traditional' teratology. The octopus is obsessively depicted as evil – indeed, such a 'perfection of evil' that its existence is a vector of heresies of a double god, a cosmic parity of good and evil.[13] Although, in a more subterreanean moment of French cephalopodia, Lautréamont deploys the octopoid to mock moralism, as when 'legions of winged squid[14] […] scud swiftly toward the cities of the humans, their mission to warn men to change their ways', a similar problematic is evident in *Maldoror* (1869). Lautréamont's

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[11] Ibid., 351.

[12] Ibid., 354.

[13] Ibid., 355.

[14] '*poulpes*' – octopuses, properly.

God is confronted by Maldoror 'changed into an octopus, clamp[ing] eight monstrous tentacles about his body', the two now knowing they 'cannot vanquish each other'.[15] This Manichean tentacular is in sharp contrast with the monstrosities of *haute* Weird, which are impossible to translate into such terms – predatory and cosmically amoral, but not 'evil'. If they serve any morally heuristic purpose it is precisely to undermine any religiose good/evil binary.

Counterintuitively, it is also precisely Hugo's heady itemisation of the octopus's dreadfulness that pulls against its Weirdness. Hugo decries the devilfish as unthinkable with what is almost a sermon, that unfolds aghast, yes, but *without surprise*. Hugo's octopus lurks like a bad conscience, a horror that we *already know* we are inadequate to thinking. By contrast, whether one deems it successful, risible, both, or something else, Lovecraft's hysterical insistences that *nothing like this had ever been seen before*, that *nothing could possibly prepare anyone for such a sight*, when his Great Old Ones appear, is the narrative actualisation of the Weird-as-novum, unprecedented, Event.

In 1896, the other great early adopter of the tentacular, H.G. Wells, published the first and neglected *haute* Weird text (despite its author not generally being located in the sub-genre, perhaps because of the never-convincing Fabian camouflage draped over his bleak numinous). 'The Sea Raiders' tells of *Haploteuthis ferox*, a hitherto-unknown and aggressively predatory cephalopod which besieges the English coast, rising from deep waters to feed on boaters, and disappearing again.[16]

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[15] The Comte de Lautréamont, *Maldoror & The Complete Works*, translated by Alexis Lykiard (Cambridge: Exact Change, 1994), 101, 103.

[16] <http://en.wikisource.org/wiki/The_Sea_Raiders>

There is no Vernian rejection of ‘tentacle’: the word and its derivations appearing twenty times in the short piece. There is no moralism – though horrifying, the monsters are predators, not devils. Above all, ‘this extraordinary raid from the deeper sea’ is unprecedented, unexpected, unexplained, unexplainable – it simply is. All that we who suffer this tentacular Event can hope is that they have returned ‘to the sunless depths of the middle seas, out of which they have so strangely and so mysteriously arisen.’

The three decades between the Verne/Hugo/Lautréamont moment and Wells’s saw the Franco-Prussian War and the Commune, the so-called ‘Long Depression’ of 1873-1896, the rise of ‘new unionism’, and the ‘new imperialism’ and murderous ‘scramble for Africa’.[17] Increasingly visible, especially in the last, the crisis tendencies of capitalism would ultimately lead to World War I (to the representation of which traditional bogeys were quite inadequate). It is the growing proximity of this total crisis – kata-culmination of modernity, ultimate rebuke to nostrums of bourgeois progress – that is expressed in the shift to the morally opaque tentacular and proto-Lovecraftian radical Weird of ‘The Sea Raiders’.

Like Wells and unlike Lovecraft, William Hope Hodgson was barometric enough to the incipient apocalypse to en-monster it *before* it exploded into the war that killed him. In a stunning letter describing the front, he refers to what he considered his masterpiece, *The Night Land*: ‘My God, what a Desolation! […] the Infernal Storm that seeps for ever, night and day, day and night, across that most atrocious Plain of Destruction. My God! Talk about a lost World – talk about the END of the World; talk about the "NightLand" – it is all here, not more than two hundred odd miles from where you sit infinitely remote.'[18] The Weird is here explicitly, in John Clute's magnificent formulation, 'pre-aftermath fiction'.[19]

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[17] Simultaneous with the increase of its formlessness and historylessness, its efficacy as placeholder for the unrepresentable, the octopus’s somatic specificity – its spreading tentacles – also saw it increasingly deployed in satire as symbol for the ‘new imperialism’.

The Weird's unprecedented forms, and its insistence on a chaotic, amoral, anthropoperipheral universe, stresses the implacable alterity of its aesthetic and concerns. The Weird is irreducible. A Weird tentacle does not 'mean' the Phallus;[20] inevitably we will mean with it, of course, but fundamentally *it* does not 'mean' at all (perhaps Weird Pulp Modernism is the most Blanchotian of literature).

1. DEATHMATCH

The Weird, then, is starkly opposed to the hauntological. Hauntology, a category positing, presuming, implying a 'time out of joint',[21] a present stained with traces of the ghostly, the dead-but-unquiet, estranges reality in an almost precisely opposite fashion to the Weird: with a radicalised uncanny – 'something which is secretly familiar, which has undergone repression and then returned from it'[22] –

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[18] William Hope Hodgson, *The Wandering Soul* (Hornsea: Ps Publishing/Tartarus Press, 2005), 384.

[19] Personal communication.

[20] Which is why, despite the seeming isomorphism of interests and recent inevitable cross-fertilisation, haute Weird is radically opposed to the sub-genre of pornographic 'hentai' manga and anime known as 'tentacle rape'.

[21] Jacques Derrida, *Specters of Marx* (London: Routledge, 1994): et, subsequently, very many al.

[22] Sigmund Freud, 'The Uncanny' (1919). <http://www-rohan.sdsu.edu/~amtower/uncanny.html>.

rather than a hallucinatory/nihilist novum. The Great Old Ones (Outer Monstrosities, in Hodgson's formulation)[23] neither haunt nor linger. The Weird is not the return of any repressed: though always described as ancient, and half-recalled by characters from spurious texts, this recruitment to invented cultural memory does not avail Weird monsters of Gothic's strategy of revenance, but back-projects their radical unremembered alterity into history, to en-Weird ontology itself.

Weird writers were explicit about their anti-Gothic sensibility: Blackwood's camper in 'The Willows' experiences 'no ordinary ghostly fear'; Lovecraft stresses that the 'true weird tale' is characterised by 'unexplainable dread of outer, unknown forces' rather than by 'bloody bones, or a sheeted form clanking chains according to rule'.[24] The Weird entities have waited in their catacombs, sunken cities and outer circles of space since aeons before humanity. If they remain it is from a pre-ancestral time. In its very unprecedentedness, paradoxically, Cthulhu is less a ghost than the arche-fossil-as-predator. The Weird is if anything ab-, not un-, canny.

This must be insisted upon for the heuristic edges of the Weird and the hauntological – and indeed of other fantastic categories – to stay sharp. Hence the importance of 'Geek Critique', which rebukes, say, Terry Eagleton when he blithely discusses the 'rash of books about vampires, werewolves, zombies and assorted mutants, as though a whole culture had fallen in love with the undead';[25] because whatever the merits of the rest of his argument, *only two of those figures are undead*, and *they are all different*. Teratological specificity demands attention. And, granting the controversial position that ghosts are teratological subjects, such specificities are nowhere more different and important than between Weird and hauntological.

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[23] William Hope Hodgson, 'The Hog' (1947) <http://www.forgottenfutures.com/game/ff4/hog.htm>.

[24] Algernon Blackwood, 'The Willows' (1907). <http://www.Gutenberg.org/files/11438/11438.txt>; H.P. Lovecraft, 'Supernatural Horror in Literature' (1927). <http://www. yankeeclassic.com/miskatonic/library/stacks/literature/lovecraft/essays/supernat/supern00.htm>.

Eagleton's sort of cavalier hand-waving is increasingly rare, at least when it comes to the ghostly. Compare Eagleton with Sasha Handley, who points out that 'to distinguish the particular meanings attached to ghosts' demands taxonomy, and that her object of study is not 'anonymous angelic or evil spirits' but 'spirit[s] appearing after death'.[26] Some years previously, however, two such perspicacious writers as Julia Briggs and Jack Sullivan as a matter of policy play fast and loose with categories of ghosthood. 'I am […] compromising', Sullivan says. 'All of these stories are apparitional, in one sense or another, and "ghost story" is as good a term as any.'[27] According to Briggs, 'the term "ghost story" […] can denote not only stories about ghosts, but […] spirits other than those of the dead […] To distinguish these from one another according to the exact shape adopted by the spirit would be an unrewarding exercise.'[28] I have argued, rather, that the ‘exact shape’ is of enormous importance.

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[25] Terry Eagleton, 'Mark Neocleous: *The Monstrous and the Dead: Burke, Marx, Fascism*', *Radical Philosophy*,137, May/June 2006: 45-47, at 45.

[26] Sasha Handley, *Visions of an Unseen World: Ghost Beliefs and Ghost Stories in Eighteenth Century England* (London: Pickering and Chatto, 2007), 8.

[27] Jack Sullivan, *Elegant Nightmares: The English Ghost Story from Le Fanu to Blackwood* (Athens: Ohio University Press, 1978), 9. While praising the book in her invaluable bibliography on the supernatural, Jessica Amanda Salmonson takes Sullivan to task for the 'obscene impression that there were no women writers of ghost stories in England'. <http://www.violetbooks.com/bib-research.html>

[28] Julia Briggs, *Night Visitors: The Rise and Fall of the English Ghost Story* (London: Faber 1977), 12.

Briggs and Sullivan are wrong, but their error is not merely personal. While we may sympathise with S.T. Joshi in finding this use of the term ‘ghost story’ ‘irksome’, his deployment of a robust common sense against it – ‘To me “ghost story” can mean nothing but a story with a ghost in it’[29] – does not get at the nature of the problem. Key here is Briggs’s justification of her imprecision by claiming that the term ‘ghost story’ ‘is being employed with something of the latitude that characterizes its general usage’.[30] The imprecision is that of the culture, and it shifts.

A quarter-century before Briggs, ‘reasons of simplicity’ were sufficient for Penzoldt to ‘use the term “ghost story” also for tales of the supernatural that do not deal with a ghost’.[31] Mindful that there is nothing simple about such a decision, Briggs by contrast feels the need to justify her own position at some length: the looseness of usage is changing. A quarter-century after her, the new common sense has become that *ghostly* ghost stories are ‘a distinct literary form’,[32] and when Handley asserts her own position, precisely contrary to Briggs’s, almost as read but *not quite*, she takes a moment to argue it. Clearly the politics of ghostly specificity has shifted markedly, but has not banished all remnants of its countertendency – hauntology is haunted by a pre-hauntological taxonomic indeterminacy.

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[29] Joshi, *Weird Tale*, 2.

[30] Briggs, *Night Visitors*, 12.

[31] Peter Penzoldt, *The Supernatural in Fiction* (London: Peter Nevill, 1952), 12 n.12.

[32] Srdjan Smajic, ‘The Trouble with Ghost-Seeing: Vision, Ideology, and Genre in the Victorian Ghost Story’, *ELH*, 70:4, Winter 2003, 1107-1136, at 1131.

At this point in history, describing as a 'ghost story' a piece about werewolves or vampires, let alone about Shub-Niggurath or similar, would likely be considered false advertising. But it was not always so. In the early twentieth century, the terato-taxonomic membrane least breached today, that between the Weird and the Hauntological, was more likely to be permeated than that between ghosts and 'traditional' monsters. The self-styled 'ghost stories' of the 1920s might feature, say, giant flesh-sucking slugs ('Negotium Perambulans' and 'And No Bird Sings', by E.F. Benson).

As Handley points out, a ghost meant to the eighteenth-century English just what it does to us now: a revenant, not some eldritch oozing tentacled thing. At some point after 1800, however, that distinct ghost-ness of the ghost ebbed – temporarily, as it turned out – until by 1910 Hodgson's *haute*-Weird adventurer Carnacki could without embarrassment be described as a 'Ghost Finder' in his battles with Hog-manifestations of 'million-mile-long clouds of monstrosity'.

It is not so much irony as a constitutive contradiction that it was a few years before that, in the mid-to-late nineteenth century, almost precisely in the middle of that trajectory of the de-ghosting ghost, that the key works of what is now vaunted as a *high* ghostly, an *echt* hauntologic, the 'tradition' of the English ghost story, appeared.

2. ANCESTRAL SPIRITS

The eighteenth-Century ghost was a revenant who tended to moralism and anti-Popish sniping, embodying as dread example lessons about virtue, justice, and so on.[33]

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[33] Handley, *Visions*, 16-19.

In the early nineteenth century, the explicitly sectarian character of that moralism had waned, but the instructional nature of hauntings remained.

Cultural production expressed anxiety over the sclerotic arrogance of the Victorian era and its victims, as well as the dominant culture's ideological counterattack, the tendency to increased and cruder moralism. Non-mimetic art tends to express such frictions particularly vividly, and in the nineteenth century we can see the battle for the two souls of the ghost in the fictions of Dickens, versus those of the man he published,[34] Sheridan Le Fanu.

Dickens thinks nothing of jostling together, in 'A Christmas Carol', the ghost of a person, Jacob Marley, with those of various Christmases. To post-hauntological eyes this is a category-error, but Dickens is merely subordinating the specifics of the ghost to his extreme and mawkish extrapolation of the preceding epoch's tendency to morally 'mean' with spectrality. In neither 'The Haunted House' (1859) nor 'The Haunted Man' (1848) are the haunts revenants of the dead, but 'of my own innocence', or a doppelganger who performs a selective mnemectomy so the story can thumpingly moralise that it is important to remember wrong done to us 'that we may forgive it'. Dickens's ghosts are apotheoses of the instructional ghosts of the preceding century – out of time, rearguard in their sentimentality, themselves haunted by the future. They are not so much convincing, morally, as performatively flourished. These are not modern ghosts, but the last, already-dead walking dead of a dead epoch, bobbed about on sticks.

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[34] Le Fanu's masterly 'Green Tea' appearing in *All the Year Round* in 1869.

Le Fanu's ghosts, by contrast, in their moral contingency, are intimations of disaster.[35] Even in his more seemingly traditional 'moral' stories, such as 'Mr Justice Harbottle' (1872), the nature of the spectral agents of revenge – their inhuman, de-subject-ed strangeness, and the repeated intimations that they, victims of injustice, are in hell ('pallid […] secretly suffering […] glittering eyes and teeth') makes sense according to no moral accounting. In the extraordinary 'Green Tea' (1869), the text's insinuations that Jennings's merciless torment at the hands of the abominable monkey spirit is in some way payback – that he is 'guilty', that he shows 'shame', though for what is unknown – read as morally obscene.

The blurring of the Weird with the ghostly is prefigured in the auditioning of animal spirits as avatars of the monstrous (before the Weird's demand to be considered cephalopod was clear), in the stark and amoral universe, in the protoplasmic formlessness of the dying vampire Carmilla (1872), in the autotelos of the monster (the monkey in 'Green Tea' just *is*). For these reasons it is tempting to agree with Sullivan that Le Fanu, rather than the more-usually-cited James, is the key revolutionary figure in the so-called 'traditional' ghost-story that we can now see was a – Weird-inflected – 'New Ghostly'.

However, while his fiction is if anything more vatic and perspicacious than James's (shades of Hodgson and Lovecraft), Le Fanu is a towering *interstitial* figure. The popular story of his death is so theoretically kitsch on this point that it could have been scripted by a cultural critic. Le Fanu was reputedly a martyr to a recurring nightmare about being crushed to death by the collapse of an old grand mansion. When discovered dead, a horrified look on his face, his doctor was said to have intoned: 'I feared this. That house fell on him at last.' The story is tenacious, which, in the face of the fact that it is almost certainly untrue,[36] bespeaks its cultural resonance. Le Fanu's problematic is the crisis and coming fall of the house of Victoriana (and of the particular colonial upheavals of fading Protestant Ascendancy), and as such foundational to what followed; but the present of which it is a vivid expression is the fringe of a past, rather than the start of a future. His fiction is of end and failure.

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[35] Sullivan is excellent on this point, and I draw on him here extensively. *Elegant Nightmares*, 32-68.

The politics of sensory perception are important. Le Fanu, in his masterwork 'Green Tea', stresses the malevolent inhuman strangeness of the monkey, but also that it was *incorporeal*. This was, in ghost-story terms, not 'New Ghostly' but 'new traditionalism', uniting Le Fanu with Dickens and other pre-Weird, fabular-logic-wielding ghost-smiths. As Victorian ghosts grew more ostentatiously moralistic, they decorporealised. (In earlier centuries they had moralised *and* provided the thrills of physicality: they were often 'thought capable of moving material objects and of inflicting physical harm […] [and] those who were confronted by ghosts believed that they could inflict material damage by shooting or stabbing the spirit'.)[37]

Central in marking him out as the key figure in this peculiar period, later to be designated the birth of a ghost-nation, Le Fanu's disciple M.R. James's ghosts could be touched, and touch.

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[36] Jim Rockhill, 'Introduction', in J Sheridan Le Fanu, *Mr Justice Harbottle and Others* (Ashcroft, BC: Ash-Tree Press, 2004). xii-xv.

[37] Handley, *Visions*, 9.

3. THE OLD NEW WEIRD GHOSTLY

James is regularly cited as a – or *the* – founder of the 'tradition' of English ghost stories. It is commonplace to then wryly point out that James's ghosts are in fact often not ghosts, but inhuman 'demons' of one sort or another.[38] Lovecraft stressed that James had 'invent[ed] a new type of ghost', not 'pale and stately, and apprehended chiefly through the sense of sight' but 'lean, dwarfish, and hairy – a sluggish, hellish night-abomination midway betwixt beast and man – and usually *touched* before it is *seen*'.[39] In the rubble of the Lovecraft Event we can go further: the adversaries of James's stories are disproportionately and emphatically *Weird*.

- Touch and touchability is central. James's is the horror of the physical universe (a trauma that would trace into the obsessive materiality/-ism of Lovecraft's horror). It is the cloth-ness of the notorious face 'of crumpled linen' in 'Oh Whistle and I'll Come to You My Lad' that makes it so terrible. James even names one of his late stories 'The Malice of Inanimate Objects'. The touchability of his 'ghosts' is not a return to that of their 18th-century cousins: this is a new (Weird) haptos, with little to do with human somaticism, and everything to do with the horror of matter. The most grotesque moment in 'The Ash Tree' is the 'soft plump, like a kitten', with which a just-glimpsed giant spider drops off the bed.

- James's repeated insistence that he is an 'antiquary' is not convincing. He is acutely conscious of capitalist modernity, and a surprising number of his 'ghosts' manifest through it. The demon in 'Casting the Runes' bizarrely announces its intent by means of an advertisement in a railway carriage. The attack which the runes occasion is brought down quite amorally on whoever took them last, according to the depersonalised passings-on of bits of paper. The horror is of the universal equivalent in mass commodification: the runes are Bad Money. Most astonishingly, in 'The Diary of Mr Poynter', what is haunted is not a scrap of fabric nor the materials with which it is made but *the design upon it*: it is the *copied* design, reprinted with explicitly cutting-edge modern techniques, that is the locus for the apparition. This is the work of hauntology in the age of mechanical reproduction.

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[38] See for example Rosemary Pardoe, 'MR James and the Testament of Solomon' (1999). <http://www.users.globalnet.co.uk/~pardos/ArchiveSolIntro.html>

[39] Lovecraft, *Supernatural Horror*.

- James, like the *haute* Weird, is largely uninterested in plot, subordinating it to his invented strangeness. Unlike Lovecraft, who might simply dispense with it, to present Weirdness in pulp bricolage, 'flashed out', as he puts it, 'from an accidental piecing together of separated things',[40] James goes through the motions of plot; but i) his narrative arcs are utterly predictable, and ii) he knows this, and repeatedly uses formulations like 'I surely do not need to tell you …' or 'It will be redundant to conclude…' or similar. This palpable impatience is underlined by his later increasingly epigrammatic and sparse stories. And like Borges, when he cannot be bothered even with half-hearted narrative, James simply describes his ideas freed of it, as in 'Stories I Have Tried to Write'.

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[40] Lovecraft, 'The Call of Cthulhu'.

- Most important, of his non-ghost 'ghosts', a disproportionate number have appurtenances of the Weird, and read now as startlingly teratologically ahead of their time. His apparitions are hairy ('The Diary of Mr Poynter', 'Canon Alberic's Scrapbook'), chitinous ('The Ash-Tree'), slimy and/or amphibious ('The Treasure of Abbot Thomas'), totally bizarre ('The Uncommon Prayer-Book'), and more than once, *tentacled* ('The Treasure of Abbot Thomas', 'Count Magnus').

Today's ghost stories are, overwhelmingly, exclusively hauntological, their figures revenant dead in time out of joint.[41] This tradition misremembers itself into existence. Many of its claimed foundation texts can only be so anointed in an act of heroic misrepresentation. Neurotically insistent on his own status as a ghost-story writer James may have been (the titles of his collections reiterate: *Ghost Stories of an Antiquary* (1904), *More Ghost Stories* …, (1911), *A Thin Ghost and Others* (1919), *A Warning to the Curious and Other Ghost Stories* (1925)); however, though he is often considered to have perfected or inaugurated such hauntological work, it is not, for the most interesting part, what defines James's *oeuvre*.

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[41] Of the sixteen stories in the acclaimed recent collection of 'new ghost stories' *The Dark* (New York: Tor, 2003), various innovations of approach notwithstanding, there is only really one story ('One Thing About the Night', by Terry Dowling) in which the haunt is not a revenant function of the human (and it is not Weird, but the dark of the collection's title). Even more telling is *All Hallows*, the journal of the Ghost Story Society, that contains, according to its own guidelines, work 'in the style of the classic supernatural tale', listing James as its first exemplar. Of the 23 stories in a recent bumper issue (*All Hallows* 43, Summer 2007), one contains a hint of the genuinely Weird ('The Reflection', by S.D. Tullis, haunted both by ghosts and by the 'wrinkled tentacles' (253) which may have trapped them in a mirror). For the others, two time-slips and one imp aside, to be a ghost story is, reasonably enough but *innovatively*, and in contradiction to James, definitionally to be a story of a ghost.

Nor, though, did he write Weird in any straightforward sense. James does not have the visionary abandon of later *haute* Weird. His use of more traditional ghosts and/or occasional folk-ish figures is repeated alongside Weird figures that in shortly forthcoming work would be repudiations of them. James's corpus represents an under-one-roof *co-existence* – that would be all but unsustainable at any but that unique fulcrum moment – of what will later be seen to be hauntology and the Weird, the oppositional dyad.

In this context, the key James story is without question 'Count Magnus'. Here, the 'strange form' from whose hood projects 'the tentacle of a devil-fish' – a Weird, inhuman, Cthulhoid figure who sucks faces from bones – is the *servant* of 'a man in a long black cloak and broad hat', a malevolent human ghost. This is an astounding crossover, its categoric transgression eclipsing any Marvel-DC or Cerebus-meets-Teenage-Mutant-Ninja-Turtle shenanigans. James creates the ultimate tag-team: *Hauntology deploys Weird as its sidekick*.

4. JEAN PAINLEVÉ'S QUANTUM VAMPIRE

There is, in 'Count Magnus', and in James in general, no *aufhebung* of the Weird and hauntological. The two are, I suggest, in non-dialectical opposition, contrary iterations of a single problematic – hence in 'Count Magnus' the peculiarly literal and arithmetic *addition* of Weird to hauntological (with the latter privileged, precisely because James *is*, fundamentally, somewhat ghostlier than he is Weird).

Alongside the fantasist's urge to literalise and concretise problematics, modern – particularly geek – culture is characterised by an accelerating circuit of teratogenesis, new monsters endlessly produced and consumed (exemplified in commodity form by the innumerable RPG and video-game bestiaries; by the coquetry with which films hint at and protect their 'monster shot'; by Pokémon, which deployed the cultural addiction as its slogan: 'Gotta catch 'em all!'). If the contradiction between Weird and hauntological was sublatable, then such drives would surely have led to the monstrous embodiment of any putative 'resolved' third term between Weird and haunt.

Nor is it difficult to imagine what such a synthesis would be. The outstanding synecdochic signifier for a revenant human dead is the skull – mind-seat now empty-eyed, memento mori, grinning, screaming.[42] The nonpareil iteration of the embodied Weird is the tentacle, and by suspiciously perfect chance, the most Weird-ly mutable – *formless* – of all tentacled animals is the octopus, the body of which, a bulbous, generally roundish shape distinguished by two prominent eyes, is vaguely homologous with a human skull.

The shapes are ready, and take little to combine: the Weird-hauntological monster is clearly a tentacled skull (see facing page for my own rendition).

Considering the fecundity and vigour of the teratological drive, the symbolic resonance of its constituents and their apparent topological compatibility for easy crossbreeding, the extreme rarity of the skulltopus in culture is mysterious. There are a very few examples, but the pickings are astoundingly meagre.[43] There is clearly something not right about

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[42] See for example *The Screaming Skull* directed by Alex Nichol (1958); F. Marion Crawford's 'The Screaming Skull' (in *Uncanny Tales*, London: T. Fisher Unwin, 1911).

[43] There is a five-second animation (http://www.youtube.com/watch?v=ly2jNr1_nro); an illustration (http://tachyonmkg.deviantart.com/art/skulltopus-11383138); a hipster t-shirt (http://www.HowlingGoodTshirts.com/marketplace/87072931/skulltopus_t_shirt); and, most impressively, Becky Cloonan's cover illustration for

it – the two components may imply one another but are *resistant to syncrex*, and the categorical unease this occasions denies the figure proliferation. The Weird and the hauntological generally relate to each other not by sublation, nor, *pace* James, by addition, but by either-one-or-the-otherness, in a manner suggestive of quantum superposition.

The author, with skull and octopus, yesterday.

Bataille's favourite anarcho-visionary marine biologist, Jean Painlevé, understood this. His 1945 'Le Vampire'[44] contains extraordinary footage of an octopus lasciviously crawling over a human skull very similar to it in shape and

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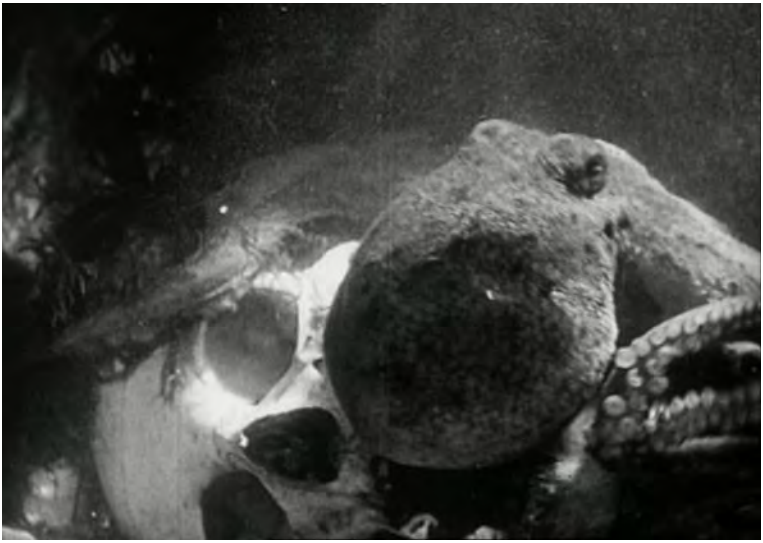
her comic *East Coast Rising* Volume 2 (Los Angeles: Tokyopop, 2008 (forthcoming)), visible online at <http://stabstabstab.deviantart.com/art/wrist-hurts-in-color-66012269>.

[44] <www.youtube.com/watch?v=wjNh0uZCCLc>

proportion. The octopus should, with that oozability of Weird skin, merge with the skull to become a skulltopus. That event is the asymptote of the interaction we see – but of course it does not happen, because it cannot.



Jean Painlevé, 'Le Vampire' (*Science is Fiction* BFIVD17190)

Instead, Painlevé shows us the unstable haptic flirtation of the two *without merger*. Those seconds are fleeting – the intervening years have distinguished the traditions of skull and octopus, and James's ingenious 'Count Magnus' solution would be hard to pull off now – but are the heart of the film (which otherwise pretends to be about vampire bats and ticks). They are the outstanding cultural example of the superposition of Weird and hauntological. We cannot sustain the skulltopus; as close as we can come is Painlevé's skull-and-octopus-interaction quantum vampire.

5. NEOLIBERALISM, THE SKULL AND THE OCTOPUS

Hauntology and Weird are two iterations of the same problematic – that of crisis-blasted modernity showing its contradictory face, utterly new *and* traced with remnants, chaotic and nihilist *and* stained with human rebukes. We can see these tendencies of the fantastic pulling at each other in the years since James, who inaugurates their contrary twinned birth, in waves of varying speeds depending on the ideological moment. At times one or other iteration might be dominant, but neither can ever efface the other. Opposed but not separable, the traces of the Weird are inevitably sensible in a hauntological work, and vice versa.

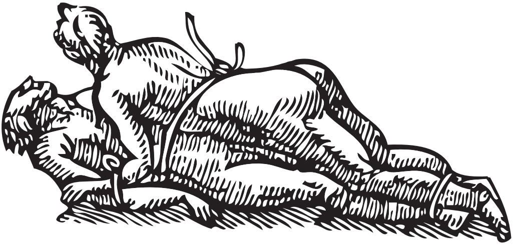
The degree to which one or the other has been stronger has affected the tendency towards their separation as genres of thought and pulp. Since the 1970s their 'separateness' has become dominant, not because there is a 'drive to separate', but as a corollary of the oscillating efficacy of as-simon-pure-as-possible Weird and/or hauntology, for thinking our fraught and oppositional history since the end of Keynesianism, that great Cthulhu-swat and ghostbuster.

In quick and dirty caricature, with the advent of the neoliberal *There Is No Alternative*, the universe was an ineluctable, inhuman, implacable, Weird, place. More recently, however, as Eagleton haunto-illiterately points out, the ghosts have come back, in numbers, with the spectral rebuke that there was an alternative, once, so could be again.

We do not get to choose, however – and why would we want to? If we live in a haunted world – and we do – we live in a Weird one.

The Corpse Bride: Thinking with *Nigredo*

Reza Negarestani



The living and the dead at his command,
Were coupled, face to face, and hand to hand,
Till, chok'd with stench, in loath'd embraces tied,
The ling'ring wretches pin'd away and died.[1]

The punishment imposed by Mezentius on the soldiers of Aneas should be inflicted, by coupling him to one of his own corpses and parading him through the streets until his carcass and its companion were amalgamated by putrefaction.[2]

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[1] Virgil, *The Aeneid*, VIII 483-88.

[2] Erinensis, 'On the Exploitation of Dead Bodies', *The Lancet*, 1828-9: 777.

A Prelude to Putrefaction

In the eighth book of Aeneid (483-88), Evander attributes an outlandishly atrocious form of punishment to Mezentius, the Etruscan King. However, it is not Virgil who first speaks of this punishment, for before Virgil, Cicero cites from Aristotle an analogy which compares the twofold composite of the body and soul with the torture inflicted by the Etruscan pirates. Revived during the reign of the Roman Emperor Marcus Macrinus, the notoriety of this atrocity survives antiquity and the Middle Ages. In the sixteenth century, the horror of this torture is expressed, once again, by a popular emblem called *Nupta Contagioso* showing a woman being tied to a man plagued by syphilis, at the King's order. Widely distributed throughout Europe, the emblem continues to reappear in different contexts during the Renaissance and even toward the nineteenth century. *Nupta Contagioso* or *Nupta Cadavera* literally suggests a marriage with the diseased or the dead: a forcible conjugation with a corpse, and a consummation of marriage with the dead as a bride.

Haunted by the unusually philosophical insinuations of this punishment as well as its subtle imagery, to which human imagination cannot help contributing, Iamblichus and Augustine – like Aristotle – ruminate on the Etruscan torture. They both adopt it as something more than a fundamental allegory in their philosophies: they see in it a metaphysical model that exposes and explains the condition(s) of being alive in regard to body, soul and intellect.[3] Jacques Brunschwig, in his 1963 essay *Aristote*

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[3] For more details on Aristotle and the fragment on the psyche see A.P. Bos, *The Soul and its Instrumental Body: A Reinterpretation of Aristotle's Philosophy of Living Nature*, (Leiden: Brill, 2003).

et les pirates tyrrhéniens, describes the baroque details of the Etruscans' punishment. A living man or woman was tied to a rotting corpse, face to face, mouth to mouth, limb to limb, with an obsessive exactitude in which each part of the body corresponded with its matching putrefying counterpart. Shackled to their rotting double, the man or woman was left to decay. To avoid the starvation of the victim and to ensure the rotting bonds between the living and the dead were fully established, the Etruscan robbers continued to feed the victim appropriately. Only once the superficial difference between the corpse and the living body started to rot away through the agency of worms, which bridged the two bodies, establishing a differential continuity between them, did the Etruscans stop feeding the living. Once both the living and the dead had turned black through putrefaction, the Etruscans deemed it appropriate to unshackle the bodies, by now combined together, albeit on an infinitesimal, vermicular level. Although the blackening of the skin indicated the superficial indifferentiation of decay (the merging of bodies into a black slime), for the Etruscans – executioners gifted with metaphysical literacy and alchemical ingenuity – it signalled an ontological exposition of the decaying process which had already started from within. Also known as the blackening of decay or chemical necrosis, *nigredo* is an internal but outward process in which the vermicular differentiation of worms and other corpuscles makes itself known in the superficial register of decay as that which undifferentiates. For the Etruscan pirates, chemistry started from within but its existence was registered on the surface, so to speak; explicit or ontologically registered decay was merely a superficial symptom of an already founded decay, decay as a pre-established universal chemistry. The victim could only be unshackled from the corpse and released when decay finished its ascension from within to the surface. Therefore the so-called climax of the punishment – the blackening of the body – coincides with the superficial conclusion of decay, the exposition of decay on an ontological level.

In a now lost piece, the young Aristotle makes a reference to the torture practiced by the Etruscan pirates.[4] In that text, Aristotle draws a comparison between the soul tethered to the body and the living chained to a dead corpse (*nekrous*):

> Aristotle says, that we are punished much as those were who once upon a time, when they had fallen into the hands of Etruscan robbers, were slain with elaborate cruelty; their bodies, the living [*corpora viva*] with the dead, were bound so exactly as possible one against another: so our souls, tied together with our bodies as the living fixed upon the dead.[5]

Whether this fragment points to a Platonic phase in the philosophical life of Aristotle or not, it provides us with a unique resource for discovering the less explicit ties between his *Metaphysics* and *De Anima*. Accordingly, it also holds a key for understanding the severed ties between Aristotle's philosophy and that of Plato on the one hand and the enduring bonds between Aristotle and Scholasticism on the other. Yet more ambitiously, this fragment subtly points to a moment in philosophy when both the philosophy of Ideas and the science of being qua being are fundamentally built upon putrefaction and act in accordance with the chemistry of decay. It is the moment when beings must undergo necrosis and decay in order to remain in being and the Ideas must be founded on an intensive necrosis and an extensive decay in order to remain in their essence and to synthesize with other Ideas. In other words, this moment marks a necessity for Ideas – even the Idea of ontology itself: in order to be active intensively and extensively, inwardly and outwardly, the Idea must first be fully necrotized and blackened on all levels, intensively and extensively.

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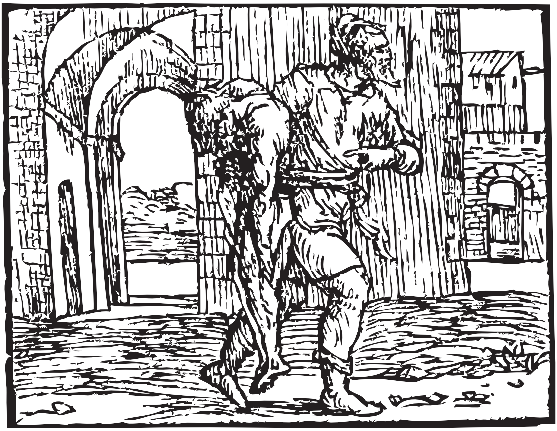
[4] Aristotle's fragment regarding the body-soul composite and the Etruscan torture is believed to be a part of *Eudemus* or *Protrepticus*.

[5] Quoted by Cicero from Aristotle in *Hortensius*. Also see *Saint Augustine Against Julian (Writings of Saint Augustine, V. 16)*, (Washington, DC: The Catholic University of America, 1957). Augustine uses the same quote from Cicero.

The following is a disorganized venture – more in line with grave robbers and necrophiles than with archaeologists and scholars of history – to disinter the twist inherent to the fragment associated with Aristotle and to delve into the moment when, prior to all arrangements and establishments, a pact with putrefaction must be made; the moment of *nucleation with nigredo*, as we must call it.



NECROPHILIC REASON

Aristotle's fragment regarding the Etruscan torture bears a deeply pessimistic irony; it is not the supposedly living body which is tethered to a corpse to rot, because it is exactly the soul qua living which is bound to a corpse – namely, the body. For Aristotle, the soul, as the essence of a being, needs a body to perform its special activities, and it is the responsibility of the soul to be the act of the intellect upon the body. Therefore this necrocratic confinement is both the price and a means of having a body as instrument, and then using this instrument to govern and eventually unite beings. The soul, in this sense, has two activities, inward and outward. The outward activity of the soul is the actualization of the body according to the active intellect (*nous*) which is immortal; in other words the extensive activity of the soul is the animation of the body according to the *ratio* (reason) derived from the *nous*, the intensive and inward activity of the soul. The inward activity of the soul is its unitive activity according to the intellect as the higher genus of being qua being. The intensive activity of the soul is the act of bringing the universe into unison with the intellect according to *ratio*; for this reason, the intensive activity of the soul coincides with the enduring of the soul in its relation to the intellect, which itself is internal to the soul. Here, the intensive and extensive, inward and outward activities of the soul must be in accordance with one another in order for the world to be intelligible and, in its intelligibility, to move toward intellect in proportion to reason.

If the intelligibility of the world must thus imply a 'face to face' coupling of the soul with the body qua dead, then intelligibility is the epiphenomenon of a necrophilic intimacy, a problematic collusion with the rotting double which brings about the possibility of intelligibility within an inert cosmos. The intelligibility allotted to the body as *corpora cadavera* by ratios of the intellect (or reasons) – each inherent to a different type or gradation of the soul – animates the world according to the intellect. Yet in doing so, reason reanimates the dead rather than bestowing life upon it; for in terms of the Aristotelian body qua cadaver, intelligibility is the reanimation of the dead according to an external agency. Reason grounds the universe not only on a necrophilic intimacy but also in conformity with an undead machine imbued with the chemistry of putrefaction and *nigredo*.

Both in Etruscan torture and in Aristotle's fragment, the living or the soul is tied to the dead or the body *face to face*. The Greco-Roman motif of the mirror is obviously at play here; one sees itself as the other, the perfect matching double. However, the great chain of philosophers from Aristotle to Augustine and beyond only tell us about one side of the mirror, shamelessly underestimating the understanding of both the living and the dead. They tell us that the soul sees itself as the dead party whilst chained to the body. But this is surely a ridiculous attempt to unilateralise the mirror motif, for not only does the living see itself as dead, but the dead also looks into the eyes of the living, and its entire body shivers with worms and dread. It is indeed ghastly for the living to see itself as dead; but it is true horror for the dead to be forced to look at the supposedly living, and to see itself as the living dead, the dead animated by the spurious living. Neither Aristotle nor Augustine tell us about this infliction upon the dead of the burden of the living, this molesting of the dead with the animism of the living. It is the Barbarians who formulated and exposed the ulterior cruelty of the Etruscan torture in retaliation for the Romans' atrocities: they slaughtered their own cattle, disembowelled them and then forced the Romans inside the carcasses in such a way that only the talking heads of the soldiers protruded. In doing so, they exhibited the farce of vitalism by ventriloquising the dead with the living.

The binding of the soul to the body as a tying of the living to the dead is later arithmetically captured by Aristotle in the formulation of a metaphysical model which is best understood arithmetically, or at least geometrically, as scholastic philosophers preferred. In vitalizing matter and actualizing it, the soul needs a body as an apparatus by which the universe of beings can be led toward the intellect which causes the noumenal universe to exist. In order both to use and to be used by the body under the direction of the intellect, the soul must first remain in itself. And conversely, in remaining in itself, the soul must animate the body and bring about the synthesis and unification of bodies. In other words, in simultaneously governing beings and conducting them toward being qua being (higher genera of being), the soul must first remain in itself and extend beyond itself. For Aristotle, this metaphysical model, the model of intelligible ontology, is arithmetically distilled as *aphairesis* (*apo*+*airein*, abstraction), a taking away or subtraction. As an Aristotelian mathematical procedure, *aphairesis* consists in two vectors of operation, of negative and positive directions in regard to each other, in diametric opposition but synergistically continuous and reinforcing. For *aphairesis*, as taking away or subtraction, emphasises simultaneously removal (that which is taken away) and conservation (that which is left behind by removal) – the removed and the remainder. A soul coupled with the body mixes with the impure –

since the body debases its essence – and at the same time approaches being qua being by remaining in itself (i.e. by ascending in its purity). For Aristotle, only subtraction can make such double-headed and simultaneous mobilization possible. *Aphairesis* or subtraction, accordingly, maps the vectors of the *mobilization* and *effectuation* of reason. *Aphairesis* is thus a procedure whereby the soul can be captured simultaneously in the sense of its belongings (or bodies) and in its movement toward *nous* which sheds those belongings as it approaches the intellect – an arithmetic formulation of the Etruscan metaphysical cruelty.[6]

The Aristotelian procedure of *aphairesis*, or subtraction, as a formulation for the metaphysical model of intelligible ontology, resurfaces explicitly during the Middle Ages – especially during the period known as High Scholasticism (1250–1350) – creeping beneath metaphysical systems, alchemical models and theological creeds. However, before affecting scholasticism, Aristotle's model implicitly exerts its forbidden influence on Neo-Platonism, especially through apophatic or negative theologians for whom the ineffability of God must be exposed by *aphairesis* or abstraction. Plotinus states that the reality of the One (*hen*) cannot be explained through the epistemological registers or attributes (belongings) which it shares with humans. Therefore, the Divine must be stripped of all its belongings by *aphairesis*, a procedure which takes away all that exists extraneously and negatively contributes to all that remains and itself progressively diminishes (becoming sublime). Here, the conceptual abstraction of *aphairesis* returns to Aristotle's subtractive model, seeded within his fragment on the Etruscan torture: the coupling of the soul with the body qua belonging is necessary in order to shed belonging and lead toward being qua being. This is so given that being qua being is a genus of being which persists and remains under any condition or environment synthesized by other beings whatsoever. In other words, being qua being is that which continues to remain after all belongings are shed, removed and taken away. This is what makes *aphairesis* the fundamental procedure in revealing or exposing the One, as employed for the most part by neo-Platonists such as Plotinus and Proclus.

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[6] *Aphairesis*, as a subtractive correlation between the soul and the body, simultaneously offers the soul the capacity of having a body as an instrument or belonging, and the opportunity of preserving its ultimate correlation with intellect. Arithmetically, in *aphairesis* or subtraction, the amount that is negated or taken away marks the dying correlation of a magnitude with its belongings (as the correlation of the soul with the mortal body). The amount that remains after subtraction, however, represents the correlation between the remainder and that which continues to remain regardless of the magnitude of subtraction. This can be expressed as the undying correlation between the soul and the intellect.

Both Aristotle's and Plotinus' formulations of *aphairesis* are grounded on one precondition, which can be summarized in terms of *conservation after subtraction*: despite being chained to the festering corpse or being subtracted, the soul is able to conserve some of itself and render the body intelligible. In the same vein, no matter what is taken away from the Divine, it will continue to remain as the One already there. Correspondingly, if magnitude Y is subtracted from magnitude X the result can be either zero, or *x* (where *x* is a remainder from X). Both Aristotle, in regard to the soul vis-à-vis the intellect (as part of the soul which remains under any condition), and Plotinus, in regard to the One, take conservation of a remainder for granted. The world cannot be intelligible and move toward intellect without the assumption that the subtraction or mortification of the soul by the body does not lead to the total erasure of the soul in the first place. Aristotle's system of metaphysics is thus built upon an assumption which has been taken for granted: that for every subtraction, there is a possibility of conservation in the form of a remainder, and for every remainder, the possibility of persistence in remaining, i.e. a resistance toward further subtraction through remaining in itself.

The coupling of the soul with the body could indeed lead to the instant mortification of the soul, thus eliminating the possibility of the soul's conferring intelligibility on the universe. But this is not the case, for the soul remains in itself and brings about the possibility of intelligibility. For this reason, the possibility of intelligibility is based on the possibility having a conserved part or remainder after subtraction – that is, the continued possibility of the soul after coupling with the dead and being putrefied by its rotting double. Only when this possibility is taken as a determinable and certain possibility can reason be associated with the intelligibility that issues forth from *nous*. The persistence of the soul in conserving its essence, or the determination of the One in remaining, certainly wards off the threat of becoming the dead qua the body or belonging; but only at the cost of becoming intimate or problematically hooked up with the dead. We shall now see how the insistence in *remaining so* or *conservation* in regard to subtraction pushes the soul to a more rotten depth of *nigredo*, and how reason exhumes a more problematic intimacy with the *nekrous*.

HORROR IN THE NEGATIVE

Subtraction is an economical mobilization of non-belonging in two directions: (1) the shedding of belongings or extension by means of *expendable* belongings; (2) remaining or intensive resistance against the expendability of belongings. The subtractive procedure of *aphairesis* bifurcates into two directionally opposite but synergistic vectors – the extensive and intensive vectors of subtraction. The outward and extensive vector of subtraction is the one by which belongings are taken away or by which the soul can extend beyond itself via a body. The latter, however, is the vector of remaining so and as such. As the inward vector of subtraction, remaining – or, more accurately, the persistence of the remainder – characterizes an intensive vector of subtraction whereby that which continues to remain brings about the possibility of being qua being or the Ideal. It is the persistence of the soul in remaining after its katabatic contact with the body that opens up the opportunity of its coming into unison with the intellect. Similarly, only that which continues to remain despite being stripped of its belongings or attributes can eventuate the One (*hen*) and the Idea of being qua being; for once again, being qua being is 'being in *remaining* so and as such'. To this extent, not only must the soul remain after its necromantic contact with the body, but also at least a part of it must continue to remain. In other words, Aristotle's model of conservation (*viz.*, having a conserved part after subtraction) might be based on the determinability of having a remainder in the first place, but it mainly concerns the continuation of the remainder.

Having a remainder after subtraction is not sufficient for the march toward the intellect, or for the exposition (explanation) of the Idea of being qua being. The remainder must *continue* to remain – this is the insinuation of the metaphysical model of conservation. The possibility of the remainder is necessary but not sufficient, for its sufficiency lies in the possibility of the remainder in remaining.

The remainder as an exposed and determinable quantity must be hosted by the indeterminable vector continued remaining, namely, *to remain*. The remainder alone as a determinable quantity is exposed by what is subtracted, but *to remain*, or in other words, to persist in remaining, coincides with the continuation of subtraction – a greater and greater subtraction. In short, the more the remaining persists, the more it is subtracted, the less the remainder gets. Persistence in remaining means to shrink more, because the act of remaining coexists with the progression of subtraction. To remain is at the same time a persistence in subtraction (hence mobilization of the vector that takes away belongings) and the continuation of the remainder in remaining less. R as the remainder reveals something *already there*, but persistence or continuation in remaining suggests insistence on what is *always* already there and can only be perpetuated through rs smaller than R. A system of cosmogenesis whose Ideals and infinities have been established prior to its building processes – as *the ones already there* – has a certain destiny with regard to the horror genre: Its horror stories are inherently concerned with decay even if they deal with other themes and dabble in other affairs.

To provide further clarification as to how the continuation of the remaining or remaining in itself is only possible in remaining less – subtractive extension and diminutive intention – the procedure of *aphairesis* can be mathematically (albeit schematically) demonstrated. Take two geometrical magnitudes A and B, where $A > B$ as the Ideal ground of the procedure and a guarantee for its continuation (iterative subtraction). The procedure starts by subtracting the greatest multiple of the smaller magnitude B (henceforth mB) from the greater multiples of the greater magnitude A: $A - mB = R$. The result of the subtraction as hitherto a conserved part is the remainder R which is less than the smaller magnitude B ($R < B$). Since the remainder R is less than the smaller magnitude B, the procedure is continued by subtracting the greatest multiple of the remainder R (henceforth nR) from the smaller magnitude B: $B - nR = r'$. The result of the subtraction is again a remainder but it is less than the previous remainder ($r' < R$). The procedure of subtraction (*aphairesis*) will continue in this way to reveal that which remains as the one already there. For this reason, the persistence in remaining or the act of remaining (to remain) – as the continual result of the subtractive operation – can only invest itself in *remaining less* and as ontological decay. The continuity of remaining and thus the revelation of the One (already there) and being qua being (being in remaining so and as such) is only attainable, and must be conducted, through diminution and decay: $R > r' > r'' > \ldots$

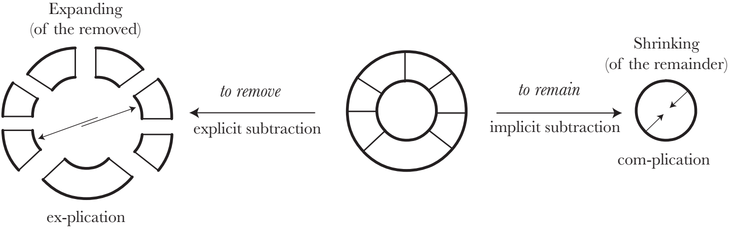
Expanding
(of the removed)
to remove
explicit subtraction
to remain
implicit subtraction
Shrinking
(of the remainder)
com-plication
ex-plication

Fig. 1. Extensive and intensive vectors of subtraction

The tenacity of the soul – as an act of the intellect upon the body – in conserving its inner parts brings life to the universe as an intelligible principle. Yet this insistence on survival or remaining introduces decay and *nigredo* into both intelligibility and vitality. The persistence of the remainder in remaining (*viz.*, to remain) is submission to the *de facto* reign of putrefaction, the universal of intelligibility and the particular of a problematical openness to the dead. For the body which is nourished by the soul, the mandatory submission of the soul to decay (*diminutio* or lessening) is in fact the mimesis of the dead by the soul. By mimicking the dead, the soul can repose intimately with the dead until it is reclaimed through reason by the intellect. But the exposition of the intellect is too contingent upon its correlation with the soul through reason which is itself aligned with decay or the intensive diminution undertaken by the soul. Accordingly, *to remain* as such is equal to intensive diminution coupled and differentially connected to extensive decay[7] – the shriveling soul whose continuity extends to the necrotized body through the worms which twist in and out of it:

> For as the Etruscans are said often to torture captives by chaining dead bodies [*nekrous*] face to face with the living, fitting part to part, so the soul seems to be *extended throughout and affixed* to all the sensitive members of the body.[8]

Mapping the vector of intensive decay or diminution, the act of remaining bridges the gap between the subtractive extension and the interiorization of no-thing or no remainder. If the soul must conserve the inner parts of itself (corresponding to the higher genera of being qua being) after coupling with the body, then it must remain itself at the same time as extending beyond itself. However, as argued above, remaining (as of the soul) is not possible except through remaining less, that is to say as intensive diminution of the remaining. Yet what is the guarantor of remaining *per se*, or to be exact, what guarantees that the remaining shrinks and becomes less? Keeping in mind that remaining in itself is *remaining less*, intensive diminution is reinforced by extensive subtraction. The answer is that only through the interiorization of nothing qua non-belonging, can remaining continue to remain, or to be precise, continue to *remain less*. Without *nothing* being interiorized diachronically within the remaining, the remaining cannot continue to become less and thus persist. This nothing qua non-belonging cannot be simply equal to the exhaustion of the remaining; nor can it be equated with the Idea of being qua being (*viz.*, the One) which sheds belongings. In other words, *nothing* as the guarantee of 'continuation in remaining' is neither the content of the exhaustion, nor can it be taken as correlated with the remaining. Interestingly, the reasons for this resistance toward correlation with what remains and what is removed lies in the premises of the act of remaining – persistence in remaining assumes two basic Ideas: diminution or shrinkage, and continuity in diminution. Not only must that which remains/survives become less, it must also maintain continuity in lessening. For this reason, the guarantor of remaining must simultaneously be the impetus of the intensive diminution and induce a continuity in remaining (in remaining less) from outside. The guarantor must be autonomous and separate from that which remains, because if correlated with that which remains, it will be indexed by exhaustion. Yet the guarantor cannot be the subject of exhaustion for if it were then it could not maintain and guarantee the lessening of the remaining, that is to say, the continuity of remaining. What is itself consumed cannot sufficiently guarantee the exhaustion of that which correlatively succeeds it.

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[7] In medieval literature and painting, the intensive and extensive vectors of decay are imagined as a shriveling body from which a cosmic range of other beings emerge. While the shriveling body which folds back upon itself visually narrates the intensive aspect of decay; worms, corpuscles and other nameless beings which come forth from the contracting body stand for the extensive vector of decay. As the inheritor of the alchemical tradition, Giordano Bruno sees the intensive decay of the shriveling body in the *caput mortuum* (death's head) or the residuum of a substance after its attributes have been extracted by distillation; while the extensive vector of decay is seen by Leibniz as worms which contain smaller worms, *ad infinitum*.

[8] Iamblichus, *Protrepticus* 8, (Leipzig, 1893), 47. 21-48.

In short, if the guarantor of remaining is correlated with the act of remaining, it will be indexed by exhaustion and thus cease to influence. Any disruption in the influence of this guarantor induces a discontinuity in the persistence in diminution, which in fact is the continuation of remaining. Moreover, the guarantor of remaining should not be sought in the extensive vector of subtraction by which belongings are taken away, because the subtracted magnitude cannot influence the fate of remaining magnitude. Therefore, not only must this guarantor evade correlation with that which remains (something), but it must also inspire the act of remaining, or in intensive terms, remaining less or diminution. Exterior to the Idea of ontology (namely remaining), the guarantor of remaining as such is *nothing* – the impossibility of being correlated either with what is removed or with what remains. To this extent, this impossibility of correlation and belongings entails both diachronicity and exteriority. The guarantor of remaining – no-thing – must be diachronic and external to the remaining, otherwise the remaining cannot maintain its continuity, whose ontological constitution is anchored by remaining less. By approximating no-thing as radical exteriority, the remaining can continue to remain and shed its belongings, that is to say, it can remain less or remain in itself. Remaining in itself is the medium of being qua being and hence the medium by which union with the intellect and the exposition (revelation) of the One is possible. But this medium only takes on its structure in so far as the remaining approximates or limitropically approaches no-thing or the impossibility of belonging in order to maintain an intensive diminution necessary for remaining less or remaining in itself. Intensive diminution is in itself synchronous only by virtue of its disjunction with a diachronic exteriority which ontologically underpins the continuity of the remaining in remaining less.

In order to remain in any instance, first of all nothing, as impossibility of belonging, must be prioritized and postulated in its exteriority. The reason for this prioritization of nothing as a non-correlatable exteriority is to satisfy the prerequisite ontological status required for effectuation of the remainder in any instance. This prerequisite status is the intensive diminution or remaining less, for the diminution of the remaining is nothing but remaining as such. In subtraction, diminution or intensive decay is at the same time a solution to the problem of remaining and the very ontological constitution of the remaining *per se*. However, this solution simply cannot work, or in other words, is not able to be correlated with its problem, unless *nothing* as radical exteriority is taken as a necessity. In order to shed belongings and remain less, the uncorrelatable primacy of non-belonging must be affirmed. In other words, *nothing* must be prioritized prior to all arrangements and establishments of the remainder.

Accordingly, something that remains, or *something* in general – as that which remains – always testifies to the binding or interiorization of nothing as priority and primacy. In the persistence of its remaining, the remainder must shed its belongings (or remain less) by affirming the primacy of nothing, for only nothing, as the impossibility of belonging, can guarantee the continuing shedding of belongings. This relation between solution and problem, secured by means of the prioritization of nothing, can be explained in Aristotelian terms as well: Chained to the body, the soul cannot bring the universe into unison with the intellect or bring about the possibility of progression toward *nous* (the problem) unless it continues to *remain* according to an inner part of itself, conserving the innermost depths of its essence (the solution). Here the solution, which pertains to remaining, cannot be correlated with the problem without submitting to the priority of nothing or – in terms of the soul – the void. The soul must submit to the priority and primacy of nothing or the void in order to solve its problem in regard to the intellect.

In short, intensive diminution or remaining less is the solution to the problem of remaining, but this solution itself must bind the priority and primacy of nothing to the fullest extent. In this sense, nothing as exteriority is interiorized to provide that which remains with the ontological constitution requisite in remaining as such – but only as a problematic bond with nothing, which, as the impossibility of belonging, cannot be relieved through being captured by correlation. If nothing qua non-belonging is uncorrelatable, then it is the embracing of *nothing* by the soul or the living that becomes the manifest problematic. In order to survive or enlighten with life, the soul must either sleep with the dead, or accede to the priority and primacy of the void as its internal guide. What could be worse for vitalism than at once being animated through a necrophilic alliance, and simultaneously, protected under the aegis of the void? It is decay that provides the bridge between the latter (the problematic embracing of nothing) and the former (the subtractive bond with the body or belonging). That which arises from death can only peacefully repose among the dead, as living.

The interiorization of nothing through which the remainder continues to remain and is subjected to ontological shrinkage by remaining in itself, deploys a subtractive vector which is implicit in remaining. This internalized or implicit subtractive vector corresponds with the persistence of the remainder, or more precisely, it coincides with the survival of the remainder in its resistance to the explicit subtractive vector through which belongings are exteriorized. The medium of survival and its constitution are thus, problematically, the implicit apparatus of death. It is in this sense that the persistence of that which remains – the innermost depth of the soul, the intellect or the One – is ultimately indeterminable; for it is not only determined by the exteriorization of belongings but also by that *nothing* to which it must implicitly submit in order to remain (less). Once the intellect, as the highest genus of being qua being, is deprived of its determinability, reason, in its mission to redeem the world on behalf of the intellect, reclaims the world for a problematic death qua life instead.

As for Plotinus' metaphysics, the horror of abstraction (*aphairesis*) is akin to the horror implicit in the Idea of ontology or remaining as such: the apogee of the One is undermined by another culmination which emphatically precedes it, yet cannot be chronically culminated. The search for the Ideal turns out to be a *sub rosa* search for the problematic on behalf of nothing, conducted all along through the bottom-up chemistry and differential dynamics of decay and putrefaction. As we shall see, the guarantor of any Idea of persistence, regardless of its Ideal or telos, is *nothing*. Remaining might be a solution in regard to finding a medium through which the Ideal can be explained, but such a solution brings with it the problems inherent to the clandestine alliance with nothing. Persistence under any subtractive condition is definitely a fitting solution for the revelation of the One and the effectuation of being qua being, but this solution was already infested with problems which do not belong here. Our survival or continuation in remaining is indeed a vitalistic solution, but it is not an authentic or genuine one, for it inherently transmits an entirely alien set of problems to which it can neither correlate nor belong. Survival, in this sense, is the remobilization of problems whose nature is radically detrimental to our solutions.

In contrast to the exteriorization of belongings, the exteriority of nothing in its primacy is internalized in order that the remainder might remain and survive. Remaining is a trajectory whose *continuity* is described by the removal of its attributes and belongings, but whose *continuation* is guaranteed only by its diminution and decay. To stave off the realism of the dead which follows from its coupling with the body, the soul disguises its putrefaction as survival; that is to say, reformulates the problem of decay according to new correlations with its own Ideals and reasons. However, in distracting the dead, the soul is exposed to problems whose concerns belong neither to the living nor to the dead. *Katabasis,*[9] or the descent of the soul, is not radical enough, for it conveys the profit-seeking openness of the soul to the body as an instrument, an *economical* openness based on mutual affordability. Yet it is exactly this conservationist affordance of the soul-body composite that causes the soul to be cracked open by nothing from within. The first descent of the soul is only a twist that opens the soul on to an ultimate *katabasis* where the soul is directly – albeit problematically – fettered to nothing, kept alive to rot away in and for itself. It is here that Aristotle's analogy of the relation between body and the soul with the tribulation imposed by the Etruscan pirates proves to be, if not wrong, then problematic; for it sincerely suggests the necrotization of the soul by the body only to divert attention from a second necrosis, blacker than the first.

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[9] In Greco-Roman ritualistic tradition, *katabasis* refers to a journey which is characterized by descent (usually to the underworld). *Katabasis* is a depthwise and pro-ground (*profundus*) movement; for that reason, in scholastic alchemy, it is often associated with *nigredo* or depthwise and intensive decay.

The soul is necrotized in its mission to govern the universe and vitalize matter according to the intellect. In full conformity with its vitalistic intention, the soul assumes an intimacy with nothing: it is invaded by *nothing* from behind (*a tergo*). The second necrosis of the soul – shrouded in the explicit cruelty of the first – is its unbreakable and wilful bond contracted with nothing in order to remain, a tie fully based on reason. It is only in the second necrosis that the climax of the Etruscan torture finds its proper narrative. The fastening of the living to the dead is a culmination from the perspective of a collective gathering, but surely of minor interest when we know that the living, the soul, is itself rotting. The real climax of the Etruscan torture, for this reason, is the *feeding* of the living while strapped to the dead. It is only this second necrosis that fully suggests the culmination of the Etruscan torture: while tethered to nothing, the soul qua remainder continues to live, as its continuation in remaining (less) is guaranteed by the primacy and priority of nothing. Bound to nothing, the remainder effectuates the act of remaining in the form of diminution and decay whilst fastened to nothing as a constitutional primacy. The two necroses of the soul, to this extent, can be categorized, as regards of their extensive and intensive development (*-plication*) in metaphysical cruelty and nigrescent *katabasis*, as *explicit* and *implicit* necroses of the soul. The former – the explicit necrosis of the soul – is the coupling with the body qua *cadavera* in order for the soul to extend beyond itself by means of subtracted or necrotized belonging (the body). The latter – the implicit necrosis of the soul – is entailed by the internalization of nothing in its primacy in order to shed belongings and remain in itself. The two necroses of the soul upon which the universe and intellect are fixed bring about the possibility of ontology as a great chain of corpses whose arrangement is determined by their explicit and implicit indulgence in necrophilia. Aristotle fully exposes the first necrosis only to exploit its explicit drama to conceal the second.

THE IDEA AND THE WORMS

The subtractive correlation between vitalism and matter, we argued, is accomplished by means of explicit necrosis, or the soul-body composite according to Aristotle's system. Yet the explicit necrosis is linked to an implicit necrosis whose necessity is fully supported and affirmed by reason. For the sake of clarity, we shall delineate the nature of the second necrosis before moving forward: The subtractive correlation between matter and vitalism is intensively conducted through a medium which constitutes the very Idea of ontology – that is, of remaining so and as such. Yet remaining as remaining less – diminution or intensive decay – requires a guarantee whereby it can be perpetuated or at least made possible in both its lessening and its continuity.

While this guarantor cannot be included by the extensive and intensive vectors of subtraction, it can be problematically posited in such a way that the remaining can maintain its diminution and continuity by approaching it as a limit process. This guarantor is the impossibility of belonging or the disjunctive nothing which, once presupposed by the remainder, can impose the continuous shedding of belongings. Recall that the shedding of belongings is registered extensively as the subtractive extension or exteriorization of belongings, and intensively as remaining, or more accurately, remaining less. In a similar vein, Plotinus' procedure of *aphairesis* or abstraction exposes the One through remaining as an ontological medium, but in doing so it exerts the imposition of nothing or no-one. It is in this sense that for both Aristotle and Plotinus, the medium of revelation for the Ideal (that which continues to remain under any subtractive magnitude) is diminution and intensive decay. Yet this is not the only twist inherent to the problem of exposing or explaining the Ideal. The second – implicit – necrosis brings a far more convoluted twist to the assumed correlations between the Ideal, the problem and the solution.

We argued that both the intellect and the One as the Ideal posit problems in regard to their ontological status (being qua being) as related to the universe or beings. Speaking somewhat reductively, part of the problem posited by the intellect regards channelling the progression of the universe into unison according to reason. Likewise, the problem posed by the One is the exposition of the One as the Ideal of being qua being – that is to say, the exposition of the One as that which is indifferent to, or even resists, the subtractive mobilization of belongings. The solution lies in the establishment of an ontological medium which not only reinforces subtraction but also remains in itself and according to the Ideal. In other words, to settle the problem of exposing Ideals, the solution must abide by the ontological status of 'the Ideal as that which withstands any subtractive magnitude'. For this reason, the solution must be correlated both to subtraction and to the ontological medium of the Ideal. Although correlated to subtraction from one side, the ontological intension of the solution must only correspond to that of the Ideal. Otherwise it undoes the problem by dispossessing it of its assumed ground.

Now, if the ontological intention of the Ideal is indifferent to subtraction, then in order to explain the Ideal, the solution must expose the continuity of the Ideal in remaining, or more accurately, the intractability of the Ideal in regard to subtraction. Accordingly, then, remaining in itself – or in other words, *remaining as such* – constitutes the solution. However, as argued, in order to expose the Ideal, *remaining as such* must correspond to the act of remaining less, which is impossible without the intervention of nothing. Therefore, the solution (*viz.*, remaining as an ontological medium) radically betrays the Ideal because, firstly, it submits to the priority and the primacy of nothing; and secondly, it internalizes the disjunctive exteriority of nothing in order to realize and authenticate itself. To this extent, if the Ideal is to be explained (the problem), the solution must essentially be posed on behalf of *nothing* because only through remaining less, or more exactly, decay (the solution), can the Ideal, the problem and the solution encompass each other as Idea. As the medium cementing the Idea in its most concrete – albeit volatile – form, decay or remaining (less) entails *nothing* on both planes of exteriority and interiority because through the intervention of nothing, the true Idea of remaining can be underpinned in its continuity, diminution and being. The Idea of something as that which remains or survives subtraction even transiently points to the essentially duplicitous nature of this intervention. The intervention or imposition of nothing in its priority and primacy ensures the act of remaining and persistence of something, but at the same time this vitalistic triumph takes place by remaining less or approximating nothing. To put it differently, the imposition of nothing imparts an inherently duplicitous nature to the Idea of ontology: remaining is at the same time a vitalistic persistence and an intensive decay on the part of a problematic intimacy with nothing. Decay conveys this duplicity in the most subtle manner where the Idea of *remaining per se* becomes that of *remaining less* and the Idea of ontology as such coincides with the second necrosis.

Correlated to this double-dealing solution, not only is the problem betrayed, but also the Ideal is undermined by virtue of its correlation with the problem. Rather than securing the Ideal as ground, the correlation between the solution (i.e. remaining) and the problem (i.e. explaining the Ideal) perforates and ungrounds the Ideal with nothing. If the correlation between solution and problem is built upon a double-betrayal and the duplicity of solution, then such correlation twists itself out of its assumed intension rather than terminating it – That is, given that this assumed intention is either that of exposing the Ideal or that of effectuating the Idea of *something* (anything) through remaining. The Idea of correlation – that is, the correlation between solution and problem – does not need to be terminated so that *nothing* can be imposed. On the contrary, the correlation *per se* is what is fundamentally needed to bring about the imposition of nothing as the exposition of the problematic. By problematic we mean the submission to the priority of nothing in order to effectuate the Idea of something or the short-circuiting of ontological intention with the intervention of nothing in order to bring about the possibility of ontology. In pursuing the ontological intension of the Ideal, the correlation between the solution and the problem traffics and imposes the intention of nothing as the implicit constitutional necessity and the radical exterior of the Ideal and its intention. Correlation, in this sense, is equal to the very Idea of twist (*flectere*), for which inflection (pursuing the intension of correlativity) is already a deflection (inviting that which is radically exterior to that intention). In twisting into something, the correlation between solution and problem, twists into nothing; and in twisting into nothing such correlation twists back into something. Only through these twists in and out can the Idea of something be resonant. The correlation between solution and problem is effectuated as intensive decay or depthwise putrefaction (*nigredo*), but it is the twist of correlation that makes for the peculiarly vermicular sinuosity of implicit putrefaction, the second necrosis. If the explicit necrosis, the coupling of the soul with the body is differentially consummated by worms' bridging of the dead and the supposedly living, the second necrosis or the tie between the soul and the intellect is vermicularly completed by the correlation as twist.

By adhering to *remaining so and as such* as a fitting ontological medium, the One submits to the intension of that which bores through it. Once the Idea of correlation is established, it refracts toward the problematic and is adopted by the Idea of twist. As what necessitates the intervention of nothing, the correlation between solution and problem renders the fate of *being something* entirely problematic. At the same time it makes the destinies of the Ideal, the problem and the solution indeterminable in themselves by factoring in the exteriority of nothing as another determinant to which they have no access and over which they have no influence. Given that the destiny of the Ideal is to survive at all costs, the destiny of the problem is to expose the Ideal and the destiny of the solution is to locate (*chorizein*) an ontological medium that encompasses the problem, the Ideal and the solution. In this regard, correlation-as-twist is also twist-as-destiny (*wyrd*). If the Ideal anticipates the correlation between the solution and the problem, then twist as correlation can also operate under the aegis of the Ideal. Corresponding to the explicit and implicit necroses of the soul and the Etruscan metaphysical cruelty, correlation as twist also operates through two concurrent waves of distortion. The explicit twist of correlation is the Idea of ontology that is generated under the aegis of nothing qua non-belonging or disjunctive exteriority. The implicit twist – more insidious than the first – is the problematic intervention of nothing under the shroud of the ontological medium or the reign of the Ideal. In this sense, the Ideal becomes a necessary excuse to transmit the intention of nothing in the form of the problematic. Whether on the side of the Idea of ontology or that of nothing, the problematic as twist becomes more intricate as each side maintains its position by conforming to the reason that either bilaterally or unilaterally supports it. As the problematic intertwines with reason, it unleashes the problematizing powers inherent to reason as a double-dealer. Once reason and the problematic copulate, the Idea of reason comes forth as that through which nothing can reside outside the pandemonium of the problematic either in supporting itself or the other.

What is at stake here is not reason as glorified tool of disclosure or sponsor of quixotic ventures toward the intellect, but rather the chameleon nature of reason unmasked by the problematic. Bound to the problematic, the animation of reason spawns writhing coils, convolutions, bends and ogees – worms, ratios of putrefaction.

The Idea of survival or the persistence of the remaining characterises the problematic both as the Idea of perforation between the problem and the Ideal, and as the twist between solution and problem. The Ideas of perforation and twist are inherent to the machinery of putrefaction and decay for which remaining less is persistence in remaining, which in turn is insistence upon nothing in the form of the problematic. Only through diminution or intensive decay, which binds survival to the problematic, can the remaining be posited as the solution to the problem of exposing Ideals. Nothing inside the Idea or encompassed by it, can invest itself outside of decay; putrefaction becomes the generative medium of the Idea. In order to be revealed or effectuated, the Ideal must not only remain in itself but must also be bound to decay. The revelation of any truth whatsoever is conducted through decay; but decay is the radically problematic – the Idea. In its intensive and implicit form, decay is problematic intimacy with nothing qua non-belonging; it is the intensive movement of the Idea according to its ontological medium and intention. The Idea of persistence in remaining or persistence in general immanently points to decay as the solution where the continuity of remaining is sponsored by nothing; thereby, the problematic imposes itself regardless of the objective of the ontological medium and its vitalistic impetus. Whether the act of remaining is bound to the intention of the Idea, the Ideal, the problem or the solution, the problematic is enacted. In short, regardless of what shrinkage through remaining entails, the Idea of remaining as such always envelops an encounter with nothing under the heading of the problematic.

MEZENTIUSIAL METAPHYSICS

> The fact is that every living thing among us suffers the torment of Mezentius - that the living perish in the embrace of the dead: and although the vital nature enjoys itself and runs things for a while, the influence of parts nevertheless gets the upper hand not long afterwards, and does so according to the nature of the substance and not at all to the nature of the living one.[10]

The vitalizing forces of the soul move in the direction of two necroses, vectorially opposite but functionally synergistic and collusive. The soul is a bicephalous necrosis. The extensive deployment of the soul through the body is equal to the synthesis of the Idea with that which does not belong to it, while the intensive employment of the soul in itself and according to the intellect is the necessary intention of the Idea. More succinctly, the coupling of the soul with the body is the outward and extensive activity of the Idea and the soul in itself as the activity of the intellect is the inward or intensive activity of the Idea. The outward activity of the Idea is marked by contingency, yet its inward activity is defined by necessity. Only through the two necroses can the necessary and contingent activities of the soul or the Idea be correlated to each other. In the same way, the creativity of the Idea, as correlation between its contingent / extensive and necessary / intensive activities, is only possible through the two necroses. The first necrosis couples the Idea (X) with that which does not belong to it (not-X) in order to extend it beyond itself; it is caused by the profit-seeking or economical openness of X to not-X. The second necrosis, the persistence of the Idea or the progress in the direction of proper perfection by virtue of imposing the primacy and priority of nothing; it is entailed by the survival of X or the possibility of the Idea in its temporal continuation. The Idea in its creativity is the distance between survival and openness. By openness we mean the extensive deployment of the Idea according to that which does not belong to it; by survival, the intensive employment of the Idea according to its ontological medium or its proper objective. Whilst establishing continuity between openness and survival, this distance also posits a subtractive correlation between them.

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[10] Francis Bacon, *De Vijs Mortis*, VI 357.

By virtue of this distance, openness and survival, the first and the second necroses negatively reinforce and contribute to each other. Through this distance or subtractive space, investment in openness contributes to survival or remaining which, simultaneously, coincides with diminution (remaining less) and closure (remaining in itself). Conversely, the immersion in survival is a contribution to openness, yet it is openness in terms of that which does not belong to the Idea (not-X) or is not the subject of its survival. Creativity is therefore the *art of ratios*[11] between openness and survival, or to be exact, between the first and second necroses. The subtractive space or the distance between openness and survival maintains the Idea between two necroses; but even the two necroses have to encompass this space to reinforce each other. The subtractive space between openness to the body and remaining according to the intellect is defined as the *third necrosis*; for it is the space where only death can enter and death is the only outcome.

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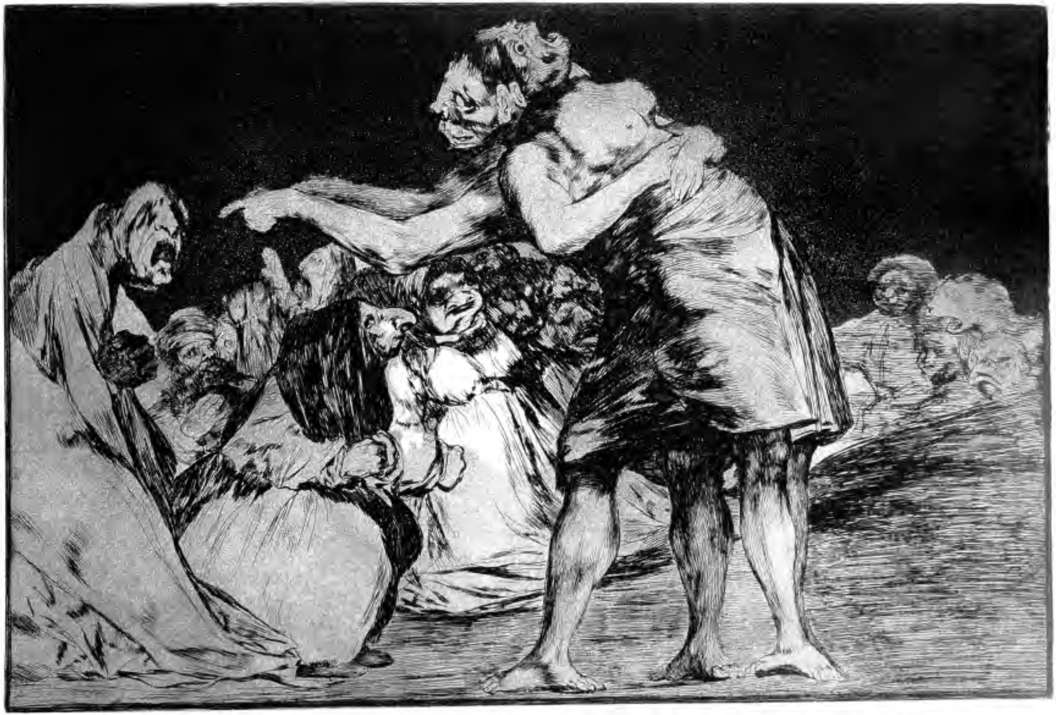
[11] Here, the word 'art' is employed in its Lullian connotation.

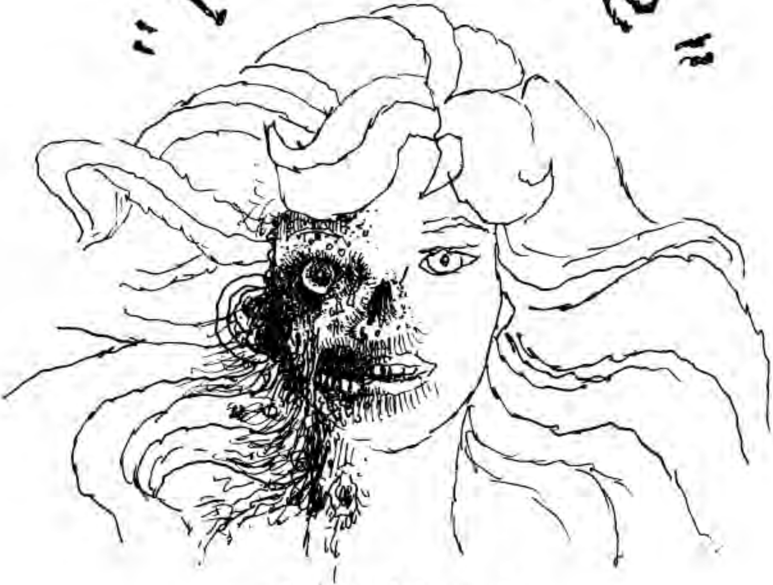
The third necrosis of the soul or the Idea simultaneously binds and unbinds the first and the second necroses; it is the effectuation of correlation as subtraction or the impossibility of addition. The third necrosis is the *vinculum of doom*, the bond through which every contribution, every investment and every impetus is subtractively – and not additively – engendered. Change through subtraction, or the mobilization of extensive and intensive vectors in regard to each other, is the very Idea of decay.

In its gradation (step-by-step movement) between the body, the soul and the intellect, reason aligns with three necroses; the truth it confirms is predominantly determined by the ternary logic of three deaths. More gravely, with regard to the connection between reason and truth, whatever necrosis reason invokes, the two other necroses will join the gathering. One should not forget that the three necroses of the soul are firmly fastened to each other in the same way that the three necroses of the Idea are subtractively tied together. Accordingly, for reason, there is always a crowd of deaths. The movement of reason is the enumeration or counting of these deaths. The first, second and third necroses, at poles and their in-between: 'It is strange', Reason shrugs; 'all roads lead to the bosom of the dead.'

Fig. 2 (Facing Page): Goya's *Disparates* plate no. 7, The 'Matrimonial' – or, according to a trial proof, 'Disordered' – Disparate (folly, nightmare) introduces a curious adaptation of Andrea Alciato's emblem regarding marriage by force to a corpse or a man seared with syphilitic scabs. In Goya's depiction, the coupling of the living with a putrid corpse is already a fiendish redundancy, for the supposed living cannot come into being other than by being fixed upon a phantom rotting double. When the implicit necrosis of the living is extended to the explicit necrosis of the dead, it begets a nonhuman deformity, a quadrupedal necrosis each of whose four legs – now two – have already been amalgamated by putrefaction.



"I Can See"

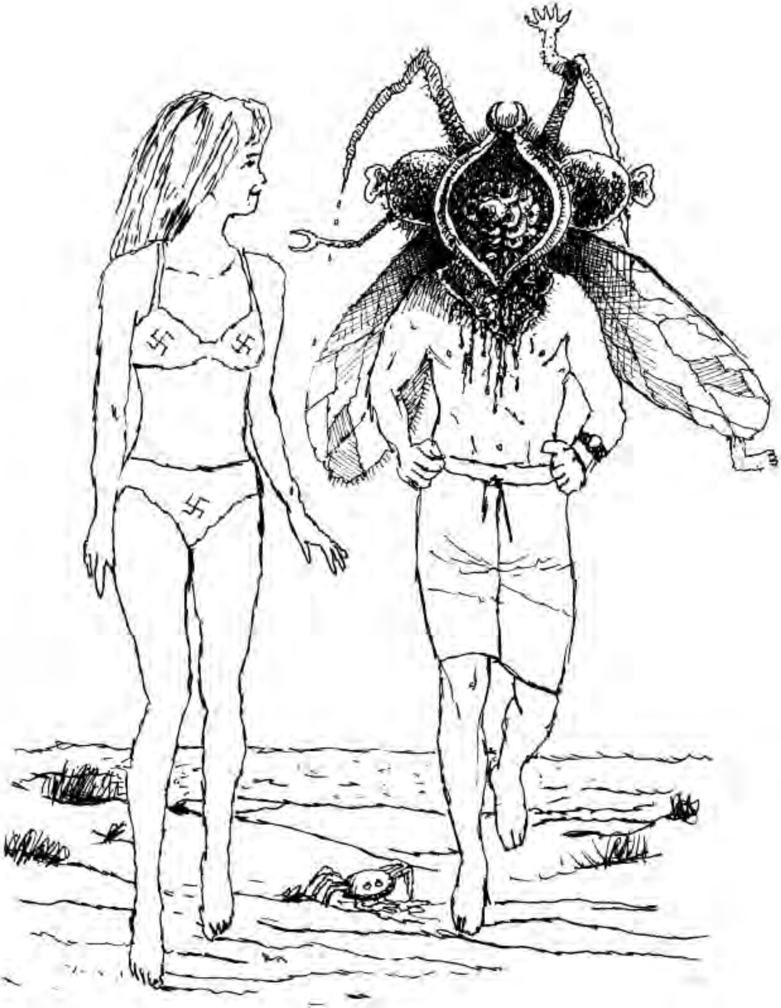


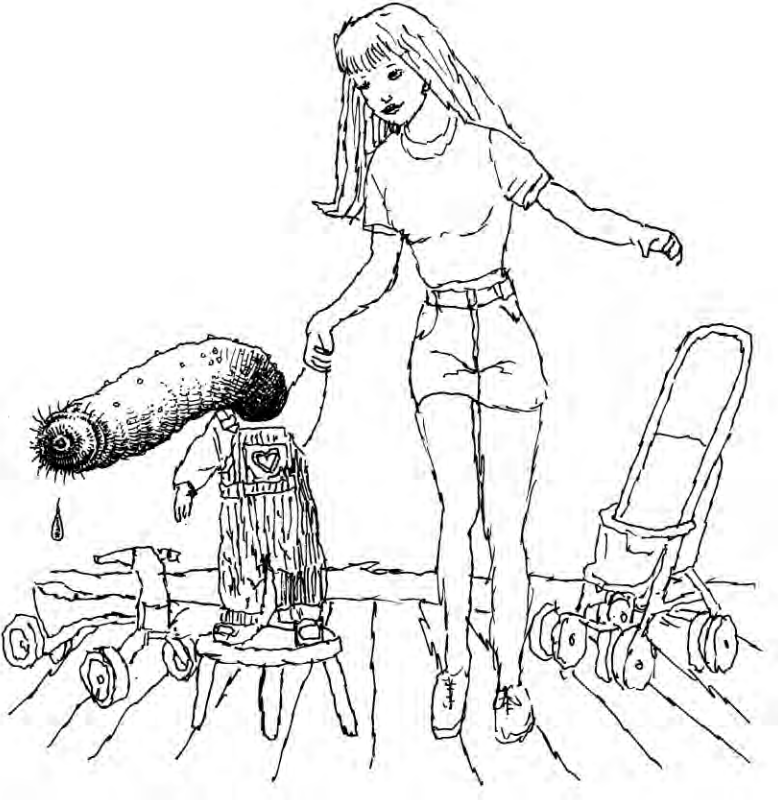
A children's coloring book about eye care

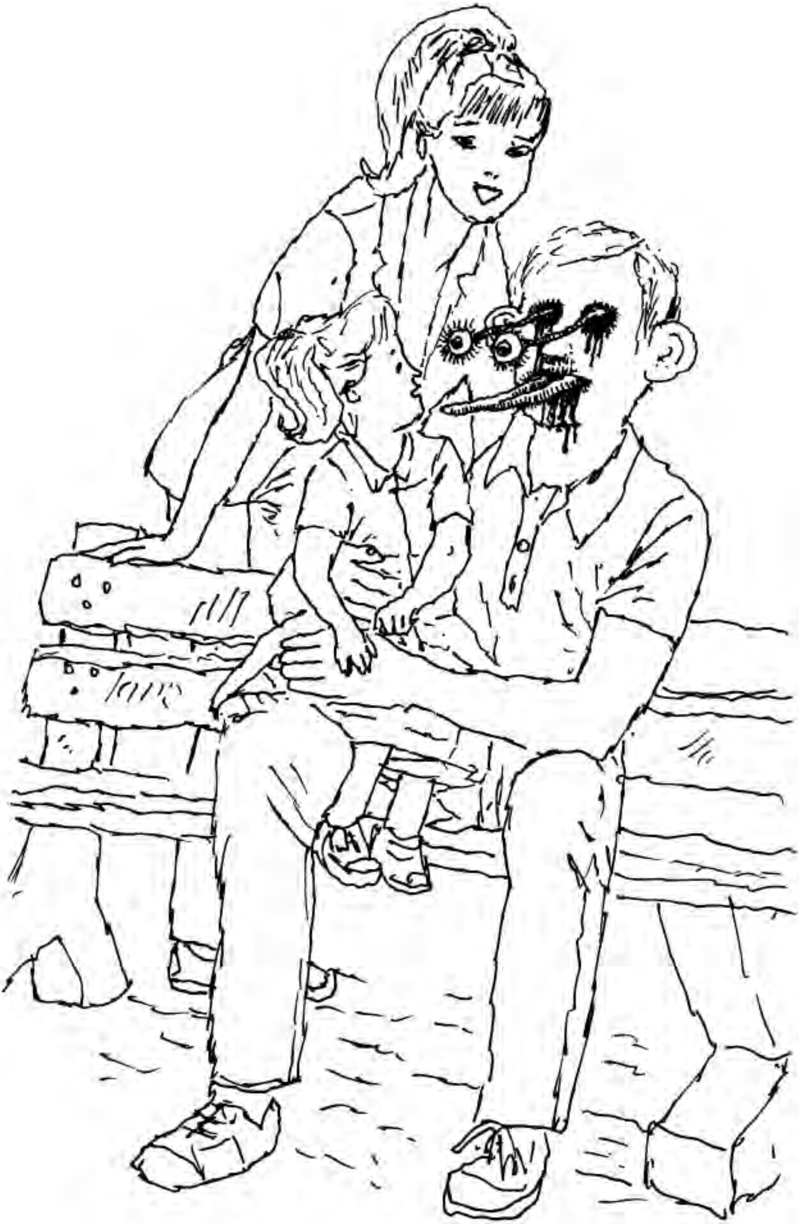
I Can See

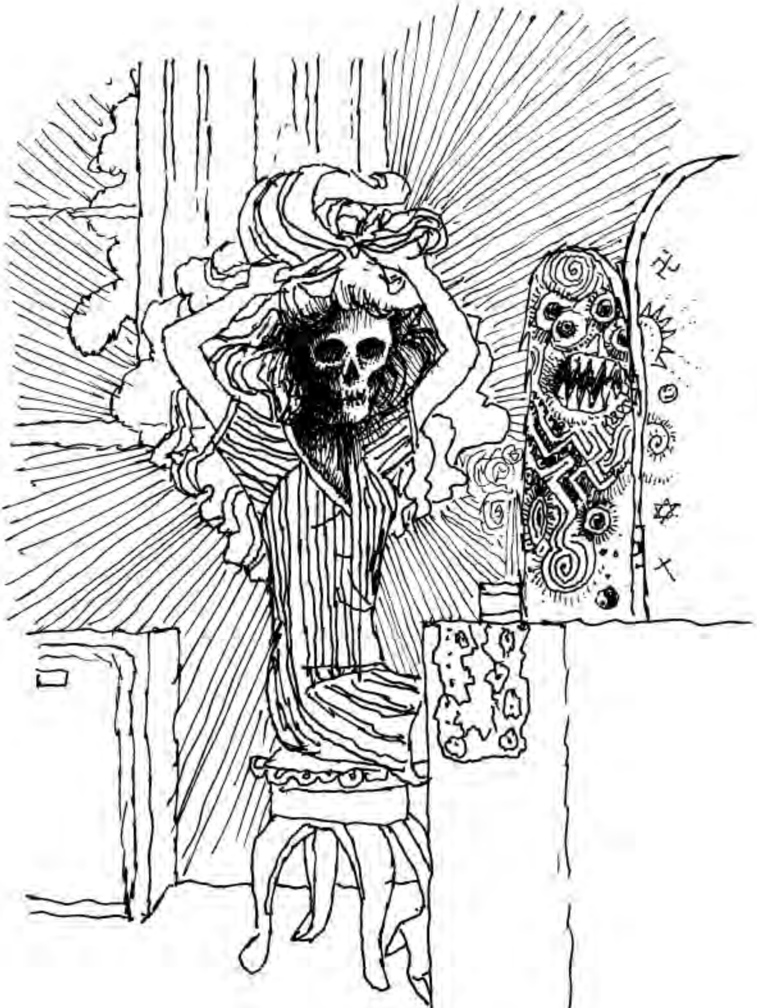
Jake and Dinos Chapman

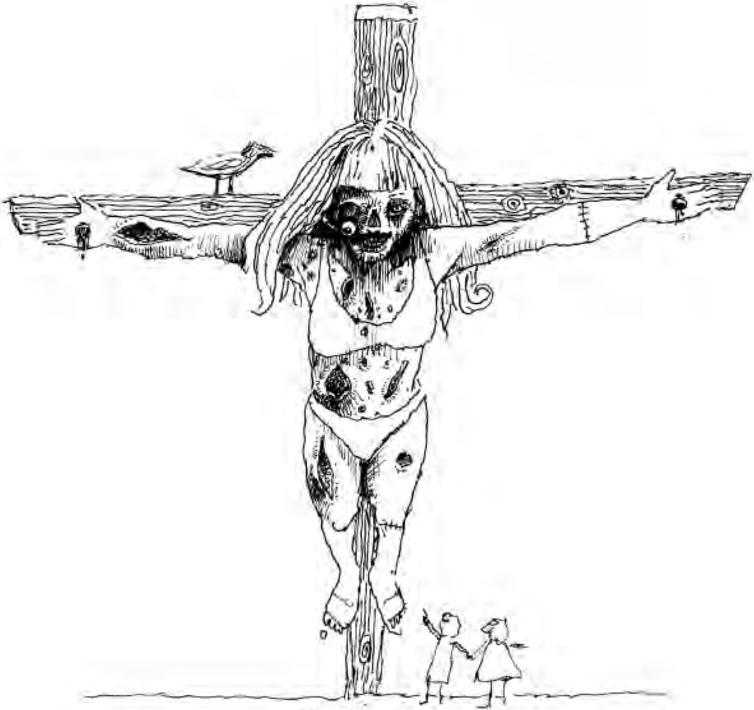
Pen and ink drawings, 2008.











Barbie

Poems[1]

Michel Houellebecq

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[1] Selected from *Le sens du combat* (Paris: Flammarion, 1996) and *La Poursuite du Bonheur* (Paris: Flammarion, 1997).

A LIFE, SMALL

I felt old very soon after my birth;
Others struggled, desired, sighed;
I felt within myself only a vague regret.
I never had anything resembling a childhood.

Deep in some woods, on a carpet of moss,
Foetid tree trunks survive their leaves;
Around them develops an atmosphere of mourning;
Their skin filthy and black, mushrooms pushing through it.

I have never been any use for anything or to anyone;
A shame – one lives badly when one lives only for oneself.
The slightest movement constitutes a problem,
One feels unhappy and yet generic.

One is obscurely driven, like an animalcule;
Reduced almost to nothing, and yet how one suffers!
Carrying along a sort of void
Portable and petty, vaguely ridiculous.

One no longer sees death as a tragic event;
Mostly on principle, from time to time, one laughs;
One tries vainly to accede to contempt.
Then we accept all, and death does the rest.

I love those hospitals, asylums of suffering
Where the elderly, forgotten, slowly turn into organs
Beneath the gazes, mocking and full of indifference
Of junior doctors who scratch themselves, eating bananas.

In their hygienic but nonetheless sordid rooms
You can easily divine the nothingness that stalks them
Especially when, in the morning, they sit up, livid,
And plead with a whine for their first cigarette.

The old know how to weep with a minimum of sound,
They forget thoughts and they forget gestures
They no longer laugh much, and all that remains of them
At the end of a few months, before the final phase,

Are a few phrases, almost always the same:
Thank you I am not hungry my son is coming on Sunday.
I can feel my intestines, my son will come all the same.
And the son is not there, and their hands almost white.

So many hearts have beaten, already, upon this earth
And the little objects curled up in their cupboards
Recount the sinister and lamentable story
Of those who had no love upon this earth.

The crockery of old bachelors,
The tarnished cutlery of the war-widow
My god! And the handkerchiefs of old spinsters
The insides of cupboards, how cruel life is!

The objects all arranged and life all empty
And the evening meals, the grocers' leftovers
TV unwatched, repast without appetite.

Finally illness, making everything more sordid,
And the tired body that mingles with the earth,
The never-loved body that fades away without mystery.

At the age of seventeen, my sister was very ugly,
In eighth grade they called her double-fatty.
One November morning she jumped in the lake;
But they fished her out; the water was yellow and troubled.

Curled up under the bedspread like an great obese rat,
She dreamt of a serene and barely-conscious life
With no social relations and no hope of a screw,
But tranquil, so gentle, almost evanescent.

The next morning she perceived forms,
Light and fleeting, on the wall to her right.
She said stay with me, I must not sleep;
I see a great Jesus, in the distance, he's limping.

She said I'm a little scared, but it couldn't be any worse.
Do you think he'll come back? I'll put on a blouse.
I can see little houses, there's a whole village;
It's so lovely, down there. Is it going to hurt?

COLLAPSE IV

Death is so difficult for old ladies who are too rich
Surrounded by daughters-in-law who call her “sweetie”,
Pressing a silken handkerchief to their magnificent eyes,
Evaluating the paintings and the antique furniture.

I prefer the death of those old people in the tower-blocks
Who still imagine right to the end that they are loved,
Awaiting the arrival of hypothetical sons
Who will pay for a coffin in real fir.

The old, too-rich ladies end up in the cemetery,
Surrounded by cypresses and plastic shrubs
A nice promenade for sexagenarians,
The cypresses smell good and keep away the mosquitoes.

The old people in the tower-blocks end up at the crematorium,
In a little case with a white label.
The building is calm; no-one, even on Sundays,
Disturbs the sleep of the very old black janitor.

Where is my subtle body? I feel the night coming on,
Pricked with needles and electric shocks
Noises come from far away into a confined space:
The rumbling city, anecdotal machine.

Tomorrow I'll go out, I'll leave my room,
I'll walk, worn-out, on a dead boulevard,
Summer women, their bodies that arch and curve
Will be renewed amidst fastidious decor.

Tomorrow there will be *salades auvergnates*
In bustling cafés where managers chew;
Today is Sunday. May the splendour of God reign!
I just bought myself a rubber doll.

And I see bloody stars flying
I see punctured eyes sliding across the walls;
Mary, mother of God, protect my child!
The night clambers onto me like an unclean beast.

At the corner of FNAC a crowd simmers
Very dense and very cruel
A huge dog chews the body of a white pigeon.
Further away, in the alley,
An old homeless woman curled up into a ball
Is spat on by kids without speaking a word.

I was alone, rue de Rennes. Electric signs
Directed me along vaguely erotic paths.
Hi it's Amandine.
I felt nothing in my prick.
A few yobs passed a menacing gaze
Over the rich girls and the salacious shows.
The managers consume. It is their only function.
And you were not there. I love you, Véronique.

NATURE

I have no time for those pompous imbeciles
Who go into ecstasies before bunnies' burrows
Because nature is ugly, tedious and hostile;
It has no message to transmit to humans.

How pleasant, at the wheel of a powerful Mercedes,
To drive through solitary and grandiose places;
Subtly manipulating the gearstick.
You dominate the hills, the rivers, and all things.

The forests, so close, glitter in the sun
And seem to reflect ancient knowledges;
In the depths of their valleys must lie such marvels,
After a few hours you are taken in;

Leaving the car, the irritations begin;
You stumble into the middle of a repugnant mess,
An abject universe, deprived of all meaning
Made of stones and brambles, flies and snakes.

You miss the parking-lots and the smell of petrol,
The serene, gentle glint of the nickel counters;
It's too late. It's too cold. The night begins.
The forest enfolds you in its cruel dream.

HYPERMARKET – NOVEMBER

Firstly I stumbled into a freezer
I started to cry and I felt a little afraid.
Someone grumbled that I was spoiling the atmosphere;
To retain an air of normality I carried on.

Commuters, drained, with brutal gaze
Walked up and down slowly near the mineral water,
A rumour of the circus and of semi-vice
Mounted from the shelves. My gait was clumsy.

I collapsed at the cheese counter;
There were two old ladies carrying sardines.
The first turned and said to her neighbour:
“It’s really sad, though, a boy of that age.”

And then I saw very broad, circumspect feet;
There was a salesman who took measurements.
Many seemed surprised by my new shoes;
For the last time I was a little on the margins.

END OF THE EVENING

At the end of the evening, the rise of despair is an inevitable phenomenon. There is a kind of timetable of horror. Well, I don't know; I think so.

The expansion of the internal void. That's what it is. A taking-flight of every possible event. As if you were suspended in the void, equidistant from every real action, by monstrously powerful magnetic forces.

Thus suspended, incapable of any concrete grip on the world, the night can seem so long to you. And, indeed, it will be.

It will be, however, a protected night; but you will not appreciate this protection. You will only appreciate it later, once you return to the city, once you return to the day, once you return to the world.

Around nine'o'clock, the world will already have attained its full level of activity. It will turn smoothly, with a gentle whirring. You will have to take part in it, to jump in – a little as if one jumped onto the footplate of a shuddering train ready to leave the station.

You don't make it. Once more, you await the night – which, however, once more, will bring you exhaustion, uncertainty and horror.

And this will happen again, every day, until the end of the world.

The Shadow of a Puppet Dance: Metzinger, Ligotti and the Illusion of Selfhood

James Trafford

There are no people, nothing at all like that.
Thomas Ligotti

No such things as selves exist in the world:
Nobody ever was *or* had *a self.*
Thomas Metzinger

I. BEING NO-ONE

In his *Being No-One*,[1] Thomas Metzinger sets out a radical challenge to any philosophical defence of the status of subjective self-consciousness against the incursions of reductive neuroscience. Deploying all the resources of a nascent science of consciousness, Metzinger proposes at a stroke to eliminate selves from the ontological horizon and to destroy our most cherished 'originary' intuitions about 'ourselves' and our place in the world. Such intuitions furnish the precondition for the phenomenological description of the world that distinguishes between natural, manifest appearances and the supervening artifices of theoretical knowledge. By staking out a supposedly 'unobjectifiable' domain of subjectivity, philosophy has sought to maintain its distance from the coruscating potency of neuroscience. Husserl's so-called 'principle of all principles' provides perhaps the most radical expression of this kind of philosophical presupposition: 'that every originary, presentive intuition is a legitimising source of cognition, that everything originarily offered to us in "intuition" is to be accepted simply as what it is presented as being, but also only within the limits in which it is presented'.[2] But it is precisely the legitimacy of such 'pre-theoretical' intuitions that Metzinger problematises, on the grounds that even appearances themselves are never immediately 'manifest' to the conscious subject who experiences them. Working across several levels of explanation, Metzinger is not only able to draw out a tractable science of consciousness, but to expose consciousness' 'naive realism' about its own states.

Despite formidable technical complexity, the upshot of Metzinger's analyses could not be more clear: 'no such things as selves exist in the world: Nobody ever *was* or *had* a self'.[3] Consequently, 'consciousness is *only* appearance'.[4]

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[1] T. Metzinger, *Being No One: The Self-Model Theory of Subjectivity* (London: MIT Press, 2004).

[2] E. Husserl, *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy, First Book: General Introduction to a Pure Phenomenology*, trans. F. Kersten. (The Hague: Martinus Nijhoff, 1982), 44. This is concurrent with Husserl's call to get 'back to the things themselves, questioning them in their self-givenness, and laying aside all prejudices alien to them.' (Husserl, *Ideas* I section 19)

[3] Metzinger, *Being No One*, 1.

[4] T. Metzinger, 'Appearance is Not Knowledge: The Incoherent Strawman, Content-

According to Metzinger, organisms are not selves; rather, they possess 'self-models' which cannot be recognised by the system that employs them. All that exist are specific information processing systems engaged in self-modelling, but whose models cannot be correlated with any ostensibly 'real' items in the world. Metzinger thereby eliminates substantive subjectivity in favour not of reduction as such, but of tractable explanation. Rather than reducing the self, he uses the scientific resources at his command to produce a functional model of what 'selves' must be: 'The phenomenal self is not a thing, but a process – and the subjective experience of *being someone* emerges if a conscious information processing system operates under a transparent self-model.'[5]

Expanding upon Wilfred Sellar's attack on the 'Myth of the Given' – 'the idea that some of our beliefs or claims have a privileged epistemic status because the facts that make them true are "given" to us by experience'[6] – Metzinger claims that our folk-philosophical intuitions are a direct result of the bounds of our cognition, as expressed in the limitations of our phenomenal state-space. He illustrates this with a naturalist substantiation of Plato's allegory of the cave, predicated on the argument that 'our phenomenal model of reality is an internal model of reality that could, at any time, in principle, turn out to be quite far removed from a much more high-dimensional physical reality

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Content Confusions and Mindless Conscious Subjects', *Journal of Consciousness Studies* 11:1 (2004), 67-71.

[5] T. Metzinger, 'Response to "A Self Worth Having": A Talk With Nicholas Humphrey', at http://www.edge.org/discourse/self.html#metzinger (2003).

[6] S. Stich, *Deconstructing the Mind* (Oxford: Oxford University Press, 1996), 118.

than we have ever thought of'.[7] The 'cave' is the physical organism; the shadows, a 'low-dimensional projection of a higher dimensional object'; the fire is neural dynamics, i.e. the 'self-regulating flow of neural information processing'; the wall is the space of phenomenology, though the wall and fire are not separate entities. In sum, '[t]he cave in which we live our conscious life is formed by our global, phenomenal model of reality.'[8] In line with some of the bolder suggestions proposed by contemporary physicists,[9] then, Metzinger's analogy proposes that phenomenological perception may well be imprisoned within a virtual model, in which an experienced object is merely a 'low-dimensional shadow of the actual physical object in your hands, a dancing shadow in your central nervous system'.[10] The crucial and far-reaching difference from Plato's cave, however, is that this illusion is, quite literally, *no-one's* illusion: 'there is no-one *in* the cave [...] The cave shadow is there. The cave itself is empty.'[11]

In the following, we will use speculative theses implied by Thomas Ligotti's suffocating, hallucinogenic horror[12] to draw out some of the ramifications of Metzinger's theses. Our fundamental contention is that, just as the expropriation of subjectivity which is the fundamental theme of Ligotti's fiction finds an unexpected realist basis in Metzinger's philosophical naturalism, so, conversely, Ligotti's own metaphysical 'irrealism' affords resources through which the 'unimaginable' consequences of Metzinger's naturalistic 'nemocentrism' can be brought into speculative focus.[13]

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[7] Metzinger, *Being No One*, 548.

[8] Ibid., 546.

[9] See, for example, the postulation of extra dimensions of space-time in superstring theory, about which physicist Brian Greene writes that: 'the discovery of extra dimensions would show that the entirety of human experience had left us completely unaware of a basic and essential aspect of the universe. It would forcefully argue that even those features of the cosmos that we have thought to be readily accessible to human senses need not be' (B. Greene, *The Elegant Universe: Space, Time and the Texture of Reality* (London: Penguin Science, 2005), 19.

[10] Metzinger, *Being No One*, 548-9.

[11] Ibid., 549-50.

[12] Very briefly, Ligotti's horror is characterised by a claustrophobic discrepancy between realism and oneirism, in which the world is illusional, and the real inconsistent

II. PHENOMENOLOGY AND THE FICTION OF EXPERIENCE

Metzinger argues that neuroscience circumvents the supposedly irreducible ambit of self-consciousness and dissolves self-intimacy through the objectivation of the mechanisms of subjectivity. It is the non-intuitability of these mechanisms themselves that gives rise to qualitative experience – an experience which is thus constituted by its very inability to access the impersonal mechanisms which make the phenomenal simulation of self possible. This phenomenal simulation is *transparent* to experience: 'we do

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and autonomous. Hence, Ligotti inverts the very possibility of redemption: The close-ness of world is disclosed in grotesque fabulation to be utterly autonomous in exactly the same moment as it is revealed that the mind is equally autonomous from the normative phenomenal experience of man. See, for example, T. Ligotti, *Crampton* (Poplar Bluff, MO: Mythos Books, 2002); T. Ligotti, 'I Have a Special Plan For This World' in *Teatro Grotesco* (London: Random House, 2008); T. Ligotti, 'Mad Night of Atonement' in *Noctuary* (New York: Carroll and Graf, 1994); T. Ligotti, 'The Tsalal' in *Noctuary* (New York: Carroll and Graf, 1994); and T. Ligotti, 'The Sect of the Idiot' in *Songs of a Dead Dreamer* (London: Robinson Publishing, 1989).

[13] 'A nemocentric reality model is one that satisfies a sufficiently rich set of constraints for conscious experience [...] while at the same time not exemplifying phenomenal selfhood. It may be functionally egocentric, but it is phenomenologically selfless. It would, while still being a functionally centred representational structure, not be accompanied by the phenomenal experience of being *someone*.' (Metzinger, *Being No One*, 336). Nemocentricism, for Metzinger, is a phenomenologically unimaginable possibility; however, it is a possibility that is perfectly conceivable and neurobiologically possible (see Metzinger, *Being No One*, op.cit.).

not experience phenomenal states *as* phenomenal states […] [we] *look through them*'.[14] Metzinger regularly alludes to fully immersive virtual reality to illustrate his thesis: 'We do not experience our conscious field as a cyberspace generated by our brain, but simply as reality itself, with which we are in contact in a natural and unproblematic way.'[15] Folk psychology's agenda is driven by a first person logic, occupying a perspectival and geometric structure that is temporally and spatially individuated.[16] This first-person perspective, however, is simply the phenomenal self-model, which Metzinger considers amenable to a neurobiological description, most likely involving parallel distributed processing (PDP), and a functional description: 'the phenomenal self-model is a plastic, multimodal structure'.[17]

First-person phenomenal experience is thus formulated as an empirical ideality, an empty fiction that is plastic, and therefore highly dependent upon the idiosyncrasies of the species. Effectively, the first-person perspective is a generation of worldhood, 'a *phenomenal* cosmology'.[18] The layers of simulation that coalesce into phenomenal experience encapsulate the intuition of phenomenal cosmology which, from the third person perspective, is understood to be a representational and functional property which can be analysed *in its entirety* on this basis.[19] 'Selves' in the full-blooded ontological sense, then, fall victim to Ockham's razor:

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[14] T. Metzinger, 'The Problem of Consciousness' in *Conscious Experience*, ed. T. Metzinger (Thorverton, UK: Imprint Academic, 1995) 11.

[15] **Ibid.**, *11.*

[16] Folk psychology attributes a unique and direct causal link from a selection process for volition as the cause of behaviour. Metzinger takes this causal link to be untenable, so that; 'it is not only that folk psychology is false - it is the content of the conscious self-model that attributes a causal relation between two events represented within it' (Metzinger, *Being No One*, 360). Folk psychology is therefore both false and hallucinatory from a scientific, third person account.

[17] T. Metzinger and B. Walde, 'Commentary on Jakab's "Ineffability of Qualia", *Consciousness and Cognition* 9 (2000), 352-62.

[18] Metzinger, 'The Problem of Consciousness', 6.

> Under a general principle of ontological parsimony, it is not necessary (or rational) to assume the existence of selves, because as theoretical entities they fulfil no indispensable explanatory function [...] All that can be explained by the phenomenological notion of a 'self' can also be explained using the representationalist notion of a transparent self-*model*.[20]

Even the most elementary components of phenomenality are unavailable to the self. For example, Metzinger argues that, in order to draw logical concepts from phenomenal content, and therefore to have epistemic and justified belief with regard to simple forms of phenomenal content, transtemporal identity criteria would have to be assumed, drawn directly from material identity criteria.[21] In that case, the abstraction of logic or ontology from experience would necessitate the indubitability of the self-manifestation of appearances: 'letting apparition show *itself* in its appearance according to its appearance'.[22] Thus, phenomenological appearance is rooted in an originary field of self-identity which, removing the imposition of the conceptual a priori, claims to return 'things' to lived experience, and to the fleshly actuality of consciousness. According to Metzinger, we only assume the reliability of this primitive self-identity on the assumption that 'in our subjective experience of sensory sameness we carry out a phenomenal representation of this transtemporal identity on the object level in an automatic manner, which already carries its epistemic justification in itself.' – and '[i]t is precisely this background assumption which is false'.[23] The transtemporal criteria necessary for the subjective individuation and consequent logical identity are simply unavailable to subjective introspection, so that phenomenal concepts are a priori incapable of being introspectively formed. Phenomenological primitives, supposedly straightforwardly given to the conscious subject, are incapable of providing even the most basic conceptual traction on the data of consciousness. Hence, as Metzinger argues:

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[19] See Metzinger, *Being No One*, 577. However, Metzinger suggests that this might not be a rational choice in all contexts, drawing a clear distinction between his work and the Churchlands'.

[20] Ibid.

[21] For a phenomenological account in which this is indeed assumed to be the case, see J-L. Marion, *Being Given: Toward a Phenomenology of Givenness*, trans. J. Kosky (Palo Alto, CA: Stanford University Press, 2002) 7ff.

[22] Ibid., *8*.

> The phenomenological approach in philosophy of mind, at least with regard to those simple forms of phenomenal content, is due to failure; a descriptive psychology cannot come into existence with regard to almost all of the most simple forms of phenomenal content […] The neural and functional correlates of the corresponding phenomenal states can, in principle, provide us with transtemporal identity criteria as well as with those logical identity criteria for which we have been looking. Neurophenomenology is possible; phenomenology is impossible.[24]

Only through the objective scientific circumvention of self-conscious experience is it possible to gain traction on the specific reality of both the manifest and non-manifest elements of phenomenal consciousness.

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[23] Metzinger, *Being No One*, 82.

[24] Metzinger, 'Commentary on Jakab's "Ineffability of Qualia"'.

III. TRANSPARENCY: A SPECIAL FORM OF DARKNESS

The phenomenal self comes about through a 'special form of epistemic darkness' – essentially, the inability of the subject to represent the conditions of its own intuitions. Folk psychology posits that the world is given immediately to subjective consciousness; it assumes that the experience of phenomenal content is transparent to the self. Metzinger argues, on the contrary, that immediacy is an illusory experience of the 'outside' world:

> From an epistemological perspective, we see that our phenomenal states at no point in time establish a direct and immediate contact with the world for us […] However, on the level of phenomenal representation […] this fact is systematically suppressed.[25]

In a direct inversion of the traditional notion of the transparency of inner sense, Metzinger argues that transparency, as an essential characteristic of phenomenal experience, illuminates the phenomenological fallacy of *pure* experience and the 'subjective impression of immediacy'. Naive realism is not, therefore, a philosophical theory as such; it is the global character of intuition, once the latter is understood in terms of phenomenal content locally supervening on neurobiological properties. Opacity, as opposed to transparency, occurs when appearances are cognised *as* appearances. Hence, our primitive pre-reflective feeling of conscious selfhood is *never* truthful, in that it does not correspond to any single entity *inside* or *outside* of the self-representing system.[26] The culmination of this inversion of the concept of transparency is indicated by the fact that transparency is a form of darkness: 'With regard to the phenomenology of visual experience transparency means that we are not able to see something, because it is transparent. We don't see the window but only the bird flying by. *Phenomenal* transparency in general, however, means that something particular is not accessible to subjective experience, namely, the representational character of the contents of conscious experience.'[27] The immediately given contents of the Phenomenal Self-Model (PSM) correspond neither to the sub-personal mechanisms underlying those contents, nor to any kind of external reality; the entire life-world is illusory, an 'online hallucination'.[28] Metzinger calls this feature of the self-model theory (SMT) 'autoepistemic closure' – that is, the closure and boundedness of processing in regard to internal dynamics. Autoepistemic closure allows for the availability of phenomenal content but not of the vehicle of content.[29]

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[25] Metzinger, *Being No-One,* 59.

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[26] See ibid., 565.

[27] *Ibid.,* 169. Metzinger elucidates this point: 'We do not have the feeling of living in a three-dimensional film or in an inner representational space: in standard situations our conscious life always takes place *in the world*. We do not experience our conscious field as a cyberspace generated by our brain, but simply as reality itself, with which we are in contact in a natural and unproblematic way. In standard situations the contents of pure experience are subjectively given in a direct and seemingly immediate manner. It is precisely in this sense that we can say: they are infinitely close to us.' (Metzinger, 'The Problem of Consciousness' , 11-2).

[28] See Metzinger, *Being No-One*, 51. As Metzinger puts it: 'The instruments of representation themselves cannot be represented as such anymore, and hence the experiencing system, by necessity, is entangled in a naive realism.' (Ibid., 169).

[29] The dualism of vehicle and content is not available for Metzinger; they cannot be understood as two distinct entities (see Metzinger, *Being No-One*, 166). More specifically then, transparency results from the: 'attentional unavailability of earlier processing stages in the brain for introspection. Transparency results from a structural / architectonic property of the neural information-processing going on in our brains' (T. Metzinger, 'Phenomenal Transparency and Cognitive Self-Reference',

However, as Metzinger is unwilling to split vehicle from content – which he believes would reify abstract content – transparency is further complexified by the assumption that there is a processual and physically realised *embodied* content.[30] Metzinger therefore effectively lays waste to functionalism's attempt to abstract the cognitive from actual physiological processes, an attempt which arguably already concedes the irreducible status of human sapience *vis-à-vis* its empirical substrate.

This, of course, is a characteristically modern philosophical distinction – the same one that allows Kant to maintain the autonomy of the transcendental subject from any empirical intervention or knowledge whatsoever. Through the *Critique of Pure Reason*'s so-called 'paradox of inner sense', Kant is able to maintain the transcendental status of the 'I think' without lapsing into pure idealism, which would necessarily conflate inner sense with consciousness.[31] Inner and outer sense are given in empirical perception as an intuitive whole, which is ultimately determined by the understanding through the transcendental synthesis of pure apperception.[32] Therefore, the intuitive unity of subjective consciousness remains distinct from the transcendental

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Phenomenology and the Cognitive Sciences 2 (2003), 353–93.

[30] Hence, phenomenal transparency is distinguished from a Cartesian epistemic transparency; 'The Cartesian claim about the epistemic transparency of self-consciousness can itself not be epistemically justified.' (Metzinger, *Being No-One*, 167), though it is phenomenologically adequate (see Metzinger, *Being No-One*, 340).

[31] This is key to Kant's critique of idealism and of the Cartesian subject; that they conflate inner sense with the conscious self.

[32] Kant argues that: 'What determines inner sense is the understanding and its originary power of combining the manifold of intuition, that is, of bringing it under an apperception.' I. Kant, *Critique of Pure Reason*, trans. Meiklejohn, ed. V. Politis (London: Everyman, 1993), 111 (B153).

unity of apperception, the ‘I think’, that unifies the manifold of presentations into an object of experience.

Metzinger concurs with Kant on the futile nature of rational psychology, and similarly on his transcendental (rather than ontological) distinction between phenomenal content and reality. However, this transcendental *opacity*, for Kant, lies in the fact that there can be no transparent knowledge of the self – concomitant with which is the dissolution of the substantive self through the positing of a formal a priori ground of subjectivity. Hence, whilst Kant’s concept of ‘transcendental illusion’ certainly corresponds with what Metzinger terms ‘phenomenological illusion’ – that is, the drawing of epistemic conclusions from phenomenal experience -- ultimately, Kant’s positing of a noumenal subjectivity commits the same fallacy that he had sworn to abjure. For, if Metzinger is correct, then the PSM undermines any attempt to transcendentalise subjectivity or consciousness, and the putatively noumenal substratum of inner sense can be cashed out in its entirety from within the ambit of scientific objectivity. Kant presupposed the unification of sense to be given through the unity of apperception that acts as the transcendental guarantor for the nomological consistency of appearances, and thus specifies ideal laws of appearance that have subsequently been shown to be rooted in empirical intuition. Metzinger disavows the role of syntactical invariance through his insistence on the sub-symbolic and immanent objectivity of the non-manifest element of consciousness.[33] The self-model is a

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[33] As Metzinger explicates: ‘the presence and striking holism of phenomenal reality […] would no longer have to be explained in accordance with classical philosophical models *from* above (e.g. by a transcendental subject), if we had a good bottom-up alternative […] called “feature binding” in the terminology of brain research: The fusion of different properties perceived by the system into a *holistic* internal structure.

plastic structure which can be neurobiologically described as a complex neural activation pattern. But furthermore, '[o]n a more abstract level the same pattern of physiological activity can also be described as a complex functional state'.[34] Since appearances are not discursively structured for Metzinger, he eradicates the autonomy of nomological consistency by rooting the manifestation of appearances in physical structures that are in no way dependent upon ideal (transcendental) laws.

Metzinger thus inverts Kantian 'opacity', arguing that it is not the transcendental opacity of the self that is primary, but the transparency of the self-model, which, through its objectivation, can become opaque, allowing for the cognising of appearances *as* appearances. It is our functional design that forces us into a naive realism, so that the explanation for semantic transparency is given by an evolutionary, rather than a transcendental, account: 'for biological systems like ourselves – who always had to minimise the computational load [...] naive realism was a functionally adequate "background assumption" to achieve reproductive success [...] [there was] no evolutionary pressure on our representational architecture to overcome the naive realism inherent in semantic transparency'.[35]

Such a binding of properties is, for instance, necessary in enabling us to see objects *as* objects' (Metzinger, 'Faster than Thought: Holism, Homogeneity and Temporal Coding', in *Conscious Experience*, ed. T. Metzinger (Thorverton, UK: Imprint Academic, 1995), 435.

[34] T. Metzinger, 'The Subjectivity of Subjective Experience: A Representationalist Analysis of the First-Person Perspective' in *Neural Correlates of Consciousness: Empirical and Conceptual Questions*, ed. T. Metzinger (Cambridge, MA: MIT Press, 2000), 289.

[35] Metzinger, *The Subjectivity of Subjective Experience*, 299.

IV. THE IMMANENT OBJECTIVATION OF CONSCIOUSNESS

Kant safeguards the autonomy of philosophy via recourse to a notion of an a priori transcendental subjectivity which would circumscribe possible experience, rendering empirical science inherently incapable of investigating the objectivity of the object and the formal conditions of empirical actuality. And, whether overtly or not, much 'continental philosophy' remains wedded to the presupposition that science is supervenient on a set of concepts that are ideally embedded in the subject. This disjunction of the empirical sciences and philosophy arguably attains its most extreme formulation in Husserl's conception of pure phenomenology as a transcendental-eidetic science whose bracketing of the world ensures that the natural sciences are confined to *res extensa*, thereby preserving an immanent plane of pure experience governed by an irreducible transcendental consciousness: 'the existence of Nature cannot be the condition for the existence of consciousness, since Nature itself turns out to be a correlate of consciousness: Nature is only as being constituted in regular concatenations of consciousness'.[36] However, according to Metzinger, it is the very domain of pre-theoretical access which, despite all claims to the contrary, is ultimately tethered to the myopia of contingently – evolutionarily – circumscribed conditions of intuition. Phenomenology, rather than reaching into 'the things themselves', succeeds only in transcendentalising folk psychology. In the wake of Metzinger, consciousness must be conceived of as produced by immanent objective mechanisms, which are themselves sub-symbolic, non-linguistic, and unconscious, so that 'pure self-reflection' is exposed as caught within the obscurantism of an empirico-transcendental circularity.

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[36] E. Husserl, *Ideas*, Book 1, 116. See also Husserl's account of phenomenology as an eidetic science: 'phenomenological or pure psychology as an intrinsically primary and completely self-contained psychological discipline, which is also sharply separated from natural science, is, for very fundamental reasons, not to be established as an empirical science but rather as a purely rational ("apriori," "eidetic") science. As such it is the necessary foundation for any rigorous empirical science dealing with the laws of the psychic, quite the same way that the purely rational disciplines of nature pure geometry, kinematics, chronology, mechanics are the foundation for every possible "exact" empirical science of nature' (Husserl, 'Phenomenology: Entry for the Encyclopedia Britannica', *Journal of the British Society for Phenomenology* 2, 1971: 77-90.

Metzinger argues that where philosophy has long grappled with reason and representation, it is only now that representation has 'through its semantic coupling with the concept of information, been transposed to the domain of mathematical precision and subsequently achieved empirical anchorage'.[37] Thus, '[c]onceptual progress by a combination of philosophy and empirical research programs is possible; conceptual progress by introspection alone is impossible in principle'.[38] Metzinger's work constantly forces philosophy to take account of *objective* intelligence; the sub-personal production of phenomenality as a naturalised Kantianism. The objective structure of knowledge is invested with empirical contingency, as one among many objective procedures; man as a mass of info-theoretic computation packed densely through sedimented layers of transcendental deception.

V. NEMOCENTRISM

Perhaps one of the most intriguing undercurrents of Metzinger's book, albeit one that he does not expand upon, is the implicit suggestion that the interests of thought can be unbound from lived experience, and in many cases even opposed to the interests of life.[39] For example, in a general discussion of scientific realism, Metzinger writes that 'there are aspects of the scientific world-view which may be damaging to our mental well-being'.[40] The object 'man' consists of tightly packed layers of simulation, for which naive realism becomes a necessary prophylactic in order to ward off the terror concomitant with the destruction of our intuitions regarding ourselves and our status in the world: 'conscious subjectivity is the case in which a single organism has learned to enslave *itself*'.[41] It is at this point that Thomas Ligotti's work can illuminate Metzinger's thesis, offering a phenomenological purchase upon that which Metzinger has claimed to be impossible for the imagination – methodological nemocentrism.

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[37] Metzinger, *Being No One*, 19.

[38] *Ibid.,* 83.

Ligotti invokes the expropriation of subjective experience thus: 'There are no people, nothing at all like that, the human phenomenon is but the sum of densely coiled layers of illusion, each of which winds itself upon the supreme insanity that there are persons of any kind.'[42] Ligotti couples this supreme insanity with a metaphysical irrealism regarding the substantive nature of the world. The supposedly foundational order of the phenomenal world is a mere semblance – and not a semblance of a supra-terrestrial realm, or an alien 'Other', but a semblance of the real world, which is utterly indifferent to the interests of organic life and thought. Ligotti thus unfolds some of the existential and phenomenological implications of Metzinger's conceptualisation of the relative autonomy of appearances: His characters experience reality in a way that is utterly incommensurate with the phenomenological register of human perception.

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[39] This is consistent with our general critique of phenomenology, following Derrida's characterisation of Husserl's work as 'a philosophy of life […] because the source of sense in general is always determined as an act of living, as an act of a living being, as *Lebendigkeit*' (J. Derrida, *Speech and Phenomena and Other Essays on Husserl's Theory of Signs* (Evanston, IL: Northwestern University Press, 1973) 10). On this divorce between the interests of thought and those of life, see Ray Brassier's *Nihil Unbound: Enlightenment and Extinction* (Basingstoke: Palgrave, 2006).

[40] Metzinger, 'Response to "A Self Worth Having"'.

[41] Metzinger, *Being No One*, 558. The self is mere appearance; 'the conscious self is an illusion which is no-one's illusion' (Metzinger, 'The Subjectivity of Subjective Experience', 2000).

[42] Ligotti, 'I Have a Special Plan for this World'.

Ligotti's work is characterised by two movements which he refuses to separate: the subject's passive dispossession of self-consciousness, and the 'enlightenment of inanity'. This double movement unmasks the reality within which the characters have always been. The suffocating effect Ligotti achieves through this process is intensified by his staunch repudiation of any recourse to the supernatural; there is no possibility of escape. Hence, the *ascecis* of the personal takes place within a positively insignificant reality, a realisation which dissolves both the intimacy of subjective experience, and the impersonal distance of the mechanics of that experience.

Ligotti's phenomenological nemocentrism draws out this collapse of any securely demarcated ontological and epistemological foundations in a weird-fictional landscape filled with the ruins and ghosts of puppets. Throughout Ligotti's work, the puppet figures as the insensate and sub-personal reality hidden beneath the 'mindless mirrors' of our naive reality. Puppets function as 'conduits to the unreal',[43] through whose agency hallucinatory phenomenality bleeds into a simultaneous concretisation of the oneiric. Life is played out as an inescapable puppet show, an endless dream in which the puppets are generally unaware that they are trapped within a mesmeric dance of whose mechanisms they know nothing, and over which they have no control. As Dziemianowicz notes in relation to Ligotti's 'Dreams of a Mannikin', the puppet's overriding affect is a suspicion that 'he and his entire world are merely a fictional diversion'.[44] The puppet is not merely an mocking parody of man, it is the unmasking of the animate face of insensate reality, the unveiling of the inexorable mechanics of the personal; 'There are no means for escaping this world. It penetrates even into your sleep and is its substance. You are caught in your own dreaming where there is no space. And are held forever where there is no time. You can do nothing you are not told to do. There is no hope for escape from this dream that was never yours. The very words you speak are only its very words.'[45] The irrepressible horror concomitant with Ligotti's concretisation of the oneiric stems from the *experience* of living in a 'three-dimensional film', a 'tunnel through an inconceivably high-dimensional reality'.[46] This phenomenal experience of nemocentrism ultimately dissolves both the intimacy of the personal and the distance of the impersonal; 'nothing's too small, nothing's too big. You lose your car keys, your wife gets run over by a semi, some nut blows up the capital of Pakistan'.[47] For this reason, the concretisation of the puppet concomitant with the increasing passivity of the narrator engenders an affect of universal claustrophobia through the implosion of the personal – which was, of course, never personal to begin with.

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[43] S.T. Joshi, 'Thomas Ligotti: Escape From Life', in *The Thomas Ligotti Reader*, ed. D. Schweitzer (Evanston, MD: Wildside Press, 2003) 135.

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[44] S. Dziemianowicz, 'Nothing Is What It Seems To Be', in *The Thomas Ligotti Reader*, ed. D. Schweitzer (Evanston, MD: Wildside Press, 2003), 50. See T. Ligotti, 'Dreams of a Mannikin', in *Songs of a Dead Dreamer*.

[45] Ligotti, 'I Have a Special Plan for this World'.

[46] Metzinger, *Being No One*, 551.

[47] Ligotti, *Crampton*, 82.

It is resolutely not the case, however, that the puppet-world is 'willed' into existence by an 'Other'; there is no puppet master pulling the strings.[48] Ligotti's systematic assault on empirical realism is not a result of the reinvigoration of the world with a Heraclitean flux, a pure productivity, or a contingent excess of materiality. Ligotti's real is 'positively' senseless, rigorously disabling any attempt to provide reality with substantive or ideal foundations by irreversibly severing its reciprocity with the pretensions of subjective thought. Ligotti can no more assume the existence of an extant and hypostatised nature than he can assume the necessary constancy of presence. The transcendental illusion exposed by Metzinger is expanded into a total disparity between the interests of life and the reality that life finds itself within. The secure foundations of the phenomenal and the real dissolve, not into a universal solipsism, but into a rigorous realism; 'it is not, in the end, a replacement of the real world by the unreal, but a sort of turning the real world inside out to show that it was unreal all along'.[49]

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[48] As Ligotti consistently maintains, the dissolution of the self cannot give way to a Schopenhaurian Will, as this reinstates some form of 'first philosophy' in the form of an underlying essence. See Ligotti, 'Tsalal'; 'You wrote that there is not true growth or evolution in the life of this world but only transformations of appearance, an incessant melting and molding of surfaces without underlying essence. Above all you pronounced that there is no salvation of any being because no beings exist as such, nothing exists to be saved – everything, everyone exists only to be drawn into the slow and endless swirling of mutations that we may see every second of our lives'.

[49] Joshi, 'Thomas Ligotti', 139. Hence the statement; 'Nothing is real' (Ligotti, *Crampton*, 83), is not assumable under the idealising consequences of phenomenal immediacy.

Where Metzinger definitively resolves to destroy the possibility of the synthesis of man and nature, it is through Ligotti's phenomenological fictionalisation that the affective ramifications of this move are elucidated. Ligotti has developed a method of realising the absolute indifference of the real to the human and the personal through a metaphysical irrealism in which he disentangles appearances from both sufficient reason and originary manifestation by severing the nomological isomorphism of appearances and their substrate; in the end, subjectivity is simply a specific exacerbation of objectivity.[50] Accordingly, an unforeseen consequence of Ligotti's inhabitation of Metzinger's epistemic nemocentricism is that Metzinger's naturalistic realism ends up providing traction on Ligotti's metaphysical irrealism: 'The horror and nothingness of human existence – the cosy facade behind which was only a spinning abyss.'[51] Phenomenal cosmology is not given by a structural syntax, but is simply an exacerbation of objective processes unconstrained by any form of ideality.

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[50] The dissolution of apodictic realism is continuous with the dissolution of apodictic thought; 'the integrity of material forms is only a prejudice, at most a point of view [...] things are not bolted down, so to speak. And no more is that thing which we call the mind' (T. Ligotti, 'The Cocoons' in *The Shadow at the Bottom of the World* [NY: Cold Spring Press, 2005], 164).

[51] T. Ligotti, *Conspiracy Against the Human Race* (Forthcoming – see extract in present volume). This would entail the extraction of metaphysical naturalism from naturalistic realism, which is methodological rather than ontological. Accordingly, it is possible that naturalism may not be the most promising explanatory ground for Metzinger's self-model theory, as evolutionary ethology can be shown to ground a representational efficacy, but in order to extrapolate scientific realism on this basis, Metzinger would have to argue that nature is inherently functional, and therefore promoting a functional univocity. In this case, Metzinger would succumb to the charges that Stephen J. Gould poses to Daniel Dennett: making 'thinly veiled attempts to smuggle purpose back into biology' (S. J. Gould, *The Richness of Life: A Stephen Jay Gould Reader* [London: Vintage, 2007], 442). See D. Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (London: Penguin, 1996).

Ligotti's horror, then, can be understood in terms of Metzinger's theory, in such a way as to grasp Ligotti's work as a fictional realisation of Metzinger's nemocentrism. Ligotti's horror is removed from the realm of the fantastic and given naturalistic traction through Metzinger's definition of man as the 'puppet shadow [that] dances on the wall of the neurophenomenological caveman's phenomenal state space'.[52] Equally, reading Metzinger alongside Ligotti, or as Ligottian theory-horror, accentuates the anomic terror of the arrogation of the self, as the folk psychological ascription of agency that is preserved in the artifice of natural language is extricated from the transcendental pretensions that phenomenology underwrites.

Finally, Ligotti enables us to recognise that the theoretic-practical resolve of Metzinger's theory is to be found not in the reduction of folk psychology, but in a kind of neurotechnology. Phenomenality and knowledge-weighting are malleable: 'the phenomenal self-model is a plastic, multimodal structure'[53] whose 'insertion and integration into other domains of information architecture amplify the potential for cognitive pliability'.[54] What is this but the naturalisation of the final outcome of Ligotti's fantastical puppet-dance: the realisation that underlying our parochial self-conceit is the impersonal reality of the meat-puppet?[55]

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[52] Metzinger, *Being No One*, 558.

[53] Metzinger, 'The Subjectivity of Subjective Experience', 289.

[54] See Metzinger; 'change the representational content of the conscious self-model […] get some unconscious microfunctional output' (Metzinger, 'Response to "A Self Worth Having"').

[55] The conjunction of Ligotti and Metzinger induces the definition of man as the shadow of a 'meat-puppet'. For a reading of man as a meat-puppet within contemporary science, see R. Doyle, *On Beyond Living: Rhetorical Transformations of the Life Science* (Stanford: Stanford University Press, 1997), 36; see also its fictional realisation in the character of Molly in W. Gibson, *Neuromancer* (London: Voyager, 1984).

Here the objectivation of the world indicates its *real* condition, unveiling the inexorable mechanics of appearances as a prospect of hideous insanity – a hall of mindless mirrors unbound from the densely coiled layers of illusion that characterise the interests of life and the physiology of thought. Meanwhile, cognitive protectionism and organic enslavement ensure the oneiric aphasia of the shadow of the puppet dance:

> To know, to understand in the fullest sense, is to plunge into an enlightenment of inanity, a wintry landscape of memory whose substance is all shadows and a profound awareness of the infinite spaces surrounding us on all sides. Within this space we remain suspended only with the aid of strings that quiver with our hopes and our horrors, and which keep us dangling over the gray void. How is it that we can defend such puppetry, condemning any efforts to strip us of these strings? The reason, one must suppose, is that nothing is more enticing, nothing more vitally idiotic, than our desire to have a name – even if it is the name of a stupid little puppet – and to hold on to this name throughout the long ordeal of our lives, as if we could hold on to it forever. If only we could keep those precious strings from growing frayed and tangled, if only we could keep from falling into an empty sky, we might continue to pass ourselves off under our assumed names and perpetuate our puppet's dance throughout all eternity.[56]

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[56] T. Ligotti, 'A Soft Voice Whispers Nothing' in *In a Foreign Town, In a Foreign Land* (London: Durtro, 1997).

‘Memento Mori’ – Dead Monkeys

Oleg Kulik

12 b/w photographs, 1998.
Courtesy of XL Gallery, Moscow.

Thinking Horror[1]

Thomas Ligotti

BEGINNINGS

For ages they had been without heads. Headless they lived, and headless they died. How long they had thus flourished none of them knew. Then something began to change. It happened over unremembered generations. The signs of a transfiguring were being writ ever more deeply into them. As their breed moved forward, they began crossing boundaries whose very existence they never suspected ... and they trembled. Some of them eyed their surroundings as they would a strange land into which they had wandered, even though their kind had trodden the same earth for countless seasons. And after nightfall, they looked up at a sky filled with stars and felt themselves small and fragile in the vastness. More and more, they came to know a new way of being. It was as if the objects around them were one thing and they were another. The world was moving farther and farther away, and they were at the center of this movement. Another world was forming inside the heads they now had. Each of them, in time, became frightened in a way they had never known. In former days, they were frightened only by sights and sounds in the moments they saw or heard them. Now they were frightened by things that were not present to their senses. They were also frightened by visions that came not from outside them but from within them. Everything had changed for their kind, and they could never return to what they once had been. The epoch had passed when they and the rest of creation were one and the same. They were beginning to know a world that did not know them. This is what they thought, and they thought it was not right. Something which *should not be* ... had become. And something had to be done if they were to flourish as they had before, if the very ground beneath their feet were not to fall out from under them. They could do nothing about the world which was moving farther and farther away and which knew them not. So something would have to be done about their heads.

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[1] The present text is an extract from *The Conspiracy Against the Human Race: A Short Life of Horror* (forthcoming), a work which binds together themes from pessimistic philosophy and the horror genre into an exposition on the uncanny nature and ontological fraudulence of the human species.

DIFFERENCES

For centuries a debate has been going on among us, a shadowy polemic that periodically attracts public notice. The issue: what do people think about being alive? Overwhelmingly, those questioned will say, 'Being alive is all right'. More thoughtful respondents will add, 'Especially when you consider the alternative', betraying a jocularity that is as logically puzzling as it is macabre, since the alternative is the first among certitudes that make being alive not

all right. These speakers weigh down one side of the survey. On the other side is a small sample in disagreement with the majority. Their response to the question of what they think about being alive will be a negative one. They may even fulminate about how objectionable it is to be alive. Now, there are really no incisive answers to why people think or feel this way or that. But one thing is sure: the people in the second group are pessimists. And in the minority opinion of pessimists, most of the people in this world have to work very hard to keep from thinking there is anything objectionable about being alive.

Lamentably, we cannot choose to think what we think or feel what we feel. If we did have this degree of mastery over our internal lives, then we would be spared an assortment of sufferings. Psychiatrists would be out of a job as depressives chose to stop being depressed and schizophrenics chose to stop being crazy. Most people, especially those who say that being alive is all right, do believe they have considerable choice in choosing what they think and feel. And psychiatrists, who will never be unemployed, seldom dissuade their clients from believing they can choose their thoughts and feelings. Nevertheless, those who believe they can choose what they think and feel are incapable of *choosing what they choose* to think and feel. Should they still believe themselves in control of what they choose to choose to think and feel, they still could not choose to choose to choose . . . and so on. Were there any choice on our part regarding what we think and feel, it would not be adventurous to conjecture that we would think about pleasant things rather than horrible things and choose to feel good rather than bad. Some might even choose to think about nothing at all and to live in a permanent state of euphoria until they died of natural causes. With godlike power over your thoughts and feelings, you could do as you choose. And who would choose to think horrible thoughts and feel bad feelings about being alive?

ZAPFFE

If the most contemplative individuals are sometimes dubious about the value of existence, they do not often publicize their doubts but align themselves with the man in the street, tacitly declaiming, in more erudite terms, 'Being alive is all right, etc'. The butcher, the baker, and the crushing majority of philosophers all agree on one thing: human life is justified, and we should keep our species going for as long as we can. To tout the opposing side is asking for grief. But some people seem born to bellyache that being alive is not all right. Should they vent this unpopular view in philosophical or literary works, they may do so without apprehension that their efforts will have an excess of admirers. Notable among such efforts is 'The Last Messiah' (1933), an essay written by the Norwegian philosopher and man of letters Peter Wessel Zapffe (1899-1990). In this work, which has been twice translated into English,[2] Zapffe elucidated what he saw as the tragedy of human existence.

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[2] 'The Last Messiah', *Wisdom in the Open Air: The Norwegian Roots of Deep Ecology* (Minneapolis: Minnesota U. Press, 1993), eds Peter Reed and David Rothenberg (translators Sigmund Kvaløy with Peter Reed); *Philosophy Now*, March-April 2004 (translator Gisle R. Tangenes). Regrettably, Zapffe's philosophical masterwork, *On the Tragic* (1941), has not appeared in any major language at the time of this writing. However, abstracts of its substance, as well as excerpts from this treatise and other writings by Zapffe as translated into English by Tangenes, confirm that throughout his long life he did not abandon or dilute the pessimistic principles of *On the Tragic* as they appear in miniature in 'The Last Messiah'.

Before discussing why Zapffe saw human existence as a tragedy, it may be useful to consider a few facts whose relevance will become manifest down the line. As some may know, there exist readers who treasure philosophical and literary works of a pessimistic, nihilistic, or defeatist nature as indispensable to their existence, hyperbolically speaking. Cynical by nature, these persons are well aware that nothing indispensable to their existence, hyperbolically or literally speaking, must make its way into their lives, as if by natural birthright. They do not think that anything indispensable to anyone's existence may be claimed as a natural birthright, since the birthrights we commonly bandy about are all fictions, something we dreamed up after straying from a factual world into one fabricated by our heads. For those who have given any thought to this matter, the only rights we may exercise are these: to seek the survival of our individual bodies, to create more bodies like our own, and to perish through a process of corruption or mortal trauma. This is presuming that one has been brought to term and has survived to a certain age, neither being a natural birthright. Stringently considered, *our only natural birthright is to die*. No other rights have been allocated to us except, to repeat, as fabrications. The divine right of kings may now be acknowledged as a fabrication, a falsified permit for prideful dementia and impulsive mayhem. The unalienable rights of certain people, however, seemingly remain current: whether observed or violated, somehow we believe they are not fabrications because an old document says they are real. Miserly or munificent as a given right may appear, it denotes no more than the right of way warranted by a traffic light, which does not mean you have the right to drive free of vehicular misadventures. Ask any paramedic.

Our want of any natural birthright – except to die, in most cases without assistance – is not a matter of tragedy but only one of truth. Coming at last to the pith of Zapffe's thought as spelled out in 'The Last Messiah', the tragedy of human existence had its beginnings when at some stage in our evolution we somehow acquired consciousness. Zapffe believed consciousness to be a mistake in human evolution, an adventitious outgrowth that made of us a race of monsters – things that had nothing to do with the rest of creation. Because of consciousness, we became susceptible to thoughts that were startling and dreadful to us. ('I think, therefore I am and will one day die', or thus might have read René Descartes' formulation had he gone the whole mile with it). Our heads now began dredging up horrors, flagrantly joyless possibilities, enough of them to make us drop to the ground in paroxysms of self-soiling consternation should they go untrammeled. This potentiality necessitated that certain defense mechanisms be put to use to keep us balanced on the knife-edge of vitality as a species. While a modicum of consciousness may have had survivalist properties during an immemorial chapter of our evolution, further escalations of this faculty appeared to be maladaptive, turning our awareness into a seditious agent working against us. As the Norwegian philosopher concluded, along with others before and after him, we must hamper our consciousness for all we are worth or it will impose upon us a too clear vision of the 'great matter of birth and death', to borrow a phrase from Zen Buddhism. Thus, each of us became a paradox: we could not live with ourselves as we were and we could not live otherwise. We could only keep the horror in its box.

For the rest of the earth's organisms, existence is relatively uncomplicated. Their lives are about three things: survival, reproduction, death – and nothing else. But we know too much to content ourselves with surviving, reproducing, dying – and nothing else. We know we are alive and know we will die. We also know we will suffer at intervals throughout our lives before suffering – slowly or quickly – at the point of death. This is the knowledge we 'enjoy' as the most intelligent organisms to gush from the womb of nature. And as such, we feel shortchanged if there is nothing more for us than to survive, reproduce, and die. We want there to be more to it than that, or to think there is. This is the tragedy: consciousness has forced us into striving to be something other than what we are – hunks of spoiling flesh on hardening bones. For other organisms, life is a well-managed ramble toward their demise. But we are susceptible to startling and dreadful thoughts, and we need some fabulous illusions to take our minds off them. For us, then, life is a con game we must run on ourselves, hoping we do not catch on to any monkey business that would leave us stripped of our defense mechanisms and standing bare-assed before the silent, staring void. To end this self-deception, to free our species from this backbreaking labor of lies, we must cease reproducing. Nothing less will do, per Zapffe, although in 'The Last Messiah' the character after whom the essay is named does all the talking about human extinction. Elsewhere Zapffe speaks for himself on the subject.

More audacious than it is astonishing, Zapffe's thought has a substructure in existential psychology and sociology rather than in metaphysics, analytics, or hard science. It is penetrable and ineluctably dismal, resting on taboo commonplaces and outlawed truisms while eschewing the arcane brain-twisters that for thousands of years have been philosophy's stock-in-trade. *The World as Will and Representation* (two volumes, 1819 and 1844) by the German philosopher Arthur Schopenhauer is perhaps the most handsome metaphysical system ever elaborated, which does not mean that the Will-to-live as the causal agent for everything that moves is not just an overwrought floorshow for brainiacs. But Zapffe's principles are crystalline and therefore could never interest professors or practitioners of philosophy, who prefer to circle around grand exhibitions of theory wherein harsh realities and reeling senselessness are secreted behind elegant explications of what our lives are really about. If we must think, it should be done only in circles, outside of which lies the unthinkable.

MASTERMINDING

Zapffe's two central propositions as adumbrated above are as follows. The first is that consciousness has overreached the point of being a sufferable property of our species, and thus we thwart it in four principal ways.

(1) **ISOLATION.** So that we may get on with living without going into a free fall of trepidation, we isolate the dire facts of being alive. These are stowed away in a remote compartment of our minds. They are the family freaks in the attic whose existence we deny in a conspiracy of silence.

(2) **ANCHORING.** To stabilize our lives in the tempestuous waters of chaos, we conspire to anchor them in metaphysical and institutional 'verities' – God, Morality, Natural Law, Country, Family – that imbue us with a sense of being official, authentic, and safe in our beds.

(3) **DISTRACTION.** To keep our heads unreflective of a world of horrors, we distract them with the worst trash or the best trash. The most operant and elementary method for furthering the conspiracy, distraction is in continuous employ and demands only that everyone keep their eyes on the ball – or television screen or great book.

(4) **SUBLIMATION.** That we might annul a paralyzing stage fright having to do with the nightmare intervals of being alive, we sublimate our fears by making an open display of them. In the Zapffian sense, sublimation is the rarest technique utilized for conspiring against the human race. Putting into play both deviousness and skill, this is the process by which thinkers and artistic types recycle the most demoralizing and unnerving aspects of life as works in which the worst fortunes of humanity are presented in a stylized and removed manner as entertainment. In so many words, these thinkers and artistic types confect products that provide an escape from our suffering by a bogus simulation of it – a tragic drama or philosophical woolgathering, for instance. Zapffe uses 'The Last Messiah' to showcase how a literary-philosophical opus cannot perturb its creator or anyone else with the severity of true-to-life horrors, but only provide a pale representation of these horrors, just as a movie whose centerpiece is the romance of two young people, one of whom dies of leukemia, cannot rend its audience with the throes of the real thing, even if it may produce an award-winning tearjerker, as in the case of the 1971 film adaptation of Erich Segal's 1970 bestselling novel *Love Story*.

By cleaving to these stratagems, we keep ourselves from scrutinizing too closely the smorgasbord of pain and fear laid out for us by life.

The second of Zapffe's two central propositions – that our species should refrain from reproducing – brings to mind a familiar cast of characters. The Gnostic sect of the Cathari in twelfth-century France were so tenacious in believing the world to be an evil place engendered by an evil deity that its members were offered a dual ultimatum: sexual abstinence or sodomy. (A similar sect in Bulgaria, the Bogomils, became the etymological origin of the term 'buggery' for their practice of this form of erotic release). Around the same period, the Catholic Church mandated abstinence for its clerics, a directive that did not halt them from betimes giving in to sexual quickening. Most sadly, the *raison d'être* for this doctrine was the attainment of grace (and in legend was obligatory for those in search of the Holy Grail) rather than an enlightened governance of reproductive plugs and bungholes. Lusting to empower itself, the Church slacked off from the example of its ascetic founder in order to breed a copious body of followers and rule as much of the earth as it could.

In another orbit from the theologies of either Gnosticism or Catholicism, the nineteenth-century German philosopher Philipp Mainländer (pseudonym of Phillip Batz) advocated chastity as the surest blueprint for salvation. The target point of his redemptive plan was the summoning within ourselves of a 'Will-to-die'. This brainstorm, along with others as gripping, was advanced by Mainländer in a treatise whose title has been translated as *The Philosophy of Redemption.*[3] Unsurprisingly, the work itself has not been translated into English. Perhaps the author might have known greater celebrity if, like the Austrian philosopher

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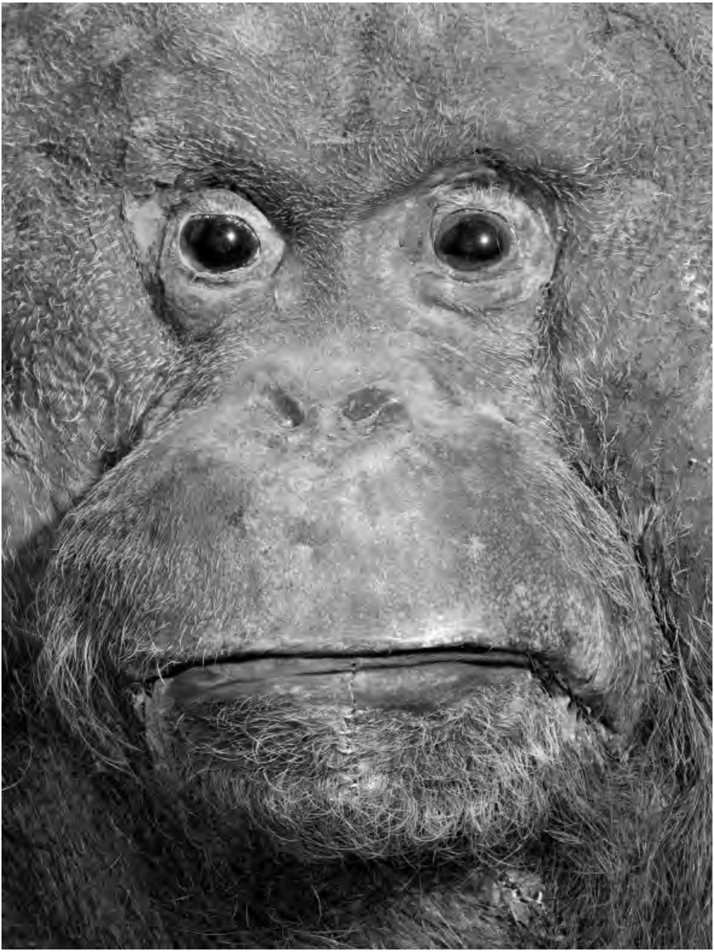
[3] *Die Philosophie der Erlösung* (Berlin: Theodor Hofmann, 1879 [second edition])and *Die philosophie der Erlösund: Zwölf philosophische* (Frankfurt am Main: C. Könitzer, 1882-6 [five volumes])



Otto Weininger in his infamous study translated as *Sex and Character* (1903), he had ruminated more *about* the venereal goad rather than *against* it. Mainländer also made the cardinal error of pressing his readers to work for such ends as justice and charity for all. An unbridled visionary, although not of the inspirational sort that receives a charitable hearing from posterity, he shot himself in the foot every chance he got before aiming the gun a little higher and ending his life. This act was consummated the day of the publication of *The Philosophy of Redemption.* To the end, Mainländer avouched his personal sense of well-being and proposed universal suicide for a most esoteric reason (see under the section 'Deicide' below).

A less composed figure than Mainländer was the Italian philosopher Carlo Michelstaedter. In his 1910 doctoral dissertation, published in English as *Persuasion and Rhetoric*[4], the twenty-three-year-old Michelstaedter critiqued, as later would Zapffe, the tactics we use to falsify the realities of human existence in exchange for a speciously comforting view of our lives. Michelstaedter's biographers and critics have speculated that his despair of any person's ability to break through their web of illusions was the cause of his suicide (two bullets from a gun) the day after he finished his dissertation. What seems to have finished Michelstaedter was a stellar fact of human life that he could not accept: no one has control over how they will be in this world, a truth that eradicates all hope if how you want to be is invulnerably self-possessed ('persuaded') and without subjection to a life that would fit you within the limits of its unrealities ('rhetoric', a word oddly used by Michelstaedter).

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[4] Trans. R. S. Valentino, C. S. Blum, and D. J. Depew. New Haven, Conn./London: Yale University Press, 2004.

But individuals are defined by their limitations; without them, we fall outside the barrier of identifiable units, functionaries in the big show of collective existence. The farther you proceed toward a vision of humankind under the aspect of eternity, the farther you drift from what makes you a person among persons in this world. In the observance of Zapffe, an overactive consciousness endangers the approving way in which we define ourselves and our lives. It does this by threatening our self-limited perception of who we are and by blackmailing us with unsavoury facts about what it means to know we are alive and will die. A person's demarcations as a being, not how far he trespasses those limits, create his identity and preserve his illusion of being someone. Transcending all illusions and their emergent activities would untether us from ourselves and license the freedom to be no one. In that event, we would lose our allegiance to our species, stop reproducing, and quietly bring about our own end. The lesson: 'Let us love our limitations, for without them nobody would be left to be somebody.'

While recognizing the nuisance of conscious existence, not all are as unrelenting in their pessimism as Zapffe. In his 1913 *Tragic Sense of Life in Men and Nations*,[5] the Spanish writer Miguel de Unamuno speaks of consciousness as a disease bred by a conflict between the rational and the irrational. The rational is identified with the conclusions of consciousness, primarily that we will all die. The irrational represents all that is vital in humanity, including a universal desire for immortality. The coexistence of the rational and the irrational turns the human experience into a wrangle of contradictions to which we can submit

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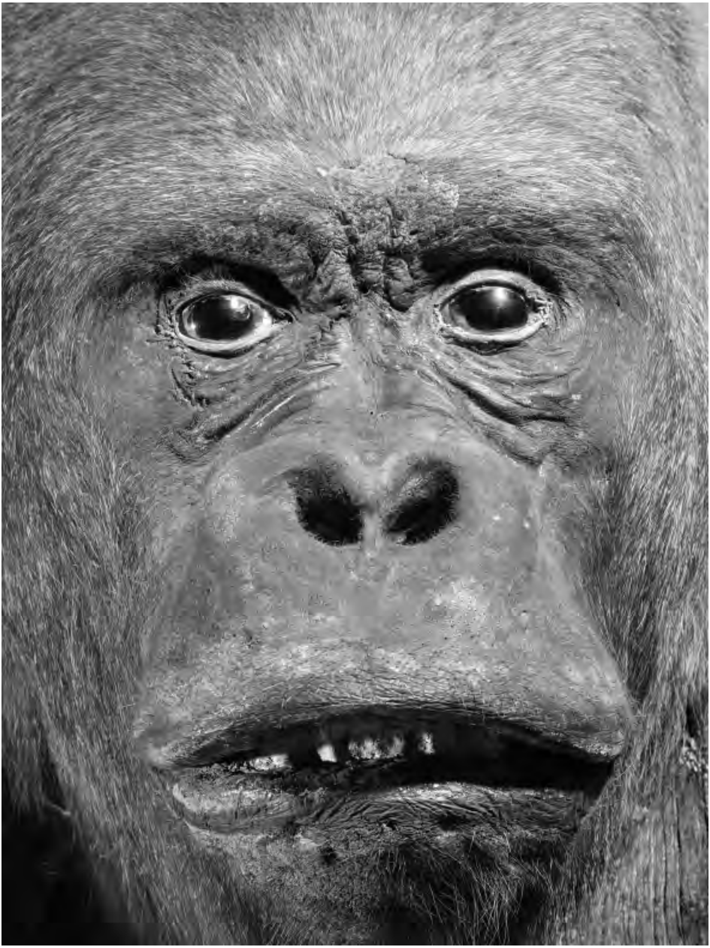
[5] Republished, trans. A. Kerrigan, Princeton University Press, 1978



with a suicidal resignation or obstinately defy as heroes of futility. Unamuno's penchant is for the heroic course, with the implied precondition that one has the physical and psychological spunk for the fight: 'I think, therefore I know that life is a meaningless bitch and then I will die; but I cannot let that keep me from living in defiance of what I know, which is what everyone does, pessimist or not.' In line with Unamuno, Joshua Foa Dienstag, author of *Pessimism: Philosophy, Ethic, Spirit*,[6] also gives the thumbs-up to the pessimist-as-hero – one who is aware of the dispiriting lowdown on life and yet marches on. Also siding with this never-say-die group is William R. Brashear, whose *The Desolation of Reality*[7] concludes with a format for redemption, however partial and imperfect, by means of what he calls 'tragic humanism', which recognizes human life's 'ostensible insignificance, but also the necessity of proceeding as if this were not so, and of willfully nourishing and sustaining the underlying illusions of value and order'. Not exactly pessimists in the tradition of Schopenhauer or Zapffe, Unamuno, Dienstag, and Brashear are at least vocal about what is at stake for those who know they are alive and will die.

MEANINGFULNESS

Among the unpleasantries of life that lie in wait is the abashment some persons suffer because they feel their lives are destitute of meaning. The sense that one's life has meaning is sometimes declared to be a necessary condition for developing or maintaining a state of good feeling. This is horrendous news considering the mind-boggling number of books and therapies for a market of discontented individuals who are short on a sense of meaning, either in a limited and localized variant ('I received an A on my calculus exam') or one that is macrocosmic in scope ('There is no God but Allah, and Mohammed is his prophet'). Those who are euphoric, or even moderately content, are not parched for meaning. Relatively speaking, feeling good is its own justification. As long as such states last, why louse up a good thing with self-searching interrogations about meaning? But an abnormal degree of elation could also be a sign of psychopathology, as it is for individuals who have been diagnosed with bipolar affective disorder. Such persons should be treated by mental health professionals, although psycho-behavioral therapeutics often puts a patient in the clutches of mind healers who are modern-day incarnations of positive-thinking preachers such as Norman Vincent Peale. No one ever bought a copy of *The Power of Positive Thinking*[8] who was not dissatisfied with his or her life. This dissatisfaction is precisely the quality that the great pessimists – Buddha, Schopenhauer, Freud – saw as definitive of the human packing plant. Millions of copies of Peale's book and its reiterations, including Martin Seligman's *Authentic Happiness: Using the New Positive Psychology to Realize Your Potential for Lasting Fulfillment* ,[9] have been sold. And they were not purchased by readers who were madly content with their place on the ladder of subjective well being, in the vernacular of 'positive psychology'. Neither have they been documented as hoisting themselves toward 'lasting' fulfillment by reading the books of these gurus of happiness.[10]

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[6] Princeton University Press, 2006.

[7] NY: Peter Lang, 1995.

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[8] NY: Prentice Hall, 1952.

[9] London: Nicholas Brearley, 2003.

[10] For a study based on clinical research that documents one's subjective wellbeing

While every other creature in the world is insensate to meaning, those of us on the high ground of evolution are full of this enigmatic hankering, a preoccupation that any comprehensive encyclopedia of philosophy treats under the heading LIFE, THE MEANING OF. We have a need that is not natural, one that can never be satisfied no matter how many big lies we swallow. Our unparalleled craving may be appeased – like the yen of a dope fiend – but we are deceived if we think it is ever gone for good. Years may pass during which we are unmolested by LIFE, THE MEANING OF. Some days we wake up and just say, 'It's good to be alive'. If everyone were in such elevated spirits all the time, the topic of LIFE, THE MEANING OF would never rise up in our heads or our conversations. But this ungrounded jubilation soon runs out of steam. Our consciousness, having snoozed awhile in the garden of incuriosity, is pricked by some thorn or other, perhaps DEATH, THE MEANING OF. Then the hunger returns for LIFE, THE MEANING OF, the emptiness must be filled again, the pursuit is resumed. And we will keep chasing after the impossible until we are no more. This is the tragedy that we do our best to cover up in order to brave an existence that holds terrors for us at every turn, with little but blind faith and habit to keep us on the move.

HUMANNESS

As heretofore posited, consciousness may have facilitated our species' survival in the hard times of prehistory, but as it became evermore acute it evolved the potential to ruin everything if not securely muzzled. This is the problem: we

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as a genetically determined lottery and not something that a self-help book can instruct an individual to achieve, see 'Happiness Is a Stochastic Phenomenon' by David Lykken and Auke Tellegen, *University of Minnesota Psychological Science*, 1996. Believe it or not.

must either outsmart consciousness or be thrown into its vortex of doleful factuality and suffer, as Zapffe dubbed it, a 'dread of being' – not only of our own being but of being itself. On the strength of this premise, Zapffe inferred that the sensible thing to do would be to call off all procreative activities. Not only would it be the sensible thing to do, but it might be the most telling indication, even the *only* indication, of what it means to be human. This could settle some old questions. Is the condition of being human what we think it is? And what do we think it is to be human? Nowhere in philosophy or the arts are there answers on which we can all agree. Science has us down as a species of organic life. But whatever it means to be human, we can at least say that we have consciousness – an attribute that has made us the royalty of creation, yet one that we cannot let get out of hand if we are to survive. Question: why would we want to survive as a species caught in this double bind? Answer: because we do not know what it is to be human.

To repeat what cannot be repeated enough: we can tolerate existence only if we believe – in accord with a complex of illusions, a legerdemain of deception – that we are not what we are: unreality on legs. As creatures with consciousness, we must suppress that divulgement lest it break us with a sense of being things without significance or foundation, anatomies shackled to a landscape of pointless horrors. In plain language, we cannot live with ourselves except as impostors, paradoxical beings who must lie to ourselves about ourselves, as well as about our no-win situation in this world. Thus, we are zealots of Zapffe's four consciousness-smothering strategies: isolation ('Being alive is all right'), anchoring ('One Nation under God with Families, Morality, and Natural Laws for all'), distraction

(‘Better to kill time than kill oneself’), and sublimation (‘I am writing a book entitled *The Conspiracy Against the Human Race*’). These practices make us what we are – beings with a nimble intellect who can deceive themselves ‘for their own good’. Isolation, anchoring, distraction, and sublimation are the wiles we use to keep our heads from dispelling every illusion that keeps us up and running. (‘We think, therefore we know we are alive and will one day die; so we had better stop thinking, except in circles.’) Without this cognitive double-dealing, our world would be seen for what it is – something that is not very good to see, something that everyone glimpses from time to time and then looks away because they do not want to see too much of it. Maybe if we could resolutely gaze wide-eyed at our lives we would know what it is to be human. But that would stop the puppet show that we like to think will run forever.

In ‘The Last Messiah’, Zapffe wrote: ‘The whole of living that we see before our eyes today is from inmost to outmost enmeshed in repressional mechanisms, social and individual; they can be traced right into the tritest formulas of everyday life.’[11] The four formulas that Zapffe picked out as individual and social mechanisms of repression are probably the most trite he could have chosen, which may have been deliberate on his part because they are so familiar to us and so visible in human affairs. No one hesitates to admit them. Not overweight persons or tobacco users, who will promptly admit to playing dumb when they are scarfing down a cupcake or smoking a cigarette. Not soldiers fighting a war, who will proudly admit they are risking their lives and limbs for a good greater than themselves – their families, their country, their god. Not anyone who is going to die soon, who will not voluntarily admit to playing the same old games for as long as possible rather than be consumed by thoughts of mortality and the agony that may precede it. Not artists, who with a shrug will admit to keeping their aesthetic distance for fear of being hamstrung by the realities they instantiate (musicians practice distraction rather than artistic sublimation). Such repressional mechanisms have been well analyzed by professional thinkers, particularly in relation to the fear of death. (For an enumeration of these and other mechanisms for grappling with thanatophobia, see *Choices for Living: Coping with the Fear of Dying*[12] by Thomas S. Langer). For almost all philosophers who write on the subject, death is studied in the abstract, while the more messy truths attending it are either bracketed or cold-shouldered. Death, of course, is only a sub-category of suffering, which, if it is even recognized by philosophers, is not something they care to brood upon. Suffering cannot be studied in the abstract. Philosophically, there is not much that can be done with it, and those few who try will be arraigned for talking nonsense. Almost all philosophers balk at saying anything about SUFFERING, THE MEANING OF. But none of them hesitate to admit that they, in league with everyone else, employ repressional mechanisms in their lives. And what use are repressional mechanisms if not to avoid discussions about suffering?

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[11] Translation by Gisle R. Tangenes, op. cit.

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[12] NY/London: Kluwer, 2002.

SUFFERING

In *The Open Society and Its Enemies*,[13] Karl Popper expounded a new slant on human suffering. Briefly, he revamped the Utilitarianism of the nineteenth-century British philosopher John Stuart Mill, who wrote, ‘Actions are right in proportion as they tend to promote happiness, wrong as they tend to promote the reverse of happiness’. Popper remolded this summation of a positive Utilitarianism into a *negative* Utilitarianism whose position he handily stated as follows: ‘It adds to clarity in the fields of ethics, if we formulate our demands negatively, i.e. if we demand the elimination of suffering rather than the promotion of happiness.’ Taken to its logical and most humanitarian conclusion, Popper’s demand can have as its only end the elimination of those who now suffer and those who will suffer if they are born. What else could the ‘elimination of suffering’ mean if not its total abolition, and ours? Naturally, Popper held his horses well before suggesting that to eliminate suffering would demand that we as a species be eliminated. But he should still be applauded for promoting the basics of a school of thought that would prefer to eliminate suffering – or at least tone it down – than to promote happiness in human life.

Other philosophies of a similar type as Negative Utilitarianism are Abolitionism and Algonomy. The people behind these incipient movements are fiery battlers against a world that is effectively indifferent to human suffering, which they have situated as the only problem with being alive. Abolitionism has gone so far as to preach that not only should human beings be emancipated from suffering, they should also know what it is like to feel unbroken bliss throughout their lives and no mental or physical inconvenience upon their deaths – a Utilitarianism beyond positivity or negativity. While no safe and efficient means yet exists to reach this peak existence, the parent figure of Abolitionism, the British philosopher David Pearce, has encyclopedically catalogued the ameliorations for suffering that now exist and has brilliantly outlined what steps we should presently be taking toward a life of engineered happiness. Nevertheless, an Abolitionist life would still not be perfect, since painful fatalities caused by accidents and natural disasters can never be gotten around. And such a life would be as useless as any other. That having been said, the existence that Pearce wants for the human race would at least not be malignant through and through, since it would turn the suffering with which we are drenched into a shower of (mostly) pleasurable sensations.

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[13] London: Routledge, 1945.

In 'The Last Messiah', Zapffe is not sanguine about eliminating suffering, nor is he so unworldly as to beseech a communal solution for its elimination by snuffing out the human race, as did the Cathari and the Bogomils. (He does critique the barbarism of social or religious proscriptions of suicide, but he is not a standard-bearer for this form of personal salvation). Zapffe's thought is foremost an addendum to that of various sects and individuals who have found human existence to be so unquestionably awful that extinction is preferable to survival. It also has the value of advancing a new answer to the old question 'Why should generations unborn be spared entry into the human thresher?' But what might be called 'Zapffe's Paradox', in the tradition of possessively named formulations that saturate primers of philosophy, is as useless as the propositions of any other thinker who is pro-life or anti-life or is only juggling concepts to clinch what is reality and can we ever

get there. Having said as much, we can continue as if it had not been said. The value of a philosopher's thought is not in its answers – no philosopher has any that are more helpful than saying nothing at all – but in how well they speak to the prejudgments of their consumers. Such is the importance – and the nullity – of rhetoric. Ask any hard-line pessimist, but do not expect him to expect you to take his words seriously.

The greatest strike against philosophical pessimism is that its only theme is human suffering. This is the last item on the list of our species' preoccupations and detracts from everything of any importance to us, such as the Good, the Beautiful, and tomorrow's weather. Cures may be discovered for certain diseases and sociopolitical barbarities may be amended, but these are only stopgaps. Human suffering is insoluble as long as human beings exist. The one truly effective solution for suffering is that spoken of in Zapffe's 'Last Messiah'. It may not be a realistic solution for a stopgap world, but it is one that would forever put an end to suffering, should we ever care to do so. The pessimist's credo, or one of them, is that nonexistence never hurt anyone and that conscious existence hurts everyone. (Uneasy indeed are the heads that wear the crown of creation). Without consciousness we would still know pain; suffering, however, would not disturb us.

The twentieth-century Austrian philosopher Ludwig Wittgenstein once said or wrote, 'I don't know why we are here, but I'm pretty sure it is not in order to enjoy ourselves'. But Wittgenstein's uncertain determination does not go to the heart of human existence. Hedonism is irrelevant as a justification for our lives. No price is too high for our creaturely reward of just being here and knowing that others will be here after us. This is our 'pleasure', and no amount of suffering will lead our species to question it. While this pleasure began as a relief from the anxieties of genealogical slippage, it now stems in the main from psychological satisfactions. The modern family unit is an indulgence, not a necessity. It is a satisfaction of the ego or an appurtenance of one's public image. Children are not economic insurance for their families but consumer goods, personal accessories, trinkets or tie-clips. No longer their parents' *employees*, as in earlier days, they strike out on their own and go into business for themselves when sufficient capital has been accumulated or may be borrowed – life on the installment plan.

But if the price of suffering has fallen – not that it was ever unaffordable – we still must deal with a progressively insidious consciousness, that invader of our homes and heads. Zapffe's achievement as a pessimist treads beyond plaints of how rich with suffering life can be. We – as genetic donors consorting two by two for the protraction of our species – have no problem with suffering. The problem for us – as billions of lone individuals who mingle but can never merge with one another – is the pyrotechnics of cogitation we must perform to stave off our consciousness of pain, of death, of life as a danse macabre into which we are always pulling new partners and lying to them as we lie to ourselves.

Our success as a survival-happy species is calculated in the number of years we have extended our lives, with the reduction of suffering being only incidental to this aim. The lifespan of non-domesticated mammals has never changed, while ours has grown by leaps and bounds. What a coup for us. Unaware of the length of their stay on earth, other warm-blooded life forms are sluggards by comparison. Without consciousness of death, we would not frantically rouse ourselves to lengthen our mortal tenure. And how we have cashed in on our efforts: no need to cram our lives into three decades now that we can cram them into seven, eight, nine, or more. Time will run out for us as it does for all creatures, true, but at least we can dream of a day when we might *choose* our own deadline. Then everyone could die of the same thing: satiation with a durability that is MALIGNANTLY USELESS. Without a terminus for the journey of our lives, their uselessness would become excruciatingly overt. Knowing ourselves to be on a collision course with the Black Wall of Death may be a horror, but it is the only thing that makes it possible to value that which comes before, if we are not too cast down by thoughts of our mortality to do so. While this quid pro quo may be a bad value, without it there is no value. Only a terminal point, only *endness*, can make the present seem precious, although the here-and-now is almost invariably taken for granted so that we can squander what little time we have by looking cockeyed to the future. It is in the future that we expect to inherit a greater value than that which trickles backwards into our lives from their certain end. But as everyone knows, even though we disregard this knowledge, the future is only the present in disguise, and as soon as it arrives we begin hunting for *another* future. Not until the future is behind us can there be any peace on this earth or in our heads. If only we could end our arduous voyage to a fool's future, Zapffe's prospectus for our self-extermination would be a walk in the park. At all levels, the systems of life – from sociopolitical systems to solar systems – are repugnant and should be negated as MALIGNANTLY USELESS.

'Worthless' rather than 'useless' is the more familiar epithet in this context. The motive for using 'useless' in place of 'worthless' in this histrionically capitalized phrase is that 'worthless' is tied to the concepts of desirability and value, and by their depreciation introduces them into the mix. 'Useless', on the other hand, is not so inviting of these concepts. 'Worthless' can serviceably be connected to the language of pessimism and does what damage it can. But the devil of it is that 'worthless' really does not go far enough when speaking pessimistically about the character of existence. Too many times the question 'Is life worth living?' has been asked. This usage of 'worth' excites impressions of a fair lot of experiences that are arguably desirable and valuable within limits and that follow upon one another in such a way as to suggest that life is not worthless overall, or not so worthless that a case could not be made for its worth. With 'useless', the spirits of desirability and value do not as readily rear their heads, and existence as dizzying pointlessness state of affairs may be more intemperately asserted. Naturally, the uselessness of all that is or could be may be repudiated as well or badly the worthlessness of all that is or could be. For this reason, the adverb 'malignantly' has been annexed to 'useless' to give it a little more semantic stretch, if not enough to deter any rebuttals from the opposition. But to express with any adequacy a sense of the sucking uselessness of everything, a nonlinguistic modality would be needed, some effusion out of a dream that coalesced every nuance of the useless and wordlessly transmitted to us the inanity of any possible thing, conception, or condition. Indigent of such means of communication, the uselessness of all that exists or possibly could exist must be spoken with a poor potency.

Of course, everyone believes there are things, conceptions, and conditions that are not useless. We all live within relative frameworks where something may not be useless – in a practical way – with respect to something else. A potato masher is not useless if one wants to mash potatoes. For some people, a system of being that includes a god may not seem useless, possibly because it involves concepts such as eternity and infinity. Yet even something that involves concepts such as eternity and infinity is not saved from being useless except within a relative framework of what is not eternal or infinite. It would then not be useless only in the same relative capacity as a potato masher. As long as there are entities that are relative to one another, they will be potato-masher entities. And if there were a god that had no relation to anything that was not that god – that was not relative to anything because nothing else existed – then such a thing would be the paradigm of uselessness, being that there would be nothing for which it could not be useless. Should that god drum up a universe in which there were things for which it would not be useless, it could only be a potato-masher god. Far more likely in the minds of many people is that the universe was drummed up without a god, thereby making the uselessness of that universe, except in the potato-masher relations of its part, unbelievably evident. Some people do not get up in arms about the relativity of everything; others do. The latter want to worship gods that are not just potato-masher gods or to think in terms of absolutes that are really absolute and not just absolute potato-mashers. They cannot accept an existence in which everything is MALIGNANTLY USELESS except as some species of potato masher. They particularly do not like to think that they themselves are potato-masher things living potato-masher lives in a potato-masher world.

Christians, Jews, and Muslims have a real problem with a potato-masher world. Buddhists have no problem with it because for them the way to salvation is to realize the truth of ‘dependent origination’, which means that everything is related to everything else in a great network of potato mashers that are always interacting with one another. So the only problem Buddhists have is not being able to realize that everything is a great network of potato mashers. They think that if they could get over this hump, then they would be forever liberated from suffering. In the Buddhist faith, everyone suffers who cannot see that the world is a MALIGNANTLY USELESS potato-mashing network. Contrary to Christians, Jews, and Muslims, Buddhists do not have the handicap of believing in a god or even in their own reality, although they do have other handicaps.

DISCONTENT

Being royally conscious of the solemn precincts in which we exist, of the savage wasteland and sordid burlesque that lies beneath life’s piddling nonsense, would turn us to dust. Saddled with self-knowledge, we thrive only insofar as we vigilantly obfuscate our heads with every baseless belief or frivolous recreation at our disposal. But as much as our heads are inclined to clog themselves with such trash, a full-scale blockage is impossible. This impossibility makes us heirs to a legacy of discontent. In his study *Suicide* (1897), the French sociologist Emile Durkheim contended that ‘one does not advance when one proceeds toward no goal, or – which is the same thing – when the goal is infinity. To pursue a goal which is by definition unattainable is to condemn oneself to a state of perpetual unhappiness’. Who can gainsay that the goal of our race has no visible horizon and therefore, in Durkheim's view, we are doomed, as the French thinker rather euphemistically put it, to 'a state of perpetual unhappiness'? Along similar lines, psychoanalyst Adam Phillips writes in his *Darwin's Worms: On Life Stories and Death Stories*:[14] 'Tyrannical fantasies of our own perfectibility lurk in even our simplest ideals, Darwin and Freud intimate, so that any ideal can become another excuse for punishment. Lives dominated by impossible ideals, complete honesty, absolute knowledge, perfect happiness, eternal love are experienced as continuous failures.' (Phillips' twist of mind may be seen as self-serving due to his belief in psychoanalysis, which by its nature is not designed to make people happy on a tight schedule, or to make them happy at all). To counter these glum assessments of things, the world's religions all offer goals that they say are very much attainable, if only in the afterlife or the next life.

In *The Myth of Sisyphus* (1942), existentialist superstar Albert Camus represents the unattainable goal of the title figure as an apologetic for going on with life rather than ending it. As Camus insisted in his discussion of this gruesome parable, 'We must imagine Sisyphus as happy.' The credo of the Church Father Tertullian, 'I believe because it is absurd', might as rightly be attributed to Camus. Caught between the fabrications of the Carthaginian and the rationalizations of the Frenchman, Zapffe's proposal that we put out the light of the human race extends to us a solution to our troubles that is infinitely more satisfying than that of either Tertullian or his modern avatar Camus, who considered suicide as a philosophical issue for the individual yet, by some oversight, did not entertain the advantages of an all-out attrition of the species. Aside from a repertoire of tricks we can do that other animals cannot, the truest indicator of a human being is unhappiness. The main fount of that unhappiness, as Zapffe and others have written, is our consciousness. And the more dilated consciousness becomes, the more unhappy the human. In the end, Camus' injunction that we *must* imagine Sisyphus as happy is as unavailing as it is feculent.

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[14] London: Faber, 1999.

On the subject of whether or not life is worth the trouble, the answer must always be unambivalent . . . and positive. To teeter the least bit into the negative is tantamount to moral suicide. If you value your values, no doubts about this matter can be raised, unless they occur as a lead-up to some determinate affirmation. In the products of high or low culture, philosophical disquisitions, and arid chitchat, the anthem of life *must* forever roar above the squeaks of dissent and *must* be delivered to us without abatement or appreciable contradiction. We were all born into a rollicking game that has been too long in progress to allow a substantive change in the rules. Should the incessant fanfare that meets your ears day in and day out sound out of tune and horribly inappropriate, you will be branded *persona non grata* and welcome wagons will not stop at your door. So if you know what is best for you and want a good seat from which to watch human existence as it goes by, you must *not* recognize Zapffe's proposal for the salvation-by-extinction of the human race as a solution to the absurdity of life.

Those who treasure philosophical and literary works of a pessimistic, nihilistic, or defeatist nature as indispensable to their existence are hopelessly frustrated with living in a world on autopilot when they would like to switch it over to manual consciousness and nosedive humanity into a crash without survivors. On the flip side, most ordinary

people can live with discontent because it is concomitant with their expectation that humanity will forever 'survive' (Middle English by way of Middle French from the Latin *supervivere* – to outlive or live beyond). Bulletin: we, as a subcategory of the *mélange* of earth's organisms, may outlive other species, but we will not live beyond our own time of extinction, as over ninety-nine percent of preceding life forms on this planet have not lived beyond theirs. We can pretend this will not happen, fantasizing super-scientific eternities, but in good time we will be taken out of the scene. This turn of events will be the defeat of Project Immortality, which has been in the works for millennia.

MISTAKE

Consciousness is an existential liability, as every pessimist agrees. It is also a mistake that has taken humankind down a black hole of logic: to make it through this life, we must pretend that we are what we are not, according to Zapffe's Paradox. To correct this mistake, we should desist from procreating. What could be more judicious or more urgent? At the very least, we might give some regard to this theory of the mistake as a 'thought-experiment'. All civilizations become defunct. All species die out. All the suns of all the galaxies will blow up. There may even be an expiration date on the universe itself. Human beings would certainly not be the first phenomenon to go belly up. But we could be the first to spot our design-flaw, that absent-minded flub of nature called consciousness, and do something about it. And if we are mistaken about consciousness being a mistake, our self-removal from this planet would still be a magnificent move on our part, the most laudable masterstroke of our existence, and the only one. No evil would attend our departure from existence, and the many evils we have known would go extinct along with us.

Taking our leave from life might seem a thoroughly negative course of action, but it is not as simple as that. Every negation is adulterated or secretly initiated by an affirmative spirit, mass suicide included. An unequivocal ‘no’ cannot be uttered or acted upon. Lucifer’s last words in heaven may have been ‘Non serviam’, but none has served the Almighty so well, since His sideshow in the clouds would never draw any customers if it were not for the main attraction of the devil’s hell on earth. Only catatonics and coma patients have what it takes to sit out the horseplay of creation. Without a ‘yes’ in our hearts, nothing would be done. And to be done with our existence *en masse* would be the most ambitious affirmation of all.

With regard to consciousness, ‘fluke’ or ‘mutation’, rather than ‘mistake’, would be more accurate terms in the present discussion, since it is not in the nature of Nature to make mistakes – it just makes what it makes. ‘Mistake’ has been used for its pejorative connotation in ‘The Last Messiah’. Of course, phenomena other than consciousness have been thought to be a mistake, beginning with life itself. For example, in a novel titled *At the Mountains of Madness* (1936), the American writer H. P. Lovecraft has one of his characters mention a ‘primal myth’ about ‘Great Old Ones who filtered down from the stars and concocted earth life as a joke or mistake’. Schopenhauer, once he has drafted his theory that everything in the universe is energized by a Will-to-live, shifts to a commonsense pessimism to visualize a species inattentive to the possibility that its life is a concatenation of snafus.

> Many millions, united into nations, strive for the common good, each individual for his own sake; but many thousands fall sacrifice to it. Now senseless delusion, now intriguing politics, incite them to wars with one another; then the sweat and blood of the multitude must flow, to carry through the ideas of individuals, or to atone for their shortcomings. In peace, industry and trade are active, inventions work miracles, seas are navigated, delicacies are collected from all the ends of the earth; the waves engulf thousands. All push and drive, some plotting and planning, others acting; the tumult is indescribable. But what is the ultimate aim of it all? To sustain ephemeral and harassed individuals through a short span of time, in the most fortunate cases with endurable want and comparative painlessness (though boredom is at once on the lookout for this), and then the propagation of this race and of its activities. With this evident want of proportion between the effort and the reward, the will-to-live, taken objectively, appears to us from this point of view as a folly, or taken subjectively, as a delusion. Seized by this, every living thing works with the utmost exertion of its strength for something that has no value. But on closer consideration, we shall find here also that it is rather a blind urge, an impulse wholly without ground and motive.[15]

Schopenhauer is here straightforward in limning his awareness that, for human beings, being alive is all 'folly' and 'delusion'. He also noted elsewhere in his work that consciousness is 'an accident of life'.

Schopenhauer's is a great pessimism, not least because it revealed a pattern underlying the pessimistic imagination. As indicated, Schopenhauer's insights are yoked to a philosophical superstructure centered on the Will, or the

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[15] *The World as Will and Representation,* trans. E. J. F. Payne (NY: Dover, 1969).

Will-to-live, a blind, deaf, and dumb force that surfaced for reasons unknown, assembled a universe, and, once human bodies had shot up within it, mobilized them to their detriment. While Schopenhauer's metaphysics is impossible to swallow and could never persuade anyone of its validity, no intelligent person can fail to see that every living thing behaves *exactly* in conformance with his thought in its liberal articulation: wound up like toys by some force – call it Will, *élan vital*, *anima mundi*, or whatever – organisms go on running until they run down. In pessimistic philosophies, only the force is real, not the things that are activated by it. They are only automata, puppets, and, if they have consciousness mistakenly, believe that they are self-winding selves and not self-conscious nothings suffering from Zapffe's Paradox. Here, then, is the pattern Schopenhauer made discernable in pessimism: behind and beyond the scene of life, there are machinations that are not amenable to resistance or control. For Zapffe, consciousness is a mistake, but it is also a mystery whose workings elude us while we are tugged along by the invisible hand of nature to survive and reproduce. For Unamuno, we are prodded by an irrational and irresistible vitalism to letch after immortality. For Michelstaedter, individuals are fitted into a straightjacket by faceless doctors who control their patients' minds with unrealities. For Mainländer, a Will-to-die, not a Will-to-live, plays the occult master pulling our strings.

Of a kind with these scheming powers that the pessimist places in the background of life are those enormities that skulk within the narratives of the great supernatural horror writers. In conceiving Azathoth, that 'nuclear chaos' which 'bubbles at the center of all infinity', Lovecraft might well have been thinking of Schopenhauer's Will. In 'The

Willows', the twentieth-century British writer Algernon Blackwood suggests the existence of a minatory force as unseen and pitiless as Zapffe's Nature. Such supernatural writers are great because they do not follow the rules of popular horror literature: there are no 'good versus evil' scenarios in their stories and no one need survive to make for a good ending. Human beings are set up to be destroyed, as they are in reality, and their destruction occurs not in an everyday world bustling with life and pleasure but in hermetic haunts bustling with death and suffering.

ECOCIDE

Despite Zapffe's work as a philosopher, although not in an occupational capacity (he earned his living by writing poems, plays, stories, and humorous pieces), he is nonetheless better known as an early ecologist who popularized the term 'biosophy' to name a discipline that would broaden the compass of philosophy to include the interests of other living things besides human beings. Thereupon, he serves as an inspiration to the environmentalist agenda, the politics of the health of the earth. Here, too, we catch ourselves – and Zapffe himself, as he affirmed – in the act of conspiring to build barricades against the odious facts of life by isolation, anchoring, distraction, and sublimation as we engage in an activity (in this case the cause of environmentalism) that bypasses the perennial issue. Vandalism of the environment is but a sidebar to humanity's refusal to look its fate in the face. We live in a habitat of unrealities – not of earth, air, water, and wildlife – and cuddly illusion trumps grim logic every time. Some of the more militant environmentalists, however, have concurred with Zapffe that we should retire from existence, although their advocacy of abstinence and universal suicide to save the earth from being pillaged by human beings is not exactly what the philosopher had in mind. While a worldwide suicide pact is highly appealing, what romantic fabrications would cause one to take part in it just to conserve this planet? The earth is not our home. We came from nothing, and to that condition our nostalgia should turn. Why would anyone care about this dim bulb in the blackness of space? The earth produced us, or at least subsidized our evolution. Is it really entitled to receive a pardon, never mind the sacrifice of human lives, for this original sin – a capital crime in reverse (just as reproduction makes one an accessory before the fact to an individual's death)? Someone once said that nature abhors a vacuum. This is precisely why nature should be abhorred. Instead, the nonhuman environment is simultaneously extolled and ravaged by a company of poor players who can no longer act naturally. It is one thing for animals to feed and fight and breed in an unthinking continuance of their existence. It is quite another for humans to do so, since it is possible for us to ask the wholly legitimate question: 'Is it really all right for us to be alive and know that we will die?'

It might be theorized that the human species evolved to serve as nature's roundabout way of cutting into its veins and bleeding out. A strange idea, no protesting that, but not the strangest we have ever heard or lived by. We could at least take up the theory and see where it leads. If it is false, then where is the harm? But until it is proven so, we must let ourselves be drawn along by nature's plan, as we always have, if only by twiddling our thumbs and letting its suicidal course continue without interference. From a human vantage, would this not be a just self-punishment on nature's part for fashioning a world in which pain is essential, a world that could not exist without pain, a world where pain is the guiding principle of all organisms, which are inexorably pushed by pain throughout their lives to do that which will improve their chances to create more of themselves? Left unchecked, this process will last as long as a single cell remains quivering in this cesspool of the solar system, this toilet of the galaxy. So why not lend a hand in assisting nature's suicide, in case it has second thoughts? For want of a deity, let the earth take the blame for our troubles. What else is it good for? Let it save itself if it can – the condemned are known for the acrobatics they will execute to wriggle out of their sentences – but if it cannot destroy what it has made, then may it perish along with every other living thing it has brought forth in pain. While pain is not a problem for species, even a hyper-conscious hive of creatures such as human beings for whom pain has been upgraded to suffering, it is not a phenomenon whose praises are often sung.

DEICIDE

The idea of a self-destructing nature parallels Mainländer's fantasy in which the Will-to-die that should inhere in humanity is only a reflection of the death wish of a God who, in the beginning, masterminded His own quietus from an existence He did not want to spin out any longer than it had already been spun. God's plan to suicide himself could not work, though, while he existed as a unified entity outside of space-time and matter. Seeking to nullify His oneness so that He could be delivered into nothingness, he disintegrated Himself – big bang-like – into the time-bound fragments of the universe, which included organic life forms. In Mainländer's philosophy, 'God knew that he could change from a state of super-reality into non-being only through the development of a real world of multiformity.' Through this method, He excluded Himself from existence. 'God is dead', wrote Mainländer, 'and His death was the life of the world'. Once the great individuation had been accomplished, the momentum of its creator's self-annihilation would continue until nothing remained standing. And those who committed suicide, as did Mainländer, would only be following God's example and moving toward the end of the Creation. Furthermore, the Will-to-live that Schopenhauer argued activates the world was revised by his disciple Mainländer as evidence not of a movement of a tortured life within beings, but as a deceptive cover for an underlying will in all things to burn themselves out as hastily as possible in the fires of becoming ... or begoing, as it were. In this light, human progress is shown to be an ironic symptom that our downfall into extinction has been progressing nicely, because the more things changed, the more they progressed toward a reliable end.

While the wisdom of religions such as Christianity and Buddhism is all for leaving this world behind, their leave-taking is for destinations unknown and impossible to conceive. For Mainländer, these destinations do not exist. His forecast is that one day our will to survive in this life or any other will be universally extinguished by a conscious will to die and stay dead, after the example of God. From the standpoint of Mainländer's philosophy, Zapffe's Last Messiah would not be an unwelcome sage but a crowning force that has been in the works since God took his own life. Rather than resist our end, as Mainländer concludes, we will come to see that the knowledge that life is worthless is the flower of all human wisdom. Elsewhere the philosopher states, Life is hell, and the sweet still night of absolute death is the annihilation of hell. Mainländer's cosmic scenario, inhospitable as it is to all other ideations that include a god-figure, should give pause to those absorbed with supernatural schemes that are no less bizarre (for example, the much-studied soteriology of the Gnostics). Consider this: if God exists, or once existed, what would He not be capable of doing? Why should God not want to be done with Himself as a reaction to His suffering the sickness and pain now reflected in His creation? Why should He not have kicked off a universe that is one great puppet show destined by Him to be crunched or scattered until an absolute nothingness has been established? Why should He fail to see the benefits of nonexistence, as many of us lesser beings have? Alone and immortal, nothing needed Him. In the same way, nothing in this world needs us, which could be why we created a god who pays attention to everything we do, since no other organism cares about us or could be diminished by our extinction. (Quite the opposite). Mainländer's first philosophy, and last, is in fact odd, but no more so than those of any religious or secular ethos that presupposes the worth of human life. Both are objectively insupportable and come out of nowhere: they are only propensities in search of validation.[16]

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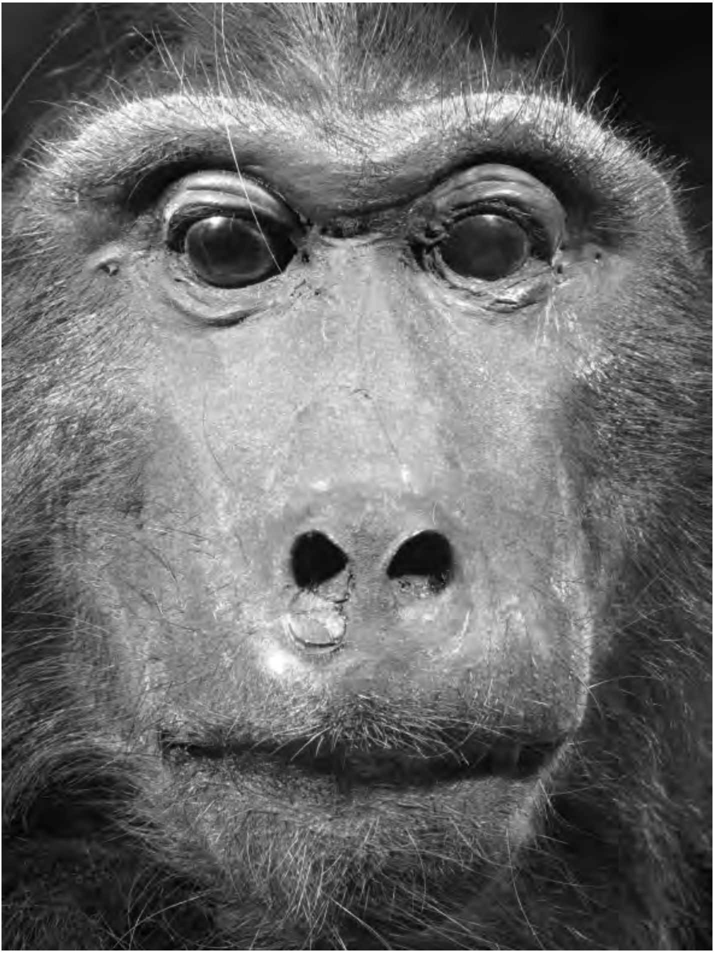
[16] This précis of Mainländer's philosophy is sourced in Thomas Whittaker's *Essays and Notices Philosophy and Psychological*, 1895; Rudolph Steiner's *The Riddles of Philosophy*, 1914, and *Evil: Selected Lectures*, 1918; Radoslav Tsanoff's *The Nature of Evil*, 1931; Johann Joachin Gerstering's *German Pessimism and Indian Philosophy: A Hermenuetic Reading*, 1986; and Henry Sheldon's *Unbelief in the Nineteenth Century*, 2005. For a rebuttal of Mainländer's thought, see H. P. Blavatsky's 'The Origin of Evil' in the October 1897 issue of the journal *Lucifer*.



PESSIMISM

It would be a sign of callowness to bemoan the fact that pessimistic writers do not rate and may be denounced in both good conscience and good company. This judgment makes every kind of sense in a world of card-carrying or crypto-optimists. Once you understand that, you can spare yourself from suffering excessively at the hands of 'normal people', a pestilent confederation of upstanding creatures who in concert keep the conspiracy going by rehashing their patented banalities and watchwords. This is not to say that such people do not have their struggles and responsibilities, their pains and sufferings, and their deaths by accident, murder, or disease, which only makes all the more pestilent their normal thinking that being alive is all right and that happiness should attend upon the arrival of life's newcomers, who, it is always assumed, will be normal.

Phobic to any somber cast of thought, humankind as nonetheless imbibed ever-increasing disillusionments throughout its history. The biblical Genesis, along with all other fables of origination, has been reduced to a mythic analogue of the big bang theory and the primordial soup. Pantheon after pantheon has been belittled into 'things people used to believe'. And petitions for divine intervention are murmured only inside the tents of religious fanatics and faith-healers. In the past century or so, disillusionments of this kind have become the province of specialists in the various sciences, so they are not well understood by, if known to, those who go to church on Sunday and read the astrology column in the newspaper the rest of the week. Generalists of disillusionment broadcast on a wider frequency. Yet their message, a repetitive dirge that has been rehearsed for thousands of years, is received only by epicures of pessimism, cognitive mavericks who have impetuously circled the field in a race to the finish line.

Contemporaneous with every generation, disillusionment must proceed furtively. Anyone caught trying to accelerate its progression will be reprimanded and told to sit in the corner. While the Church has lost its clout to kill or torture dissenters such as Zapffe, Schopenhauer, and Lovecraft, they are still under watch by guard dogs both sacred and secular. A sign of progress, some would say. But sufferance of such minds should not lead us into premature self-congratulation. The pace at which our kind plods toward disillusionment is geologically slow, and humanity can be cocksure of kicking the bucket by natural causes or an 'act of God' before it travels very far toward that radiant day when with one voice it might cry out, 'Enough of this error of conscious life. It shall be passed down no longer to those innocents unborn'.

Spectral Dilemma[1]

Quentin Meillassoux

Mourning to come, god to come.

> […] every man has two things belonging to him, namely, a life and a phantom.[2]

1. THE SPECTRAL DILEMMA

What is a spectre? A dead person who has not been properly mourned, who haunts us, bothers us, refusing to pass over to the 'other side', where the dearly-departed can accompany us at a distance sufficient for us to live our own lives without forgetting them, but also without dying their death – without being the prisoner of the repetition of their final moments. Then what is a spectre become the essence of the spectre, the spectre *par excellence*? A dead person whose death is such that we cannot mourn them.

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[1] Originally published as 'Dilemme Spectrale', in *Critique* 704-705, Jan/Feb 2006.

[2] E. Tylor, *Religion in Primitive Culture* (New York: Harper and Row, 1950), 12.

That is to say: a dead person for whom the work of mourning, the passage of time, proves inadequate for a tranquil bond between them and the living to be envisaged. A dead person the horror of whose death lays heavy not only upon their nearest and dearest, but upon all those who cross the path of their history.

Essential spectres are those of terrible deaths: premature deaths, odious deaths, the death of a child, the death of parents knowing their children are destined to the same end – and yet others. Natural or violent deaths, deaths which cannot be come to terms with either by those whom they befall, or by those who survive them. Essential spectres are the dead who will always refuse to 'pass over', who obstinately cast off their shroud to declare to the living, in spite of all evidence, that they still belong amongst them. Their end attests to no meaning, brings with it no completion. These are not necessarily shadows who declare their revenge, but shadows who cry out beyond all vengeance. Whoever commits the imprudence of lending an ear to their call risks passing the rest of his life hearing their complaint.

We will call *essential mourning* the completion of mourning for essential spectres: that is to say the accomplishment of a living, rather than morbid, relation of the survivors to these terrible deaths. Essential mourning assumes the possibility of forming a vigilant bond with these departed which does not plunge us into the hopeless fear – itself mortifying – that we feel when faced with their end, but which, on the contrary, actively inserts their memory into the fabric of our existence. To accomplish essential mourning would mean: to live with essential spectres, thereby no longer to die with them. To make these spectres live rather than becoming, in hearing their voices, the mere shadow of a living being. The question which poses itself to us is thus the following: *is essential mourning possible – and if so, under what conditions*?

Is it possible, after a twentieth century whose history was dominated by odious deaths, to live a non-morbid relation with the departed, for the most part unknown to us, and yet still too close for our lives not to be secretly gnawed away at by them? At first glance, we seem to find ourselves constrained to respond in the negative. For this essential mourning seems impossible to envisage if it is referred to the general alternative of which the relation to the departed seems to admit. This alternative can be stated, summarily, in very simple terms: either God exists, or he doesn't. Or more generally: either a merciful spirit, transcending humanity, is at work in the world and its beyond, bringing justice for the departed; or such a transcendent principle is absent. Now, it becomes rapidly apparent that neither of these two options – let's call them for convenience religious or atheistic, however innumerable the ways in which they can be configured – allows the requisite mourning to take place. To say that God exists, or that he does not – whatever is thought through these two statements, both are paths to despair when confronted with spectres. To demonstrate this, let us directly exhibit, in the form of 'cases for the defence', what appear to us to be the strongest responses of each position to the challenge of such a mourning.

Take the following religious apology: 'I might hope to come to terms with my own death, but not that of terrible deaths. It is terror in confronting these past deaths, irremediably past, not my coming end, which makes me believe in God. Certainly, if my disappearance, by some chance, should be terrible, then I shall die hoping for myself what I hope for spectres. But I myself am but a spectre in waiting. I can be Sadducean for myself, and for others, but I will always be Pharisean for spectres. Or again: I might be rigorously atheist for myself, might refuse to believe in immortality for myself, but I could never do so for them: For the idea that all justice is impossible for the innumerable massed spectres of the past corrodes my very core, so that I can no longer bear with the living. Certainly, it is they, the living, who need help, not the dead; but I think that help to the living can only proceed given some hope for justice for the dead. The atheist might well deny it: for my part if I were to renounce this, I could not live. I must hope for something *for* the dead also, or else life is vain. This something is another life, another chance to live – to live something other than that death which was theirs.'

Now take the following, atheist response: 'You want to hope, you say, for something for the dead. Let's look closer, then, at what you promise them. You hope for justice in the next world: but in what would this consist? It would be a justice done under the auspices of a God who had himself allowed the worst acts to be committed, in the case of criminal deaths, or who himself had committed them, in the case of natural deaths. You call just, and even good, such a God. But what would you think of this: the promise to live eternally under the reign of a being called just and loving, who has, however, let men, women and children die in the worst circumstances, when he could have saved them without any difficulty whatsoever; who has even directly inflicted such sorrows – And even this, He says, as a mark of his infinite (and thus mysterious, unfathomable) love for the creatures he thus afflicts. To live under the reign of such a perverse being, who corrupts the most noble words – love, justice – with his odious practices: isn't this a good definition of hell? You say that in the dazzling presence of such a God, I will grasp the infinitely loving nature of his attitude to his creatures? You only succeed in exacerbating the nightmare you promise: for you suppose that this being has the power to spiritually transform me in such a radical fashion as to make me love He who allows such atrocities to occur, for having let those atrocities occur. This is a promise of a spiritual death infinitely worse than a merely bodily death: in the presence of God, I will cease to love the Good, for He would have the power to make me love Evil as if it were Good. If God exists, the exit of the dead is thus aggravated to infinity: their bodily death is redoubled in their spiritual death. To this hell you wish for them, I prefer, for them as for myself, nothingness, which will leave them in peace and conserve their dignity, rather than putting them at the mercy of the omnipotence of your pitiless Demiurge.'

We can see that each of these two positions is only supported by the weakness of the other: the atheist is atheist because religion promises a fearful God; the believer anchors his faith in the refusal of a life devastated by the despair of terrible deaths. Each masks his specific despair by exhibiting his avoidance of the other's despair. Thus the dilemma is as follows: either to despair of another life for the dead, or to despair of a God who has let such deaths take place.

We will call *spectral dilemma* the aporetic alternative of atheism and religion when confronted with the mourning of essential spectres.[3] In this aporetic alternative, we oscillate between the absurdity of a life without God, and the mystery of a God who calls 'love' his *laissez-faire* and production of extreme evil: the double form of a failure to accomplish essential mourning. On the contrary, we will call a *resolution* of the spectral dilemma a position which would be neither religious nor atheist, and which, because of this, would manage to extract itself from the double despair inherent to their alternative: despairing at the belief in justice for the dead, or believing despairingly in a God without justice. Our question concerning the possibility of essential mourning can be reformulated as follows: *Under what conditions could we hope to resolve the spectral dilemma*? How to think a bond between the living and dead which extracts itself from the twofold distress of the atheist and the religious believer?

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[3] I have called 'religious' every position which brings together the thesis of a life beyond the grave with the existence of a personal God; 'atheistic' every position

To sketch a possible response to this question, we must proceed in the following fashion: we must exhibit the conditions of a solution to the dilemma, and evaluate the theoretical legitimacy of the latter along with its credibility. We do not exclude, of course, the possibility that this solution might eventually turn out to be illusory, and that we might have in the end to renounce extracting ourselves from the atheo-religious alternative. But this potential renunciation must proceed only from the precise examination of the solution. Not being able to present the

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which recuses both of these theses. One might certainly conceive of positions which derogate from this convenient classification: Sadduceanism, evoked above, conjugates the belief in a personal God with the refusal of immortality; Spinozism, on the other hand, conjugates the recusal of a personal God with the thesis of a possible immortality. However, such positions do not change the essential point of the analysis: the incapacity of the principal systems of representation to resolve the spectral dilemma. In the case of Sadduceanism, I add to the despair of an evil God the despair of the non-resurrection of the dead; in the case of Spinozism, I must renounce all hope of a happy immortality for those who perished too soon to accede to wisdom, and accommodate myself to the pitiless necessity which presides over this type of destiny.

latter in its totality, we will content ourselves here with commencing its exposition.

2. CONDITIONS FOR THE RESOLUTION OF THE DILEMMA: THE DIVINE INEXISTENCE

Let us begin by exposing what we shall call the 'formal' conditions for a resolution of the dilemma. These conditions constitute at once the irreducibly legitimate part of the two preceding positions – atheistic and religious – and the source of the aporia. Each of these positions of the dilemma exhibits, we believe, an indispensable element of essential mourning:

- the religious position establishes that mourning is not possible unless we can hope for the dead something other than their death. The spectres will not pass over to the other world until the day we might hope to see them rejoin ours.
- The atheistic position establishes that the existence of God is an insurmountable obstacle to the elaboration of such despair, for only a perverse God could permit terrible deaths, and only an even more perverse God could make himself loved for doing so.

The aporia stems from the fact that these two conditions, equally indispensable, appear incompatible. There is only one way, then, to lift this impasse: we must prove that the incompatibility between these conditions is only apparent, and that there exists a third option, neither religious nor atheistic, capable of coherently combining the two elements of the response. From this point on, our path is clear: *resolving the dilemma comes down to making thinkable the statement* *conjugating the possible resurrection of the dead* – the religious condition of the resolution – *and the inexistence of God* – the atheistic condition of the resolution. These two elements will be synthesised in the following statement, which will occupy our attention from now on:

God no longer exists.

This statement formulates a thesis which we will call the thesis of *divine inexistence*, an expression that must be understood in the twofold sense that permits its equivocity. Firstly, in an immediate fashion, the divine inexistence signifies *the inexistence of the religious God*, but also the metaphysical God, supposed actually existent as Creator or Principle of the world. But the divine inexistence also signifies *the divine character of inexistence*: in other words, the fact that what remains still in a virtual state in present reality harbours the possibility of a God still to come, become innocent of the disasters of the world, and in which one might anticipate the power to accord to spectres something other than their death.

The position of the divine inexistence allows us to grasp the source of the apparent insolubility of the spectral dilemma. The latter comes from the fact that atheism and religion seem to constitute an alternative exhausting all the possibilities: either God exists, or he does not. But the two theses are in truth stronger than these factual statements: for their sense lies in the supposedly *necessary* character of either the inexistence or the existence of God. To be atheist is not simply to maintain that God does not exist, but also that he could not exist; to be a believer is to have faith in the essential existence of God. We now see that the thesis of the divine inexistence must, to gain ground against such an alternative, shift the battle to the terrain of modalities:

It is a question of maintaining that *God is possible* – not in a subjective and synchronous sense (in the sense that I maintain that it is possible that God currently exists), but in an objective future sense (where I maintain that God could really come about in the future). At stake is the unknotting of the atheo-religious link between God and necessity (God must or must not exist) and its reattachment to the virtual (God could exist).

The question then takes on a greater precision: resolving the spectral dilemma comes down to exhibiting the exact sense of the divine inexistence, at the same time as establishing that one can legitimately adhere to it.

The thesis – God no longer exists – can be decomposed according to two poles of signification which must then be studied consecutively:

1. What must be signified by a 'no longer', in order for a god to be thought as one of its eventualities? Such an examination comes down to thinking the signification of a time compatible with essential mourning: What is time, if it contains the divine as one of its virtualities, and what could legitimate our belief in the effectivity of the latter?
2. What does the signifier 'god' really mean once the latter is no longer posited as existing – as possible and to come, but no longer as actual and necessary? Such an examination would necessitate, notably, an elaboration of the elements of a discourse on the divine distinct from all theology founded on the thesis of an eternal God.

Within the confines of the present article we can only broach the first point. We will thus agree here to understand by ‘god’ the minimal sense required for an essential mourning to be envisaged: the emergence of a regime of existence in which, for the spectres, something begins other than their death.

3. SPECULATIVE TREATMENT OF HUME’S PROBLEM

What would a time capable of divine emergence be? And what could make us decide to adhere to the idea of such a time, knowing that our all-too-evident desire to believe, far from rendering the task easier for us, can only increase our suspicion in regard to every plea which flatters our hopes?

Before entering into the heart of the subject, let us begin by distinguishing the so-called ‘occult’ senses of the divine inexistence, that is to say those which rest upon the thesis that a hidden law exists, unknown for the moment, but capable of being at the origin of a redemption to come. This thesis comes down to an atheistic or religious interpretation of the divine inexistence, depending on whether it will be a question of founding the hope of rebirth on the Promethean mastery of death by a future humanity supposed technically capable of effectuating it; or a question of maintaining that a necessary process of divinisation of the world is already secretly in progress, which will culminate in universal justice for the living and the dead alike. In both cases, one maintains that an occult law exists upon which all hopes must rest: a natural law not yet known, of the resurrection of bodies, a providential law of progressive emergence of the divine – indemonstrable, even fantastic, theses, incapable in any case of supporting any serious hope.

But as soon as we prohibit ourselves any such path, we must say of the sought-after God not only that it must be posited as inexistent and possible, but also that it can only be conceived as *contingent* and *unmasterable*. This God, in fact, cannot be posited except as contingent, in the sense that, if its thinkability supposes that nothing prohibits its advent, inversely, no destinal law can be supposed to guarantee its emergence, for such a supposition is still theoretically exorbitant. It must be able to be, but nothing can be thought that constrains it to be. And this God can only be thought as unmasterable in its advent, in the sense that it must exceed all phantasmatic hopes of absolute domination of nature on the part of man. Neither Prometheanism of death vanquished, nor providentialism of a god to come – which are just exacerbated versions of atheism and religion confronted with the spectral dilemma – can found the hope of a solution.

Taking as granted the following hypotheses:

1. The laws of nature do not allow us to hold out any serious hope of a future rebirth of the departed.
2. Neither is there any hope of a transcendent Order of laws of nature, a bringer of justice for living and dead, whether actually at work, or in the course of emerging.

What outcome remains to us? It suffices, in response to this question, to determine what it is in such hypotheses that constitutes an obstacle to essential mourning: What seems to prohibit any resolution of the spectral dilemma, once I renounce the idea that a law exists, either natural or supernatural, capable of realising my hopes? The response is obvious: If I admit that there only exist natural laws incapable of resolving my dilemma, then this dilemma is insoluble, in so far as – but only in so far as – I admit also *the necessity of the laws of nature*. It is not the incompatibility between the laws of nature and the divine which prevents essential mourning: it is the belief in the necessity of such laws. And it is indeed this modal thesis which founds the atheistic belief in the impossibility of the existence of God, as of any event contradicting the attested constants.

The first question we must treat is thus as follows: what founds my adhesion to the necessity of laws, and thereby my refusal of any possible event's contradicting them? Now, this problem is well-known since it is precisely *the question posed by Hume concerning the rational justification of our belief in causal necessity*. We are consequently confronted once more by this question, but – let us note well, for this is the speculative interest of the matter – we must tackle it 'backwards' in relation to its traditional treatment.

Let us explain. The usual way of posing the question of causal necessity proceeds with the interrogation as formulated by Hume himself, and which can be stated as follows: it being understood that we believe in the necessity of laws, can this belief be founded in reason, so as to guarantee that laws will be in the future what they are today, all other circumstances being equal? The aporia encountered by Hume consists in the fact that neither logic nor experience are able to offer any such justification. For, on one hand, there is nothing contradictory in the observable constants being modified in the future; and, on the other, experience teaches us only about the present and the past, not the future. So that the supposed necessity of natural laws becomes an enigma since the Principle of Sufficient Reason cannot be effectively applied to it: We cannot rationally discover any reason why laws should be so rather than otherwise, that is to say why they should remain in their current state rather than being arbitrarily modified from one moment to the next.

Now, our perspective is the inverse of Hume's: for we propose on the contrary to start out from the *effective possibility* that natural laws might break down without reason, in favour of an eventality incompatible with them. For we pose the following question: since Hume has convinced us that we could *a priori* (that is to say without contradiction) conceive a chaotic modification of natural laws, why not have confidence in the power of thought, which invites us to posit the *contingency* of the laws of nature, rather than in experience, in which alone the presentation of the apparent fixity of observable constants finds its source? Why extrapolate the empirical fixity of laws into a belief in their necessity, rather than adhering to the intellection of a radical Chaos which Hume has masterfully, if implicitly, revealed to us? Why not, in other words, *absolutise* the failure of the Principle of Sufficient Reason, by maintaining that the meaning of that absence of reason for laws which we run up against in the Humean problem is not an incapacity of thought to discover such reasons, but a capacity of thought to intuit *a priori*, in the real itself, the effective absence of the reason of things as laws, and the possibility of their being modified at any moment? It would be a question of making of contingency the absolute property of every being, laws as well as things – a property which a redefined reason, *a reason emancipated from the Principle of Sufficient Reason*, would take as its task to conceive and to describe. Thus the idea presents itself of an *inverted*, rather than a *reversed* Platonism, a Platonism which would maintain that thought must free itself from the fascination for the phenomenal fixity of laws, so as to accede to a purely intelligible Chaos capable of destroying and of producing, without reason, things and the laws which they obey.

Does this mean that we will have resolved Hume's problem when we have posited the contingency of laws rather than their necessity? No, indeed, for we are then confronted by another problem, in the form of an objection expressing the reason why our thesis does not appear credible, namely: If laws could be modified without reason at any moment, it would be *extraordinarily improbable* if this possibility were never to manifest itself. And in truth, if matter could incessantly, in the least of its parts, follow innumerable different laws, the disorder would be such that there would not even be manifestation. This argument, as we know, is the very core of Kant's transcendental deduction: the contingency of laws is incompatible with the constitutive stability of representation. But our task is more precise now: to resolve the reformulated Humean problem, *we must refute such an inference, from the contingency of laws to a frequent, even frenetic, disorder,* whether *of matter* or of representation; we must establish that the manifest stability of laws does not demand that we maintain their necessity. Such is the first problem – which is far from being the last – that the spectral dilemma obliges us to resolve if we would recuse the impossibility of a counter-natural event coming to pass. From this point on, God must be thought as *the contingent, but eternally possible, effect of a Chaos unsubordinated to any law*.

Let us agree to call *speculative* all philosophies which accord to thought the capacity to accede to an absolute, and *metaphysical* all philosophies which ground themselves on a modality of the Principle of Sufficient Reason to accede to the absolute. All metaphysics, according to this reading, cannot but be speculative; however, not all speculation is necessarily fated to be metaphysical. For speculation which founded itself on the radical *falsity* of the Principle of Sufficient Reason would describe an absolute which would not constrain things to being thus rather than otherwise, but which would constrain them to being able not to be how they are. We can therefore formulate the conclusion at which we wished to arrive at, namely that *the existential resolution of the spectral dilemma passes by way of the speculative, but non-metaphysical, resolution of Hume's problem*.

* * *

A few words, to conclude, on the inexistent god. How – according to what principles of investigation – might one attempt to designate its nature, once the latter is defined as a contingent effect of Chaos? On this point, we must agree to pose again, outside the transcendental field, a Kantian-style question: What am I permitted to hope for, now that I can hope? What is a god which would be once more desirable, lovable, worthy of imitation? If one supposes granted the real eventuality of emergences in rupture with the present laws of nature, what will be the most singular possible divinity, the most interesting, the most 'noble' in a sense (paradoxically) close to Nietzsche's? Must this future and immanent god be personal, or consist in a 'harmony', a becalmed community of living, of dead, and of reborn? We believe that precise responses to these questions can be envisaged, and that they determine an original regime of thought, in rupture with both atheism and theology: a *divinology*, yet to be constituted, through which will be fabricated, perhaps, new links between men and those who haunt them.

Horror Temporis

Benjamin Noys

In his 'Notes on Writing Weird Fiction' (1937) Lovecraft wrote that time played such a large part in his fiction because he found it 'the most profoundly dramatic and grimly terrible thing in the universe'.[1] On the one hand, the horror of time is not simply the trifling matter of individual human finitude, but rather the recognition of scientific statements concerning cosmic timescales that precede and exceed the existence of humanity and life itself. Unlike Engels, who hoped against hope for future relief from the second law of thermodynamics,[2] Lovecraft only foresaw future extinction.

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[1] H. P. Lovecraft, 'Notes on Writing Weird Fiction' (1937). *Malacandra*. 2003. At http://www.geocities.com/soho/cafe/1131/14notesen.htm

[2] As Engels puts it, in the vein of William Hope Hodgson's *The Night Land* (1912):

> Millions of years may elapse, hundreds of thousands of generations be born and die, but inexorably the time will come when the declining warmth of the sun will no longer suffice to melt the ice thrusting itself forward from the poles; when the human race, crowding more and more about the equator, will finally no longer

A science that produces time as indifferent to humanity is thus the source of the *horror temporis*. On the other hand, he writes that his stories are concerned with achieving the 'suspension or violation' of natural laws in order to probe 'the infinite cosmic spaces beyond the radius of our sight and analysis.' This suspension seems to promise an oneiric mysticism in the Dunsanian vein that escapes 'the prison-house of the known' into the 'enchanted lands of incredible adventures and infinite possibilities'. Thus, we seem to be left with the paradox of a horror based on science that threatens to proceed through an insipid anti-scientific mysticism. But Lovecraft's actual solution, at least in his great texts, was more inventive: the suspension of natural laws would produce a new materialism which liberates us into the experience of the horror of time in its subtraction from any law and any relation.[3]

> find even there enough heat for life; when gradually even the last trace of organic life will vanish; and the earth, an extinct frozen globe like the moon, will circle in deepest darkness and in an ever narrower orbit about the equally extinct sun, and at last fall into it. Other planets will have preceded it, others will follow it; instead of the bright, warm solar system with its harmonious arrangement of members, only a cold, dead sphere will still pursue its lonely path through universal space. And what will happen to our solar system will happen sooner or later to all the other systems of our island universe; it will happen to all the other innumerable island universes, even to those the light of which will never reach the earth while there is a living human eye to receive it.
>
> And when such a solar system has completed its life history and succumbs to the fate of all that is finite, death, what then? Will the sun's corpse roll on for all eternity through infinite space, and all the once infinitely diverse, differentiated natural forces pass for ever into one single form of motion, attraction? 'Or' - as Secchi asks – 'do forces exist in nature which can re-convert the dead system into its original state of an incandescent nebula and re-awake it to new life? We do not know'.

Dialectics of Nature (1883) 'Introduction'. At http://www.marxists.org/archive/marx/works/1883/don/ch01.htm

[3] This obviously indexes the work of Quentin Meillassoux, in particular his paper 'Subtraction and Contraction', **Collapse** III (2007): 63-107. Through a reading of

The question is of 'the mode of manifestation' of this operation, which Lovecraft regards as requiring an 'object embodying the horror and phenomena observed'. His fiction works through images of these objects, through the domain of the imaginary, but only through the impasse where the imaginary touches upon the real. If scientific laws provide him with the final regulative guarantee of consistency then his fiction probes the inconsistency of 'shattered natural law' and the inconsistency of the object. To achieve this effect requires the gradual purification of the object from the regulation of representation. In the case of time this process can be traced in the last of his great texts: 'The Shadow Out of Time' (1936).[4] Here it is a matter of what kind of object constitutes the shadow that falls from the outside – not a mystical outside of completed alterity, the *tout Autre*, but a material 'outside' which does not respond to the effect of law or to any correlation or relation to humanity.

That outside is named in the opening of the story as the 'seething vortex of time'. The preliminary image of the vortex obviously derives from Poe and his use of the vortex in the form of a whirlpool in a number of his stories.

Bergson and Deleuze Meillassoux approaches a subtractive thinking of matter as 'an *infinite madness*' in which,

> we would have to conceive what our life would be if all the movements of the earth, all the noises of the earth, all the smells, the tastes, all the light – of the earth and of elsewhere, came to us in a moment, in an instant – like an atrocious screaming tumult of all things, traversing us continuously and instantaneously. (104)

Can we suggest that this is often the state of the Lovecraftian hero at the end of many of the stories? Can we also suggest, alongside Meillassoux, that this indicates the ruination of philosophy in 'absolute communication', the point at which Lovecraft indicates the collapse of the philosophical in chaos?

[4] H. P. Lovecraft 'The Shadow Out of Time' in H. P. Lovecraft, *The H. P. Lovecraft Omnibus 3: The Haunter of the Dark and Other Tales* (London: Panther Books, 1985), 464-544.

Take, for example, this description from 'A Descent into the Maelström' (1841): 'the interior surface of a funnel vast in circumference, prodigious in depth, and whose perfectly smooth sides might have been mistaken for ebony, but for the bewildering rapidity with which they spun around.' In this case we have an image taken from nature that embodies a turbulent flow in excess of mechanistic materialism. This is nature itself as what Lacan would call *antiphysis* – a 'rotten', chaotic, fractured nature. Lovecraft radicalises this impasse of nature by not containing it within nature as an emergent fracture. Instead, as the 'seething vortex of time', the vortex becomes the chaotic space of the emergence of nature itself: the Outside. We no longer have a confined phenomena, a hole in the imaginary through which the real surges. Lacan would state that while the real does not lack anything, it is full of holes and one can even make a vacuum in it.

The mode of manifestation proceeds through a number of supplementary objects of horror that embody the shadow that falls from outside. In the first instance the shadow falls on the story's narrator, Nathaniel Peaslee, when he suffers from a strange experience of amnesia between 1908 and 1913 (the same period as Lovecraft's own nervous breakdown). As the narrative unfolds it soon becomes evident that Peaslee had his mind exchanged with a member of the Great Race – alien beings that lived on the earth fifty million years before mankind and that have mastered the secret of time. When Peaslee returns to his body he finds that 'my conception of *time* – my ability to distinguish between consecutiveness and simultaneousness – seemed subtly disordered'. This disorder of time can be explained as a result of the transference or interference by the Great Race, but also by the impact of his realisation that for these alien creatures 'there was no such thing as time in its humanly accepted sense.' During the period in which Lovecraft was writing, Heidegger and Bergson were trying to produce new concepts of time that would correlate, in however attenuated a fashion, with the human experience of time. What Lovecraft suggests is the detachment of time from any relation to humanity – proceeding without philosophy towards the real.

This, though, is only the first object of *horror temporis*. Despite the monstrous nature of these creatures, Lovecraft's narrator evinces considerable sympathy for the Great Race and their project to gather knowledge, and secure their future survival, by this process of mind exchange. The organisation of their social system by 'a sort of fascistic socialism' dominated by a clerisy implies a kind of cosmic Keynesian planner-State of the kind Lovecraft himself obviously approved. The crisis that State has to manage is the threat of the elder beings – the second object of horror. These 'half polypous, utterly alien entities' are only partly material (here we see the purification of the object) and dominated the earth six hundred million years ago. The Great Race would subdue these creatures beneath the cities they had built and which were then occupied by the Great Race. The old mole of alien class struggle had literally gone underground only to sporadically erupt in revolutions 'shocking beyond all description'. The final flight of the Great Race to new bodies would be caused by the 'final successful irruption of the elder beings'.[5]

This little allegory of 1917 and the New Deal requires little deciphering, especially after China Miéville's reading of *At the Mountains of Madness* (1931).[6] The layering of these two objects of horror can be found in Peaslee's exploration of the ancient city of the Great Race in the Australian desert, as he searches for definitive proof of his abduction. The city itself forms an abyss, parallel to the horror of the vortex, with its 'vast chain of aeon-dead black gulfs'. Within the abyssal city, however, there is a further abyss. This is one of the prisons of the 'elder things': a 'downward aperture' open and 'yawning unguarded down to abysses past imagination'. Returning back past the open trap door Peaslee stumbles and hears the resultant noise answered by 'a shrill, whistling sound, like nothing else on earth, and beyond any adequate verbal description' – the sound of the elder beings. These 'tides of abomination surging up through the cleft itself'[7] fill-out the abyss or vortex with a material presence. Unlike *At the Mountains of Madness* we are not greeted with the appearance of these creatures; instead they remain signalled only by sound.

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[5] H. P. Lovecraft 'The Shadow Out of Time', 502, 504, 505, 506.

Therefore this filling-out of the abyss is withdrawn and we are faced with a further layer of the shadow. The alien whistling of the creatures calls up another fear, the fear of being 'engulfed in a pandemoniac vortex of loathsome sound and utter, materially tangible blackness'.[8] The 'materiality' here is the subtractive or purified materiality of the vortex of seething time – the seething blackness of chaos. Recall 'The Music of Erich Zann' (1921),[9] in which the mad music of Zann is played to ward off something worse: 'the blackness of space illimitable; unimagined space alive with motion and music, and having no semblance of anything on earth.'[10] The narrative had earlier made clear how even the horror of the elder beings is finite; the Great Race knows that these creatures 'were slowly weakening with the aeons. Indeed, it was known that they would be quite dead in the time of the post-human beetle race which the fleeing minds would tenant'.[11] No consciousness, alien or human, subtends the seething vortex of time.

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[6] China Miéville, 'Introduction' in H. P. Lovecraft, *At the Mountains of Madness* (New York: The Modern Library, 2005), xi-xxv.

[7] H. P. Lovecraft 'The Shadow Out of Time', 526, 529, 534, 539, 541.

[8] Ibid., 541.

[9] H. P. Lovecraft 'The Music of Erich Zann' in *Omnibus 3*, 335-345.

Sound is then only the signal for the definitive rupture of the *musica universalis* – and the revelation of the real qua chaos – compact but full of holes. But this effect is withdrawn. The final 'shattering' revelation of Lovecraft's narrative is the – by now for the reader, entirely predictable – recovery by the narrator of a text from the depths of the alien city written in his own hand. This forms the definitive proof that 'there lies upon this world of man a shocking and incredible shadow out of time'. In this revelation we witness the retraction of the horror back towards the constraints of the object. Lovecraft himself remained dissatisfied with the story and refused to type it up. If every critical reading is a kind of rewriting, and often, as in this case, something of the expression of the text we desired rather than the text we have, then what I desire is that 'terrible thing': a fiction of the 'seething vortex of time'.

> I, Nathaniel Peaslee, have found that last proof of my otherness written in my own hand. But then this textual proof serves to keep me guarded as one of the chosen of the Great Race. I is another, another subject. We might all be doomed but I,

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[10] Ibid, 343-4.

[11] H. P. Lovecraft 'The Shadow Out of Time', 506.

Nathaniel Peaslee, have had the honour of being chosen as a great mind who will be recorded.

Something, however, whispers in poor Nathaniel's ear: What about the shadow out of time? You presume that the shadow comes from outside. You suggest, implicitly, some stable and material outside that forms the flipside of existent reality. I come with the good bad news, the shadow out of time does not exist outside time, it is time. Time itself is the shadowy vortex of a 'matter' that forms nothing and has no need of you, anyone or anything else. Good night Nathaniel and good luck.

Drawings

Todosch

p.290, p.297 (detail), p.306, p.313 (detail), p.320.
All Ink on Paper, 50 x 32 cm.

Being and Slime: The Mathematics of Protoplasm in Lorenz Oken's 'Physio-Philosophy'

Iain Hamilton Grant

> *It is a daring act of reason to set humanity free and to abstract the shock of the objective world; yet the venture cannot miscarry, since man becomes greater to the degree he knows himself and his strength.*
>
> Schelling[1]

> *A philosophy or ethics without a philosophy of nature is a non-thing, a bare contradiction, like a flower without a stem.*
>
> Oken[2]

1. INTRODUCTION: THE NON-THING OR, ON THE FORMS OCCURRING IN CONTEMPORARY PHILOSOPHY

The fate of post-Kantian philosophy depends on whether the 'shock of the objective world' can be overcome by self-knowledge, on the actuality of the 'shock of the actual'.[3] A seismic chain runs through transcendentalism's subjugation of earthquakes to epistemology, a vulcanism poignantly articulated in the objections of the cosmologist Johann Heinrich Lambert to Kant's relegation of time to an a priori form of inner intuition: '*If changes are real, then time is real* […] *If time is unreal, then no change can be real*'.[4] This is the shock of physics shattering the insularity of transcendental subjectivity, demonstrating the stakes of the modal investigation of epistemogenesis with which the transcendental philosophy attempted to replace ontology.

Schelling's account of transcendentalism as a 'daring act of reason' clearly articulates the substitution of ethics for ontology that lies at its core. The accuracy of this diagnosis is certainly revealed in transcendental philosophy's restriction of reality to the scope of possible intuition,

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1. Schelling, *Of the I as the Principle of Philosophy*, in *Schellings sämmtliche Werke*, ed. K.F.A. Schelling (Stuttgart and Augsburg: J.G. Cotta'scher Verlag, 1856-1861), 14 vols, cited as *SW* 1-14. Here *SW* 1: 157.

2. Lorenz Oken, *Elements of Physiophilosophy*, Alfred Tulk's translation, which I have occasionally modified, of Oken's *Lehrbuch der Naturphilosophie*, 3 vols (Jena: Friedrich Frommann, 1809, 1810, 1811, 3rd edition, Zürich 1843). References throughout will be to *Elements* followed by the section numbers common both to Tulk's work and the recent republication of the *Lehrbuch* as volume 2 of the newly published *Okens gesammelte Werke*, ed. Thomas Bach, Olaf Breidbach and Dietrich von Engelhardt (Weimar: Hermann Böhlhaus Nachfolger, 2007). On Oken, see Michael T. Ghiselin, 'Lorenz Oken', in Thomas Bach and Olaf Breidbach, eds., *Naturphilosophie nach Schelling*. (Schellingiana 17) (Stuttgart-Bad Canstatt: Frommann Holzboog, 2005), 433-57; Olaf Breidbach and Michael T. Ghiselin, 'Lorenz Oken's *Naturphilosophie* in Jena, Paris and London', in *History and Philosophy of the Life Sciences* 24 (2002), 219-47; and Olaf Breidbach, Hans-Joachim Fliedner and Klaus Ries, eds. *Lorenz Oken. Ein politischer Naturphilosoph* (Weimar: Hermann Böhlhaus Nachfolger, 2001).

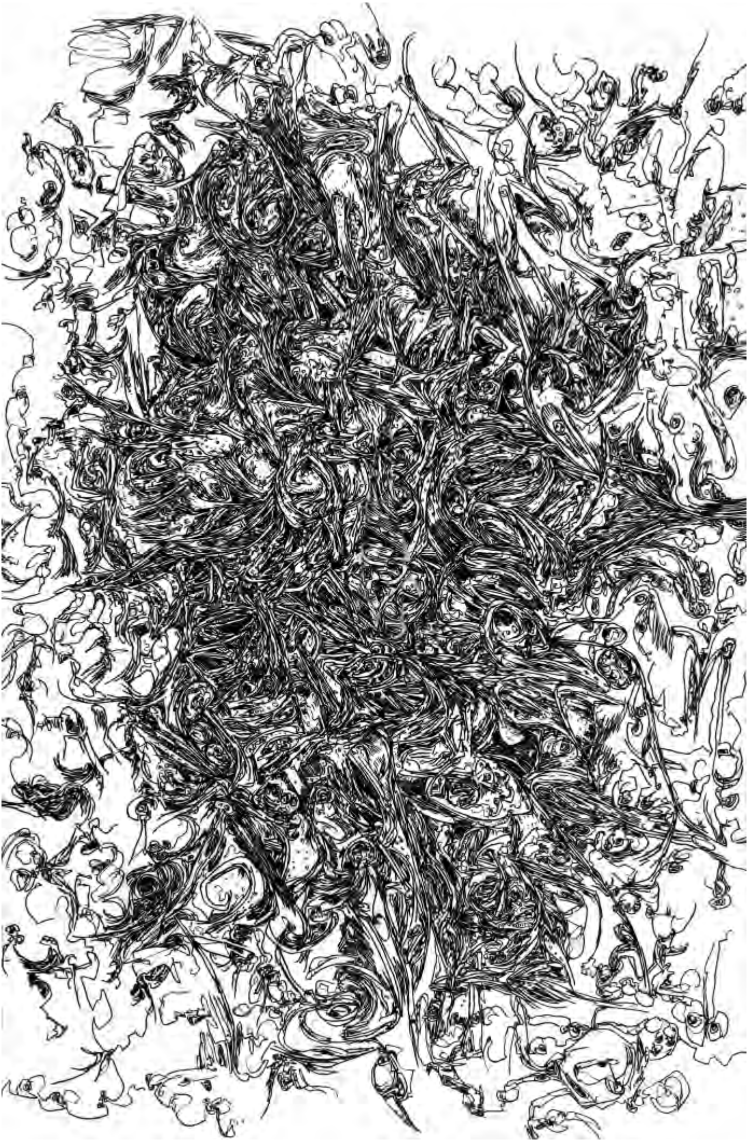
3. Novalis, *Heinrich von Ofterdingen*, as cited by Hegel in the *Rezensionen aus den Jahrbüchern für wissenschaftliche Kritik* in *Georg Wilhelm Friedrich Hegel. Werke* ed. Eva Moldenhauer und Karl Markus Michel (Frankfurt am Main: Suhrkamp, 1979), vol.11: 215. Interestingly, Hegel is here discussing the relation between actuality and freedom.

4. Lambert, Letter to Kant of October 13th 1770 in *Kants gesammelte Schriften* (Berlin: Königliche Preussische Akademie der Wissenschaften, 1902ff), cited *Ak*. Here *Ak*.X: 107 (italics in original). Lambert is responding to § 14 of *On the Form and Principles of the Sensible and Intelligible World*, where Kant argued that 'although time, posited in itself and absolutely, would be an imaginary being […], it is a condition, extending to infinity, of intuitive representation for all possible objects of the senses' (*Ak*.II: 401; 1992a: 395). Kant echoes Lambert's question and his response in the first *Critique*: 'Time is certainly something real, namely, the real form of inner intuition' (A36-6/ B53-4).

but its terms are more overtly displayed in the unstable dualism of teleology and mechanism in the third *Critique*. The dualism is unstable, because despite appearances, it is not *only* a dispute about natural causality (although this is certainly part of it), but outlines the procedure whereby physical grounds are reduced to the inscrutable abjecta of reason's ultimately moral actualisation. This procedure consists in (a) maintaining the phenomenal indifference of moral and natural purposes in keeping with the constraints placed by the first *Critique* on theoretical reason; while (b) extending the authority of practical over theoretical reason, in keeping with the second *Critique*; and *thereby* (c) rejecting ontology for an ethicised phenomenology. It should be noted, moreover, that the logical form of this procedure is self-reinforcing: (a) + (b) = (c) = (a) + (b). We shall call it the ethical process.

The claim of this paper is that this ethical process is as untenable as it is ubiquitous. It is point (c) that makes it recognisably ubiquitous, although usually (not always) without the string of reasons (a) and (b) that establish it. It is untenable because reason must now affirm ethical grounding as the absence of grounds, or *the absence of grounds as ethical grounding*. The ethical process is the principal element of the philosophy of what Oken, above, calls the 'bare contradiction, the non-thing'.

In the equation of 'bare contradiction' and 'non-thing', it is clear that Oken considers logical forms to entail ontological consequences: that a *bare* contradiction *is* a non-thing. This is in complete contradiction to the verdict of Hegel's *Philosophy of Nature*, where he dismisses Oken as practising a 'mere formalism' comprising nothing but 'assertions' common to 'the philosophy of nature of his



time'.[5] In contrast, what the geological *Naturphilosoph* Henrik Steffens called Oken's 'hard, insurmountable realism'[6] consists, in part, in a realism with regard to *grounds*. The core philosophical problem to which Oken's *Naturphilosophie* is addressed is consequently to determine 'how something derived its existence from nothing'.[7] As will become apparent, the 'nothing' from which 'somethings' always derive their existence is the mathematical nothing, the *zero*. Thus, Oken's 'generative history of the world'[8] consists entirely in demonstrating the *repeated* ontological consequences of what he calls, emphasising this generative operation, the *mathes*-is issuing from Zero. Thus, the formal reason of an existent is = the real ground of existence = 0. The question is whether the zero is always the same, i.e. whether 0 is always = 0, or whether, for instance, in the domain of biology, the 0 is *slimy*.

The story is often told that the immediate post-Kantian reaction consists in the 'organicist turn', with Goethe, Schelling and the *Naturphilosophen* cited as evidence. While it is certainly true that the post-Kantian philosophers and naturalists attempted to resolve Kant's dualism by way of organic or self-organizing causality, this story remains philosophically inadequate. In brief, the reasons for the insufficiency of this story are (i) that it segregates philosophy from nature, making the former merely the corollary of the latter; and (ii) that by making the naturalisation of teleology versus cognitively insuperable intentionality (the problem of 'access') into the only significant problem to which the Idealists contribute, it (iii) leaves the problem of the forms of realism pursued in the long aftermath of Kantianism, entirely unaddressed. This essay will therefore take Oken's Mathesis as a particular case study in the pursuit of a post-Kantian realism reducible neither to dogmatism nor to the ethical process, a pursuit that remains as insistent today as it did two hundred years ago.

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[5] Hegel, *Philosophy of Nature,* trans A.V. Miller (Oxford: Oxford University Press, 1970) §346*, Zusatz*. There are moments in the *Elements*, notably its first section, that seem to ratify Hegel's assessment: 'Philosophy, as the science which embraces the principles of the universe or world, is only a logical, which may perhaps conduct us to the real, conception.' Hegel ignores countervailing propositions: 'what holds good of mathematical principles must also hold good of the principles of nature' (*Elements* 67).

[6] Henrik Steffens, *Schriften alt und neu* Vol.1. (Breslau 1821: 81), cited in Hinrich Knittermeyer *Schelling und die romantische Schule* (München: Ernst Reinhardt, 1928), 192.

[7] *Elements,* 10.

[8] *Ibid.*,11.

2. Physio-Philosophy as the System of the Generation of the World

The *Elements of Physio-Philosophy* (*Lehrbuch der Naturphilosophie*) is a summative work that synthesises Oken's previous researches. Since his Preface to the *Lehrbuch* provides a retrospective of this works, and since, like most of the *Naturphilosophen*, Oken remains as scorned as he is ignored, we will introduce the main points of Oken's system through his own bibliographical commentary.

Oken's first work, the *Outline of Nature Philosophy, Theory of the Senses and the Animal Classification based Thereupon* (1802), sets out from the thesis that 'the animal classes are virtually nothing else than a representation of the sense-organs', a position by which, he states, he 'still abides' in the *Elements* (xi). This is notable both in its attempt to infer a system from physiological particulars, a realism that will survive, just as it is inverted, in the *Elements*; and in the structural role it allots to the theory of recapitulation, further developed and exemplified in this gloss of the theory as propounded in *On the Significance of the Cranial Bone* (1807):

> […] the head is nothing other than a vertebral column […] [just as] the maxillae are nothing else but repetitions of arms and feet, the teeth being their nails […][9]

This 'vertebral theory of the skull', over the discovery of which Oken disputed with Goethe,[10] not only 'supposed a community between the human skull and that of the lower vertebrates', but extended beyond the organic into the mineral, geological and cosmogenic domains, carrying the 'law of serial repetition […] to ludicrous lengths' in Oken, according to some.[11] While such a law must lose in determinacy what it gains in extent, the principle behind it is simple: that no product of nature arises in isolation from all other products, each being dependent on others, 'tak[ing] its starting-point from below', as Oken notes.[12] How far below, however, must research plunge in order to locate the basal, serially repeated element? Writing retrospectively in 1846, this is what the neurophysiologist Jacob Henlé called the 'genetic method', which had as its goal 'to identify the simple type of a given structure and to trace its progressive elaboration'.[13] Where the genetic researcher is in possession of the fully elaborated organ, the task is simplified; insofar as the basal element of any living organisation is to be encountered within the domain of the biotic, the task becomes simpler still: to find the basal type of all life.

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[9] *Elements,* xii.

[10] As notably discussed by Hegel in his *Philosophy of Nature*, §354 *Zusatz*: 'Oken, to whom Goethe had communicated the treatise [*On Morphology* 1785], paraded its ideas as his own in a programme he wrote on the subject, and so gained the credit for them.'

[11] Edwin Clarke and L.S. Jacyna, *Nineteenth Century Origins of Neuroscientific Concepts* (Berkeley: University of California Press, 1987), 42.

[12] *Elements,* zxiii.

[13] Cited in Clark and Jacyna (1987), 21, 43.

However, if in principle there are no independent products in nature, then the prospect of an end to the genetic typing of any natural product is not to be found in the part, but rather in the whole. Oken's next work will accordingly transform the search for nature's basal elements into the search for 'the nature of nature',[14] or metaphysics.

Combining the results of the *Outline* and *Significance*, Oken's *On the Universe as a Continuation of the Sensory System* (1808) argued 'that the Organism is nothing other than a combination of all the Universe's activities within a single individual body' and that 'World and Organism are one in kind, and do not stand merely in harmony with each other'.[15] The last clause here indicates an important thesis regarding the theory of recapitulation, which does not assert that there merely exists a contingent 'harmony' or phenomenal similarity between parallel series (e.g. world-generation and speciation) that remain of fundamentally different natural orders, but rather that all of nature is involved in the generation of any part of it. Moreover, as evinced by the work's title, Oken is no longer concerned, as he was the *Outline*, to derive merely formal devices from physiological givens, but rather to assert that this structure is *really instantiated* in the universe as such. Accordingly, Oken extended his systematising attention to the elements of physics in *First Ideas towards a Theory of Light, Darkness, Colour and Heat* (1808), where each of these phenomena are derived from tensions, antagonisms and motions in the aether, constituting a 'primitive field theory',[16] and in the *Natural System of Ores* (1809), where mineral particulars are considered for the first time.

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[14] Novalis, *Werke 2: Die Christenheit oder Europa und andere philosophische Schriften*, ed. Rolf Toman (Köln: Könemann, 1996), 440.

[15] *Elements,* xii.

While the resultant dynamics fulfilled the post-Kantian brief for physics established especially by Franz von Baader's *Ideas On Rigidity and Fluidity* (1792), Apolph Karl August von Eschenmayer's *Propositions from the Metaphysics of Nature applied to Chemical and Medical Objects* and *Attempt to Derive the Laws of Magnetism A Priori from the Propositions of the Metaphysics of Nature* (both 1797), Oken had also to integrate the phenomena of life into this universal physics. While it is only in the *Elements* that this is achieved, Oken's contribution towards it – the theory of 'primal slime' or protoplasm – was first advanced in *On Generation* (1805), which argued

> […] that all organic beings originate from […] the infusorial mass, or the protoplasm [*Urschleim*] from whence all larger organisms fashion themselves or are evolved. Their production is therefore nothing else than a regular agglomeration of […] mucus vesicles or points [*Schleimpunkte*], which first form themselves by their union or combination into particular species.[17]

Since naturephilosophy is to be 'the generative history of the world',[18] rather than that of biological individuals alone, the *Elements* undertakes to synthesise the sensory, cosmogonic, geological, embryological and philosophical systems into a single, self-recapitulating series. The question arises as to how primary the ‘primal slime’ is. Written prior to the cosmogonic synthesis of *Of the Universe*, Oken’s programme in *On Generation* has not yet undertaken the transition to from the physics to the metaphysics of nature. Thus, as briefly digested as the *Elements* is vast (numbering 3652 propositions), Oken describes its project as finally

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[16] Pierce C. Mullen, 'The romantic as scientist: Lorenz Oken', *Studies in Romanticism* 16 (1977): 381-99, 388.

[17] *Elements,* xi-xii.

[18] Ibid., 11.

> [...] bring[ing] these different doctrines into mutual connexion, and to show, forsooth, that the Mineral, Vegetable and Animal classes are not to be arbitrarily arranged in accordance with single or isolated characters, but to be based upon the cardinal organs or anatomical systems, from which a firmly established number of classes must of necessity result; moreover, that each of these classes commences or takes its starting-point from below, and consequently that all of them pass parallel to each other.[19]

Yet even here Oken holds out a physicalist solution to the genetic problem, noting that a *parallelism* between the classes make it possible ‘to prove that they by no means form a single ascending series’.[20] Although the primacy of primal slime may thus yet be safeguarded, how the *Elements*’ project is to be achieved is set out in the opening sections of the work, which introduce the naturephilosophical terms of reference. Amongst the most important of these is the actual and logical priority of natural ground:

> Naturephilosophy is the first, philosophy of mind, the second: the former, therefore, is the ground and foundation of the latter,

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[19] *Elements*, xiii.

[20] Ibid.

> for nature is antecedent to the human mind. […] Without naturephilosophy, therefore, there is no philosophy of mind, any more than a flower is present without a stem, or an edifice without a foundation.[21]

Moreover, since naturephilosophy 'has to show how, and in accordance indeed with what laws, the material took its origin', it follows that history forms a single temporal series from the development of matter to particular natures to mind. The formal reason = real ground of existence consists in the various solutions to the problem of 'how something derived its existence from nothing'.[22]

The other element, then, is Zero, the nothing, and it is introduced in the *Elements* for the first time as *paralleling* the *Urschleim* in biology. In what sense, however, 'parallel'? Are the biological and the mathematical parallel and thus independent, or does everything depend on 'what is below it'? The problem of the relative and mobile primacies attaching to the various basal types running throughout Oken's system is that Zero is the equilibrium point in Oken's polar philosophy of nature, and is so dominant that it led Steffens to describe Oken's 'insurmountable realism' as complemented only by an 'ideal element' that is 'entirely negative', a view Knittermeyer endorses.[23] The basal Zero – 'Oken's most pervasive principle' – states that 'all development proceeds along the same path by adding elements to an original nothingness', a law that 'holds for human ontogeny, the historical sequence of species, the evolution of the earth itself'.[24] This account certainly follows from the irreversible priority Oken attaches to Nature over Mind; but the problem remains: *either* the Zero is the merely *formal* element Hegel accused Oken's naturephilosophy as consisting in, in which case 'The universe' is *not* 'the reality of mathematics';[25] *or* 'existence derives from nothing' and Slime is *not primal.* The Okenian solution to the genetic problem therefore consists in a struggle between Nothing and Slime.

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[21] *Elements* 15-16, t.m.

[22] Ibid., 10.

[23] *Schelling und die romantische Schule* (op.cit.), 192.

3. ZERO OR SLIME? THE ELEMENTS OF THE *ELEMENTS* AND THE GROUNDEDNESS OF THE GROUND

The *Elements* outlines its system in sections 18-21 of its 'Introduction'. The 'generative history of the world' divides into three parts:

1. Mathesis (of the whole),
from which stem (a) Hylogeny and (b) Theogony, or the
generative philosophy of matter and mind;

2. Ontology (of the singular),
which follows the generation of nature from Mathesis, and from
which stem (a) Cosmogony and (b) Stoichogeny; and

3. Biology (of the whole in the singular),
which recapitulates the generation of Hylogeny, Theogony and
Ontology in embryogenesis.

Mathes*is* – the *actions* of mathematics, 'the only true, the primary, the universal science'[26] – subdivides in turn into the theories of material totalities or Hylogeny, a 'rather primitive field-theory'[27] comprising aether, light and heat; and of immaterial totalities or Pneumatogeny, a Theogony comprising God and Nothing. Ontology divides into Cosmogony, or the emergence of the cosmic bodies, and Stoichogeny, or how the heavenly bodies 'divide themselves further […] into the elements'. Biology, concerned with 'the whole in singulars [which] is the living or *Organic* […] divides into *Organogeny, Phytosophy* and *Zoosophy*'.[28]

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[24] Stephen Jay Gould, *Ontogeny and Phylogeny* (Cambridge MA: Bellknap Harvard, 1977), 44, 40.

[25] *Elements* 2.

Two things concerning Oken's conception of Biology are immediately apparent. The first is that it is no longer predicated, as was Oken's procedure in the *Outline* (1802), on a particular kind of being whose contours are given *in* nature, but rather on a particular stage in the development of structural complexity *involving* God, Nothing and Matter, or mathematics, singulars and substance; that is, the whole of nature. Since the whole is the self-division of God, Nothing and Matter, and the singular is the elemental, hylogenetic singular attained *and actualised* through these divisions; and since further it is articulated primarily by mathematics, then the true object of Biology is the mathematics of these self-divisions as actualised in living somethings. This is the fork in Biological science that leads to the theory of the Primal Slime (*Urschleim*) and its manifestation in Slime Points (*Schleimpunkte*). The theory of slime which forms the oozing ground of Oken's 'physio-philosophy' is ultimately therefore a 'mathematics endowed with substance',[29] or the product of the mathetic-ontogenetic process; the biogenetic process then 'takes its starting point' from the 'infusorial mass' or 'primal slime' *below*, which it divides into the innumerable 'mucus vesicles [*Schleimpunkte*]' that are the 'primal constituent parts of [this] organic mass'. The production of complex singulars (individuals) consists therefore in the 'agglomeration of infusoria' up to the level of species.[30] Biology is therefore the science of the production of individuals that has as its basis the science of the production of wholes.

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[26] Ibid., 24-5

[27] Mullen (1977) *Loc.cit.*

[28] *Elements,* 21.

Secondly, if the system that supports this account of the organic is a *true* system, that is, if the philosophy of nature is not merely a reflection upon nature, but rather 'the generative *history* of the world',[31] a world that articulates 'mathematical propositions' as much as it generates 'natural things',[32] then it follows that Biology is no isolated science of abstracted particulars, but rather concerns the developmental singularities by which the mathematicising cosmos is actualised. Hence Oken's insistence that

> Natural History is not a closed department of human knowledge, but presupposes numerous other sciences, such as Anatomy, Physiology, Chemistry and Physics, with even Medicine, Geography and History.[33]

Biology becomes the science it must when and only when the totality of the sciences – of wholes, singulars, and singulars-in-wholes – recovers the *entirety* of science as such. This means that Biology recapitulates Mathesis, just as Oken's categories suggest: of the Whole, and of the Whole in the Singular. The *one* science of the whole is mathematics, the language of ontogenesis. From this second perspective, Oken derives what many, including Hegel, deride as the 'empty formalism' of his system, a formalism articulated around an irreducibly ontogenetic element: the 'oscillating Zero', or God: 'God is = + 0 –'.[34] The problem of the relation between the multiplicity of sciences and the 'universal science' arises starkly: *either* there is one universal science to which all others are reducible, *or* Mathesis, the theory of the whole, has no claim to universality, and does not therefore articulate ontogeny. In short: *what is the relation between the Primal Slime and the Zero*? Oken's proposed solution is: mathematics is the universal science that generates, interconnects, and necessitates all the others. The 'wavering Zero' is the generative core of being and slime.

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[29] Ibid., 26.

[30] Ibid.,xii.

[31] Ibid., 11.

[32] Ibid., 30.

[33] Ibid., xiv.

The problem of priority is a problem for a metaphysically realist natural history precisely because the theory of recapitulation, considered causally, abolishes linear time. Whenever there arise claims to priority (the primal Zero or the Primal Slime), Oken appears to equivocate. Having noted therefore the priority of the philosophy of nature over that of mind in section 15; along with the ontogenetic dependency of the latter on the former ('nature is antecedent to mind') in section 16; section 17 concludes *not* with this serial genetic dependency, but with a 'parallelism' between the two. One section later, however, the parallelism is extended to the relative priorities of the one over the other. Thus:

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[34] *Elements,* 99. Knittermeyer puts Oken's case economically and concisely: 'God is the father, the generator, but himself ungenerated, transformed into the plus and the minus and yet always remains himself as the existent nothing [*das wesende Nichts*]. God is the son who goes forth from the father into finitude, and he is the mind that takes finitude back, in turn, to the origin and reproduces the "mental bond" with the generating origin. As the first, this divine acting is the 'primary rest [*Urruhe*]', the "wavering and resting point in the universe", the "never appearing and yet ubiquitously present". As the second he is eternal ponentiation and hence, corresponding to the number series 1 + 2 + … + *n*, the creator of the temporal series. As the third, however, God is he who takes back the finite [being] released into the restless time effecting motion and life, into the whole and binds it into him in all-filling space. The formless oscillation of life here receives form and integument. The divine brings itself closer to appearing and therefore materiality.' (Hinrich Knittermeyer, *Schelling und die romantische Schule*. München: Ernst Reinhardt, 1928, 189).

> It will be shown in the sequel that the mental is antecedent to nature. Naturephilosophy must, therefore, commence from the mind.[35]

Which, then, does come first – Zero or Slime? Around what axis is the topology of nature and mind spinning? Does mathematics remain the 'primary science', or is a mathematical realism usurped by a realism concerning natural history? The relation of system and history remains at the core of the metaphysics of natural history; especially as this project was renewed in Prigogine and Stengers new 'physiophilosophical' alliance.[36] What is seldom noted is that this entails a *natural history of metaphysics* that extends beyond the steady accumulation of form that characterises Hegelian history of philosophy. The natural history of metaphysics is a *physics* of metaphysics, a science of the grounds of metaphysics in nature, or a physics of ideation as such. Although sounding more redolent of hard-nosed contemporary eliminativists than of post-Kantian idealists, this recognition was core to *Naturphilosophen* such as

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[35] *Elements,* 18.

[36] Ilya Prigogine and Isabelle Stengers, *Order out of Chaos* (New York: Bantam, 1984), translation of *La nouvelle alliance* (Paris: Gallimard, 1979).

Schelling, who characterised philosophy as 'the natural history of mind'[37] and Troxler, who defines metaphysics as the physics (*Naturlehre*) of human knowledge.[38] If nature is necessary to generate mind, as sections 15 and 16 note, then mind is necessary to the abstract recapitulation of natural production in reflection, or to the recapitulation of the mathetic whole in the biological singular. Yet Oken's system extends beyond reflection on natural production, since ontogenesis depends on Mathesis. The Platonic kinship is unmistakable:[39] mathematics, or the Idea, are not simply nominal or formal processes, but rather ontogenetic. Just as the *Phaedo* argues[40] that it is *because* of the form of Beauty that beautiful things exist, so Oken argues that it is *because* of Mathesis that things exist, or because of Nothing (= 0) that there are beings. That Oken inverts the causal or physical dependency of mind on nature does indeed stem from his characterisation of Mathesis as hylogeny *and theogony* , which gives *direction* to the system, towards the production of animals capable of Mathesis and therefore, famously, of man:

> Man is the summit, the crown of nature's development, and must comprehend everything that has preceded him [while] man is a complex of all that surrounds him, namely, of element, mineral, plant and animal.[41]

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[37] F.W.J. Schelling, *Ideas for a Philosophy of Nature* (Cambridge: Cambridge University Press, 1988), 30; *SW* 2: 39.

[38] Ignaz Paul Vital Troxler, *Naturlehre des menschlichen Erkennens oder Metaphysik* (Hamburg: Meiner [1828] 1998).

[39] As Mullen (1977: 388) notes, 'In form and to some extent in substance [the *Elements*] closely resembles Plato's *Timaeus*.'

[40] *Phaedo,* 100d.

[41] *Elements,* 12, 98.

At the very point where *thinking slime* affords nature linearity, however, at the crown of its development from elements to animals, directionality reverses. Mathesis as theogony is concerned with the immaterial whole; yet what is the 'immaterial'? Merely 'that which is nothing in relation to the material',[42] just as 'God is = + 0 –'[43] or 'the eternal is the nothing of nature'.[44] The 'immaterial' is the zero of material, its generative ground, just as God is that of nature, since nothing iterated is the becoming of something. Thus the sense in which 'something derives its existence from nothing'[45] now becomes 'very clear'. Just as

> numbers have not issued forth from zero as if they had previously resided therein, but the zero has emerged out of itself […], and then it was a finite zero, a number[46]

so something emerges not 'out of' but rather from the *acts of* the nothing's self-extensions: 'Zero is […] the primary act [and] numbers are [its] repetitions'.[47] Thus another primary whose 'positing and negating are called realisation [which] is a process of extension taking place in the Idea'.[48] And this positing *and negating* takes place, equally, in the 'highest, most exalted art […] of war',[49] reducing everything to

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[42] *Elements,* 8.

[43] Ibid., 99.

[44] Ibid., 44.

[45] Ibid., 10.

[46] Ibid., 37.

[47] Ibid., 55, 57.

[48] Ibid., 48, 38.

[49] Ibid., 3652.

nothing after the Napoleonic model. The nothing initiates a ceaseless *imitatio nihil* amidst the extended multiplicities formed of the infinite repetition of the primary act, while existence resists the sink at its core.

At first sight far from satisfactory, all this wavering Nothing leaves an ontological queasiness in place of any principle of sufficient reason. It pervades Oken's system, with its martial apex. For what kind of biologist does war supercede life as the system's goal? That the complexifications of Primal Slime here cede to the destruction of war demonstrates that the cosmos worships the Nothing-God. The culmination of Biology is the destruction of individuals, which is held in check so long as there remains *something*. Kant tells us, reassuringly enough, that reality can never sink to zero; but Oken's *mehylotheogony* supplants all Being with increase and decrease, *each limitless*. The fragile hold of beings is secured by Slime alone – all that ontology can hope for is Slime potentiated and negated into and out of all things. The question thus arises is this: is the *Urschleim* – or, ontically speaking, the *Schleimpunkte* – negable, reducible, as well as 'potentiable'? The prospect of the *contingency of all beings* issues directly from this as it were gravitational distortion of the local spacetime of their generation.

The question would hold no terror were the passage from mathetic metheology to ontology secured, e.g. by a causal or a linear-progressive process; but it is not. The whole is not left behind by history, by the accumulation of causes from whence emerges time; rather, it *returns* in Biology. Oken's Biology is *not* therefore testimony to the final discovery of a 'Newton of the blade of grass', of an organicism to save us from the ravages of nature, but only the repetition of the None-All in every generated particular.

All directionality, whether in ideation or cosmogeny, in embryogenesis, hylogeny, temporalisation or primary Mathesis, is withdrawn in favour of the *polar* model that determines the 'primitive field theory' Oken constructs around the tensions, antitheses and motions of the aether in the *First Ideas for a Theory of Light*, and which inherits and extends the galvanic process Ritter discovered to 'constantly accompany the animal kingdom' into the mineral, chemical and mathetic domains along the lines suggested by the magnetic schema, in which the zero is not primitive, but first and last in, and the principle of, all the extensions of its force.[50] Oken's mutiplicity of primaries – act, slime, rest, etc. – are primary relative *both* to the lower nothing from which, at ontogenetic root, they issue, and to the 'higher zeros' that counteract them which they in turn give rise: rest, war, act.

The polar metaphysics of nature, therefore, collapses the axis of higher and lower, antecendence and succession, into a field theory of polar dependency: 'The world is God rotating' or 'a rotating globe of matter'.[51] Natural history is always therefore *relative* to the mathetic zero from which its objects issue, and the frame of reference is always generated *after* the field that is its object. The ultimate significance of sections 15, 16 and 18 of the *Elements* is therefore that the priority of nature with respect to mind generates a nothing in nature from which naturephilosophy begins. Ironically, Oken's post-Kantian solutions make Lambert's physico-critical intervention redundant by *realising the full consequences of self-effecting processes:* the elimination of history in nature: 'Time is the infinite succession of numbers or the mathematical nothings'.[52] We turn now to Oken's solutions to his polar take on the genetic problem.

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[50] The schema owes its most definitive account to Karl August Eschenmayer's *Attempt to Deduce the Laws of Magnetic Phenomena a priori from the Propositions of Metaphysics* (1797), and to Schelling's reworking of it in his *Exposition of my System of Philosophy* (1801). For Eschenmayer, see Jörg Jantzen, 'Adolph Karl August von Eschenmayer', in Bach and Breidbach, eds., *op.cit.,* 153-79 and Gilles Châtelet, *Les enjeux du mobile. Mathématique, physique et philosophie* (Paris: Seuil, 1993), esp. 137-9. On Schelling's transformation of the magnetic schema in his so-called Identity philosophy, see Iain Hamilton Grant, *Philosophies of Nature after Schelling* (London: Continuum, 2006), 158-82, and 'The physics of the world soul', in Judith Norman and Alistair Welchman, eds. *The New Schelling* (London: Continuum, 2004), 128-50.

[51] *Elements* 142, 161.

4. OKENIAN SOLUTIONS, AND …

Oken's solution to the genetic problem is not what Henlé's 'student of the nervous system' might have hoped for. Rather than identifying the 'basal element' of neurogenetic recapitulation, Oken resolves individuation into the whole. Schematically:

(1) *Mathesis→ Ontogenesis → Biogenesis → the production of the whole in the singular → Mathesis potentiated.*

(2) The consequence of this is that the causal series that ties time to change is sacrificed for a codependency relation, a reciprocity, between the elements recapitulating the basic scheme of the whole in a singular. 'The law of causality is a law of polarity', not of time.[53] Time, Oken continues, is accordingly 'only repetition, and thus also a suppression of

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[52] *Elements* 72.

[53] Ibid., 79.

[…] positions'.[54] Because the whole is expressed at the apexes of individuation (Ideation and War), Okenian ontogenesis produces irreducibly local maps, while 'pneumatogenesis' *has primally and then derivatively* multiplied them. Potentiation is potentiation of the whole in its individuation, as Schelling would later note of the involutive-evolutive process.[55]

(3) If, logically, mathematics is the expression of the whole in the individual; and if, theogonically, 'God = + 0 − is before and after all things', then modally, only the nothing is necessary. Here, then, we derive the central lesson of Oken's system of nature: the contingency of all beings, so the 'principle of sufficient reason' is satisfied by *nothing* potentiated. Precisely in consequence of this, mathematics or mehylogeny does not so much *supplant* nature as *generate* it: by taking on the project of the 'natural history of metaphysics', Oken's slimy Platonic naturephilosophy has mathetic functions accreting numbers and organs, indifferently: 'all development', as Gould notes of Oken's system, 'begins with a primal zero and progresses to complexity by the successive *addition* of organs in a determined sequence'.[56] The zero accretes by self-extension in the forms of mineral, chemical, plant and animal organs.[57]

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[54] Ibid., 74.

[55] See Schelling's *Stuttgart Private Lectures* (1810; *SW* VIII), in Thomas Pfau, ed. *Idealism and the Endgame of Theory: Three Essays by Schelling* (Albany NY: SUNY, 1994).

[56] Gould, *op.cit.*, 40.

[57] *Elements,* 867.

(4) If, as we have seen, recapitulation becomes, by virtue of (2), above, if not *aionic* (although Oken occasionally makes precisely this point: 'Zero must be endlessly self-positing, for in every respect it is indefinite or unlimited, eternal'),[58] then certainly *achronic*. It forms the logic of Idea in the hylogenetic → biogenetic process, and as such is the repeated intercession of the eternal into time, or its negation.

(5) Even anthropogenesis, so often criticised as the 'anti-copernican' core of the post-Kantian 'restoration', accordingly suffers. No sooner is man declared the 'highest', insofar as it is through man that nature achieves Ideation and thus *reproduces Mathesis*, than war erupts because 'the Nothing is higher than the highest': 'the Zero, the highest'.[59] Oken therefore demonstrates that anthropogenesis culminates neither in the humanism of finitude nor in the ontolotheological eschatology, but rather ceaselessly repeats the *mathetic mehylotheogony* of the cosmogonic process:

> In the process of destruction, the finite being seeks to become the universe itself [because] man is a complex of all that surrounds him.[60]

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[58] *Elements* 53.

[59] Ibid., 40.

[60] Ibid., 91, 98.

5. … POST-OKENIAN PROBLEMS.

> The continuance of Being is a continuous positing of the Eternal, or of nothing, a ceaseless process of becoming real in that which is not. There exists nothing but nothing, nothing but the Eternal, and all individual existence is only a fallacious existence. All individual things are monads, nothings, which have, however, become determined.[61]

We have noted that the Okenian number series are primary, and issue from a primary Zero, 'the one essence of all things, the 0, the highest identity'.[62] Disregarding for the moment the metaphysics of polar time, the Zero is, if not primitive, then ultimate, insofar as everything resolves into it. Oken invests considerable effort in the elaboration of zero.

Firstly, it is twofold: intensive or ideal, and extensive or real. Yet these two remain indifferent: 'the real and the ideal are no more different than ice and water; both […] are essentially one and the same'.[63] This is where the repeatedly claimed similarity of Oken's Zero and Schelling's reformulated law of Identity are apparent:[64] that identity is the

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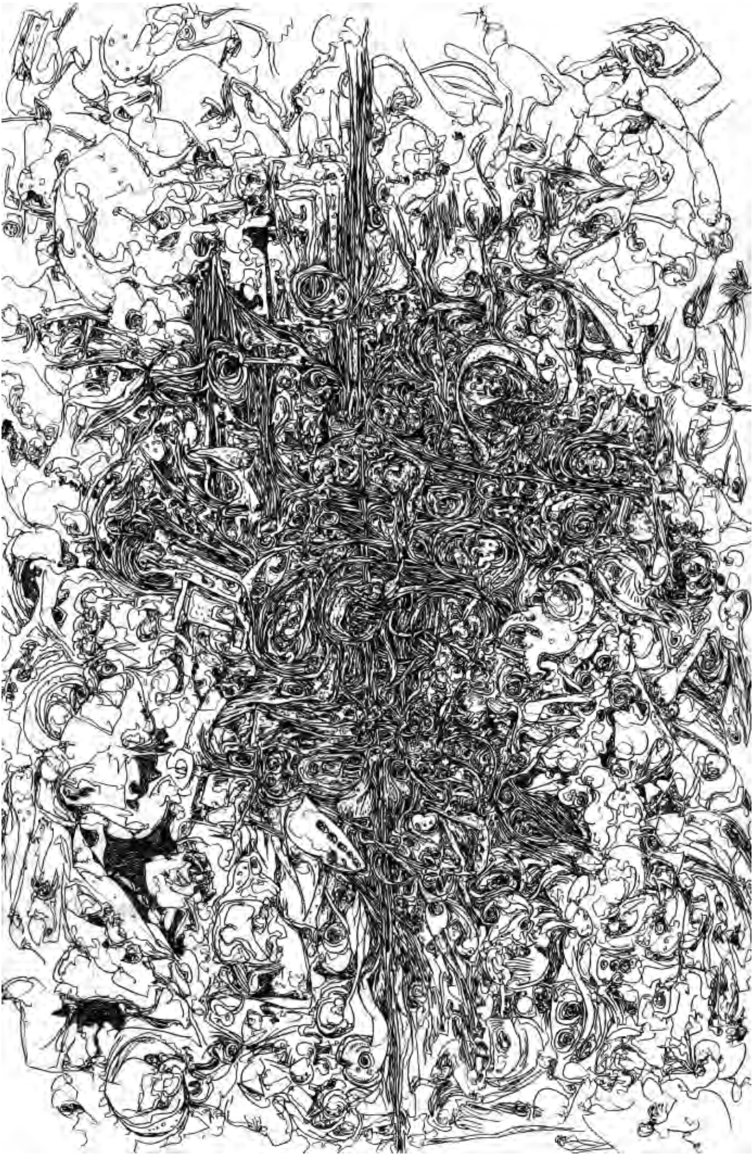
[61] Ibid., 58.

[62] Ibid., 40.

[63] Ibid., 36.

[64] This tendency starts with Oken's translator, Tulk: 'the present work stands alone in Germany, as being the most practical application upon a systematic scale of the principles advanced by Schelling, more especially in the Mathesis and Ontology' (*Elements* vi). More recently, Joseph L. Esposito, in *Schelling's Idealism and the Philosophy of Nature* (Lewisburg: Bucknell University Press, 1977, 143) repeats the point: 'Essentially Oken's system is the same as Schelling's, but with specific scientific disciplines superimposed on it, so that it became at once a picture of the World System and a proposal for how to study it. […] *Mathesis* is the condition of Schelling's Absolute Identity, wherein the first differentiation occurs'. See also Wolfgang Förster, 'Schelling als Theoretiker der Dialektik der Natur', in Hans Jörg Sandkühler, ed.,



ground of differentiation, and that no differentia, insofar as they are different, are identical.

Secondly, the susceptibility of Zero to 'infinitely numerous forms'[65] invites speculation as to the other forms it has in fact assumed: apart from Eschenmayer's magnetic schema, therefore, Kant's account of the eliminative actions of negative magnitudes, or the ontological problem of negative numbers, pinion around zeros, as does the 'minimax' of zero sum games, or the empty set from which Russell and Whitehead, on the one hand, and Badiou on the other, draw such diverse ontological conclusions. Finally, and perhaps decisively, the ungenerated and ungenerable, non-phenomenal attributes of the Platonic Idea make it into the zero of the physical world, a series of problems best explored in the *Parmenides*. The actual and potential permutability of zero into many formal schemas brings Oken's theorizing out of the domain of the 'number mysticism' of which he has been routinely accused[66] to demonstrate the ontological vitality of the problem of the relation of number, being and animal.[67] The question Badiou raises against Deleuze of the separability of mathematics and ontology, on the one hand, from nature on the other, is, as is topologically appropriate, twisted in Oken. *On the one hand*, Mathesis, ontology and biology form

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Natur und geschichtlicher Prozess. Studien zur Naturphilosophie F.W.J. Schellings. (Frankfurt am Main: Suhrkamp, 1984), 188, and Ghiselin, *loc. cit.* , 439.

[65] *Elements* 40.

[66] Ghiselin, *loc.cit.*, 440.

[67] See Alain Badiou, 'Deleuze, *The Fold: Leibniz and the Baroque*', in Constantine Boundas and Dorothea Olkowski, eds., *Deleuze and the Theater of Philosophy* (New York: Routledge, 1997), 51-69 and my discussion of it in relation to these problems, in *Philosophies of Nature after Schelling*, 8ff.

distinct domains that are all, *on the other*, articulated by their respective and interrelated zeros. In other words, each series takes its starting point from its predecessor, so that Mathesis entails ontology entails biology. The problem of the independent dependence of series one on the other is in effect the problem solved by the generation of nature itself, insofar as it recapitulates these series in all its products. On Oken's evidence, then, number is inseparable from animal precisely because *animals are the numbers of nature*:[68] 'life', he writes, 'is a mathematical problem'.[69] Mathesis, ontology and biology are equally inseparable, therefore, because the series are not statically taxonomic, but actually genetic. *It is the genetic element in Oken that indicates a resolution to the contemporary problem*.

Thirdly, the Ideal and Real forms correspond to the Zero in a state of intensity and extensity in number series. 'The latter', writes Oken, 'is only expanded intensity, the former, extensity concentrated in the point'.[70] It is this latter differentiation that provides Oken with the means to formulate the issuing forth of something out of the nothing by way of the latter's repetition rather than its expulsion of a latent content.

The Zero thus provides a genuine solution to the problem of sufficient reason: *nothing* is the reason why there are beings, or is the ungrounding of primary ground from which grounds emerge. This thesis is rich in implications: firstly, since the determination of nothing occurs only in the process of extension and concentration, and since it is susceptible to 'infinitely numerous forms', it grounds *the contingency of all beings*, although it ought not to be omitted that it *grounds* this contingency of singulars. Secondly, if all things have one essence (= 0; *Elements* 40), then in what sense are all things really diverse? If merely *formally* (as Oken in fact argues), then ontology – the *actual* generation of singulars – cannot fulfill its function, and the All remains = 0; if *essentially,* then the Zero ceases to be the primitive = the highest in all things, and the All is not = 0. The problem this poses can thus be summatively stated: is the Zero capable of real generation? Since Oken answers that 'naturephilosophy is the generative history' or 'the science of the genesis of the world',[71] the formal and essential 'generations' of zero must be essentially indifferent while formally different. If, however, all difference is formal difference, and the Zero is always the generating (potentiable and negable) element, then it must either be concluded that formal difference is essentially indifferent or that formal differentiation is the generation of an additional mode *not given* in the alternatives. This, indeed, is Oken's solution: 'positing and negating the Eternal is called realisation'.[72]

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[68] I owe this point to lengthy and unforgettable conversations with my colleague Sean Watson.

[69] *Elements,* 104.

[70] Ibid., 37.

What does the contingency of all beings therefore entail? That the formal differentiation and essential indifference of the generations of zeros never attain to fixity, whether of species, phyla or morphology. Indeed, this is guaranteed by the endlessly rotating axes of theogonic and hylogenic nature,[73] just as it is by Oken's 'singular to whole' transformation of the genetic problem. Accordingly, Oken's is a universal morphogenesis, which earned his work credit from D'Arcy Thompson[74] and E.S. Russell,[75] amongst others. Okenian ontology does not therefore so much chart whole entities, but rather *singulars*, both in the sense of *cosmogony*, or the generation of the *one* universe – 'there can be only *one* nature';[76] and of *stoichogeny*, or the generation of the elements and organs that accrete to the various *formally differentiated* singulars. Ceaselessly oscillating around the zeros from which they issue and the complexes they recapitulate, depending on the extensity of the zeros' generations, the emergent material forms are not so much limited geometries as they are limited *acts*.

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[71] Ibid., 11, 66.

[72] Ibid., 40.

[73] cf. *Elements* 142, 161.

Taking these points together, it becomes evident that what the contingency conferred upon beings by Oken's principle of sufficient reason consists in is the consequence of the contingency of dynamics. On this account, biology is the science of the contingent dynamics of the primal slime, oscillating between the achievement of Ideation and mineral inertia. Indeed, the polar field thus generated by biology *involves* rocks as much as Ideas, as much as the biological singular involves the osseous and the nervous systems; all biological systems, however, are *evolved* from the slimy, protoplasmic mass whose contingencies are *involved* in them. To return to the problem of the separability of mathematics and nature, we must now pose it the other way round: *is a slime-free matheme possible*? Morphology, with its principle of sufficient reason, argues not.

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[74] D'Arcy Thompson cites Oken twice by name in *On Growth and Form* [1917]. Ed & abridged by J.T. Bonner. (Cambridge: Cambridge University Press, 1966), and gives the following, Okenian account of morphology: 'Morphology is not only a study of material things and of the forms of material things, but has its dynamical aspect, under which we deal with the interpretation, in terms of force, of the operations of Energy', 14.

[75] E.S.Russell, in *Form and Function: a Contribution to the History of Animal Morphology* (London: John Murray, 1916), 90, thus describes Oken as'a careful student of embryology'. The most recent exponent of the positive view of Okenian morphology is Stephen J. Gould, *op. cit.*

[76] *Elements,* 166.

6. CONCLUSION: THE ROTATIONS OF THE BEFORE AND THE AFTER

With Schelling, we argued at the beginning of this essay that the *ethical process* is possible only if the 'shock of the objective world' can be abstracted away. One means of achieving this is by insisting on the separability of mathematics and nature, and by insisting on the 'impossibility' of a philosophy of nature, as does Badiou.[77] Another means of achieving this is by insisting on the insuperability of the nominal frameworks of self-conscious, finite reason. Since the latter is a subdivision of the former, however, there is no difference in kind, but only in degree, between these two means of abstracting the world.

Oken's insistence, by contrast, on the material world of nature as forming the generative basis not only of natural individuation, but also of the thought-series that can only arise on their basis in turn, suggests that one more entailment might flow from his principle of sufficient reason: the order of priority of nature and mind. With this order, the shock of conjoint time and change by which Lambert forced the progressive splintering of the system of transcendental philosophy, is reintroduced: if there is an order of priority, how can it be grounded given the ceaseless rotation of Matter and God? To resolve this merely formally, by arguing that

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[77] Badiou, *loc.cit.*, 64.

Matter is the zero of God, just as God is the zero of Matter, is not to resolve the problem at all, but to avoid it, since Mathesis consists precisely in the formal differentiation of Matter and God – of hylogeny and theogony – from which ontogenesis flows. Further, we have already noted Oken's inversion of his initially stated order of priority: 'nature first, mind second'[78] becomes 'mind first, nature second'.[79] Since we must concede that Oken's dynamics admit of no transcendent or transcendental axes, therefore, the grounds of the before and the after must be established by other means.

Ultimately, as Oken repeatedly argues, the task of naturephilosophy is 'to show how [...] the Material took its origin; and therefore, how something derived its existence from nothing'.[80] By now we recognise this as Oken's trademark, polar procedure: matter and nothing are conjointly the first focus of the systematic task of generating nature *in thought*. Thought, in other words, *involves* matter and nothing, i.e., the whole (Mathesis). Indeed, philosophy and war are the latest of the zero's accretions, the former consisting always in 'the repetition of the origin of the world',[81] while the latter, through the 'process of destruction', seeks to reestablish the essential identity of everything[82] in the zero that must necessarily remain. Each involves the entire universe and its generation; the first as universal repetition, the second as universal equation. War reveals the ground, and philosophy repeats its generations, up to

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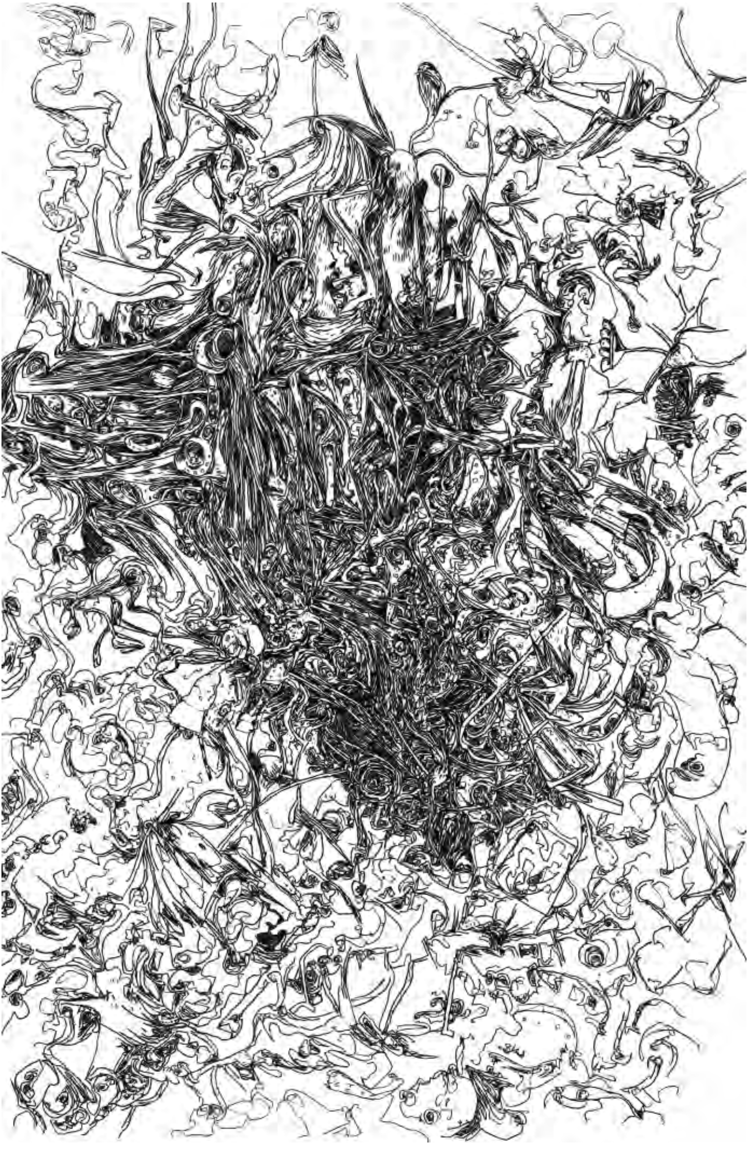
[78] *Elements,* 15-16.

[79] Ibid., 18.

[80] Ibid., 10.

[81] Ibid., 2.

[82] Ibid., 91.



and including its own generation in nature. Because ground supersedes its repetition, which precedes its revelation, an order of priority can be established *in thought*. Hence Oken: 'Time is the act of numbering; numbering is thinking; thinking is time'.[83]

This is not to argue that time exists *only* in thought, in the Kantian manner, but rather that, as Oken notes, thinking *is* time. This is because

> Time itself is only repetition […] The vicissitude of things is in fact time; if there be no change, there is also no time.[84]

In other words, because the grounding of existents consists in the repetition of zero, this grounding extends to Ideation, to philosophy. Philosophy is the *formal* repetition of cosmogony, while war is its *essential* repetition. Because Ideation is not itself the ground of time (Kant), but time that of Ideation, the grounding of existents in nothing establishes the a priority of nature with respect to mind, but without segregating mind from any part of nature or Mathesis. The principle of sufficient reason therefore states: *something emerges from nothing*, and this process is inviolable.

Oken's natural history of metaphysics therefore indicates that naturephilosophy is not simply *a* means, but the *necessary* means by which post-Kantian philosophy escapes the trap that the ethical process sets for it: the primacy of nature extends even to those slimy neural accretions to the primal Zero that make metaphysics possible.

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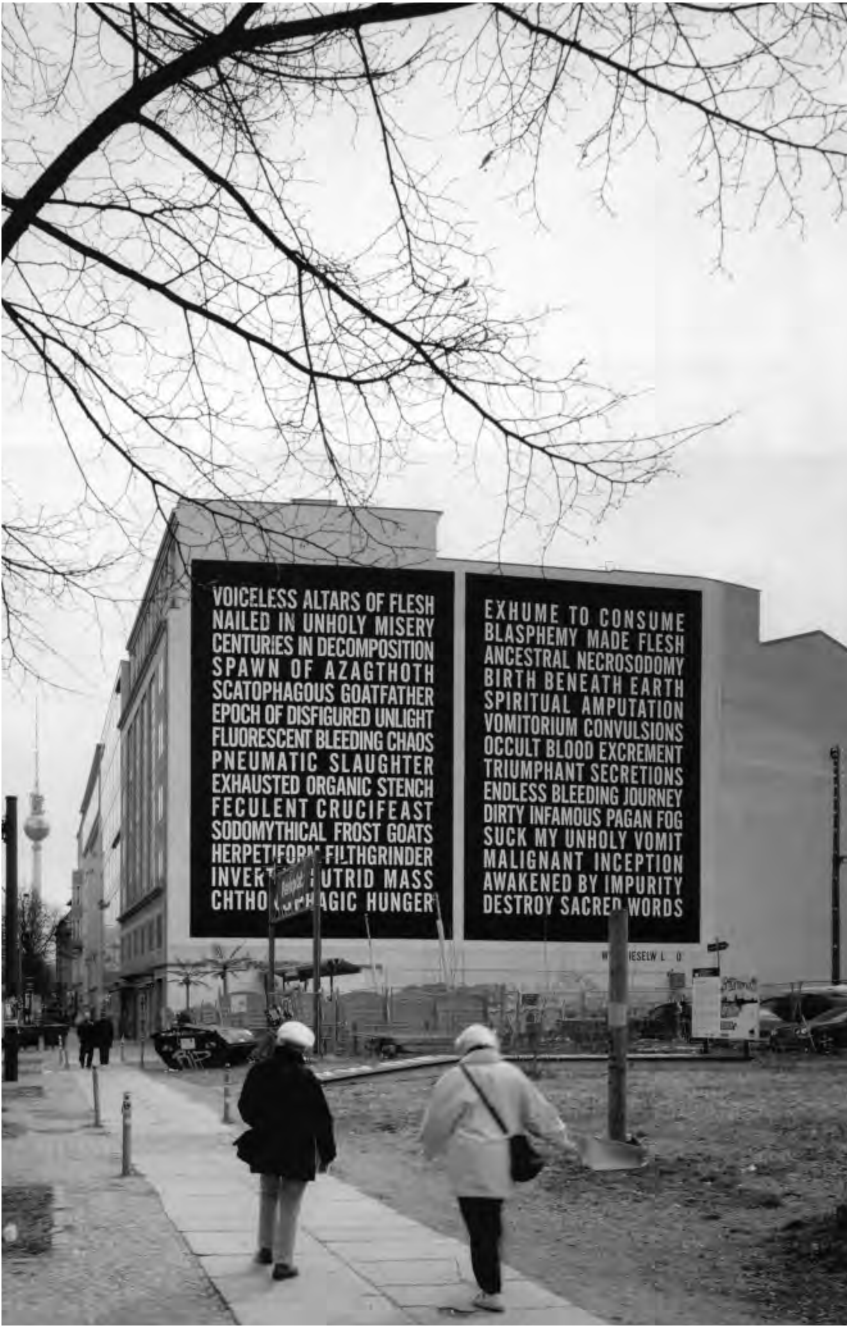
[83] *Elements,* 75.

[84] Ibid., 74.


VOICELESS ALTARS OF FLESH
NAILED IN UNHOLY MISERY
CENTURIES IN DECOMPOSITION
SPAWN OF AZAGTHOTH
SCATOPHAGOUS GOATFATHER
EPOCH OF DISFIGURED UNLIGHT
FLUORESCENT BLEEDING CHAOS
PNEUMATIC SLAUGHTER
EXHAUSTED ORGANIC STENCH
FECULENT CRUCIFEAST
SODOMYTHICAL FROST GOATS
HERPETIFORM FILTHGRINDER
INVERT UTRID MASS
CHTHO PHAGIC HUNGER
EXHUME TO CONSUME
BLASPHEMY MADE FLESH
ANCESTRAL NECROSODOMY
BIRTH BENEATH EARTH
SPIRITUAL AMPUTATION
VOMITORIUM CONVULSIONS
OCCULT BLOOD EXCREMENT
TRIUMPHANT SECRETIONS
ENDLESS BLEEDING JOURNEY
DIRTY INFAMOUS PAGAN FOG
SUCK MY UNHOLY VOMIT
MALIGNANT INCEPTION
AWAKENED BY IMPURITY
DESTROY SACRED WORDS

Poems XVII

Steven Shearer

Charcoal on rag paper, each 48 x 35 inches, 2007.
(Facing Page: InstallationView of *Poems*, Berlin 2006.)

AROUSED BY ABRUPT STENCH OF
MOLECULAR DISEMBOWELMENT
NOCTILUCENT LUBRICANT RAIN
SPASMODIC CONSECRATION
TOWERS OF LIMBS AND FEVERS
SPIRITUAL FECULENCE
DRUNKEN SODOMYTHIC DEICIDE
SEPTIC CHRIST RESURRECTION
ENSHRINED INTO ABUSE
FEEDING OFF UNHOLY GROWTH
SOLAR EXECUTION ECLIPSE
MASTURBATE UPON THRONE OF
PNEUMATIC DESECRATION
WRECKAGE IN COLD FLESH

MAJESTIC ELDERLY WASTE
SKULLFUCKING DEMENTIA
ENDLESS BLEEDING JOURNEY
FOUNTAINS OF GOAT SEMEN
COPROPHAGIC COMMUNION
BEATEN MOCKED CRUCIFIED
WELL OF ALL HUMAN TEARS
APOCALYPSE INSIDE
DARK GLEAM OF OBSCURITY
TRIUMPHANT SICKNESS
FROZEN HOLOCAUST CLOUDS
MARCHING TO MY SEPULTURE
JEHOVAH DESECRATION
EXQUISITE SEXUAL VOMIT

ELECTRONIC APPARITION
UNHOLY DEATH AFTER DEATH
SCULPTING THE UNCLEAN
GOATVOMIT TRANSFUSION
PARASITES IN GARDEN OF CHRIST
FLOWERING DECIMATIONS
DEFILED IN PUTRID SILENCE
ABORTUM ABRUPTION
FUCKING UNHOLY OBSCURITY
MISCREATION OF FUSED FLESH
PERISHING BLACK LIGHT
SUICIDAL INSTINCTS
MIRRORS OF SUFFOCATION
RESURRECTION IN RECTUM

HIGH ON FORMALDEHYDE
EXHAUSTED CENTURY
BLOOD OF CHAOS CONSUMED
DRAPED IN PUTRID FLESH
SYMPHONIC GOATSODOMY
INFECTED CADAVER FLOWS
CRUCIFIED HUMILIATION
EXTREME TRUTH OF CARNAGE
ABHORRED DESPISER
SODOMASTICATE THE LIFELESS
ENDLESS HALLS OF SUFFERING
PRAYING AND DECOMPOSING
SCRIPTURAL PERVERSIONS
CLOSE YOUR FUCKING BOOK

RAPED OF YOUR RELIGION
SUPREME ANCIENT SANCTUM
NECROCADAVERIC RUMPUS
MORBID NUN IMPREGNATOR
CEASELESS RAMPAGE
ODIOUS HARLEQUIN FETUS
TAKE OATH OF BLACK BLOOD
CRUCIFIXION SKULL CHALICE
FOR THOSE ABOUT TO ROT
MACABRE EXECUTIONS
MOLEST THE CIRCLE OF LIFE
DROWNING IN AFTERBIRTH
CHRISTIAN COMPOST
AS SEMEN BLENDS WITH ASH

DISEMBOWELMENT OF THRONE
APOCALYPTIC THORACOPAGUS
MARCHING TO WINTER BATTLE
SACRIFICED UNDER PENTAGRAM
HEDONISTIC CARVING
SPECTRUM OF AGGRESSION
PLACENTOPHAGIC GORGING
FOUL SLUMBER OF BAPHOMETH
COVERED WITH DARKNESS
SPIRITUAL MOLESTATION
CANNIBALISM FROM WOMB
HALO OF BURNING WINGS
REBIRTH IN ROTTED GALLOWS
GOATFUCKING REHEARSAL

JESUS AUTOPSY EUPHORIA
CHAINS OF CHRISTIAN FILTH
BLEED UPON THE CROSS
BEHEADED AND SANCTIFIED
CEREMONIAL DARKNESS
STRIPPED OF MY FOUL FLESH
EXHUMED NECROMESSIAH
SOLSTICE OF OPPRESSION
FRENETIC GOAT WORSHIP
CLOTTED LIGHT OF ODIUM
CEREMONIAL EMBRYOMUTATION
GRACELESS CRUEL NOISE
PROFANATICA ABRUPTUS
BAPTIZED IN VOMIT OF PRIEST

Singular Agitations and a Common Vertigo

Keith Tilford

p335. *Graft*, ink on paper, 114.3cm x 76.2cm, 2004

p343. *Chatterbox*, ink on paper, 106.7cm x 76.2cm, 2004

p347. *Untitled*, ink, marker and eraser on colour plate, 22.5cm x 18.7cm, 2008

p352. *Untitled*, ink, marker and eraser on colour plate, 26cm x 20.3cm, 2008

p358. *Negative Machinery*, ink on paper, 121.9cm x 121.9cm, 2005

p361. *Untitled*, ink, marker and eraser on colour plate, 28.6cm x 20.3cm, 2008

p364. *Untitled*, ink on bristol board, 58.4cm x 73.7cm, 2004

On the Horror of Phenomenology: Lovecraft and Husserl

Graham Harman

In a dismissive review of a recent anthology on Schelling, Andrew Bowie accuses two authors of a style he 'increasingly' thinks of as 'continental science fiction'.[1] There is room for further increase in Bowie's thinking. With his implication that science fiction belongs to the juvenile or the unhinged, Bowie enforces a sad limitation on mental experiment. For nothing resembles science fiction more than philosophy does – unless it be science itself. From its dawning in ancient Greece, philosophy has been the asylum of strange notions: a cosmic justice fusing opposites into a restored whole; a series of emanations from fixed stars to the moon to the prophets; divine intervention in the movement of human hands and legs; trees and diamonds with infinite parallel attributes, only two of them known; insular monads sparkling like mirrors and attached to tiny bodies built from chains of other monads; and the eternal recurrence of every least event. While the dismal consensus that such speculation belongs to the past is bolstered by the poor imagination of some philosophers, it finds no support among working scientists, who grow increasingly wild in their visions. Even a cursory glance at the physics literature reveals a discipline bewitched by strange attractors, degenerate topologies, black holes filled with alternate worlds, holograms generating an illusory third dimension, and matter composed of vibrant ten-dimensional strings. Mathematics, unconstrained by empirical data, has long been still bolder in its gambles. Nor can it be said that science fiction is a marginal feature of literature itself. Long before the mighty crabs and squids of Lovecraft and the tribunals of Kafka, we had Shakespeare's witches and ghosts, Mt. Purgatory in the Pacific, the Cyclops in the Mediterranean, and the Sphinx tormenting the north of Greece.

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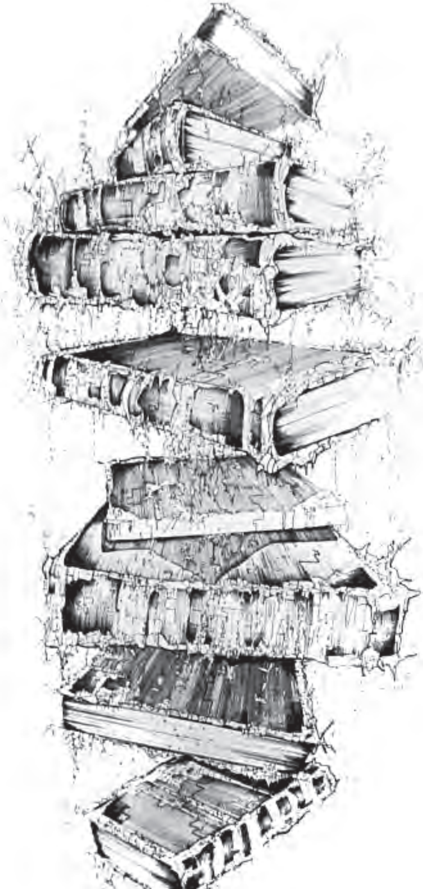
[1] Andrew Bowie, 'Something old, something new …', in *Radical Philosophy* 128 (November/December 2004), 46. The review is of *The New Schelling*, J. Norman & A. Welchman (eds.) (London: Continuum, 2004). The targets of Bowie's censure are Iain Hamilton Grant and Alberto Toscano.

Against the model of philosophy as a rubber stamp for common sense and archival sobriety, I would propose that philosophy's sole mission is *weird realism.* Philosophy must be realist because its mandate is to unlock the structure of the world itself; it must be weird because reality is weird. 'Continental science fiction', and 'continental horror', must be transformed from insults into a research program. It seems fruitful to launch this program with a joint treatment of Edmund Husserl and H.P. Lovecraft, an unlikely pair that I will try to render more likely. The dominant strand of twentieth-century continental thought stems from the



phenomenology of Husserl, whose dry and affable works conceal a philosophy tinged with the bizarre. In almost the same period, the leading craftsman of horror and science fiction in literature was Lovecraft, recently elevated from pulp author to canonical classic by the prestigious *Library of America* series.[2] The road to continental science fiction leads through a Lovecraftian reading of phenomenology. This remark is not meant as a prank. Just as Lovecraft turns prosaic New England towns into the battleground of extradimensional fiends, Husserl's phenomenology converts simple chairs and mailboxes into elusive units that emit partial, contorted surfaces. In both authors, the broken link between objects and their manifest crust hints at 'such terrifying vistas of reality, and of our frightful position therein, that we shall either go mad from the revelation or flee from the deadly light into the peace and safety of a new dark age'[3] – or preferably, revive a metaphysical speculation that embraces the permanent strangeness of objects. If philosophy is weird realism, then a philosophy should be judged by what it can tell us about Lovecraft. In symbolic terms, Great Cthulhu should replace Minerva as the patron spirit of philosophers, and the Miskatonic must dwarf the Rhine and the Ister as our river of choice. Since Heidegger's treatment of Hölderlin resulted mostly in pious, dreary readings, philosophy needs a new literary hero.

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[2] H.P. Lovecraft, *Tales* (New York: The Library of America, 2005).

[3] Ibid., 167. From the famous first paragraph of 'The Call of Cthulhu.'

LOVECRAFT'S MATERIALISM

In the great tales of Lovecraft we find a mythology centered in New England, but ranging from the Antarctic to Pluto as well. Humans are no longer lords of the cosmos, but are surrounded by hidden monstrosities who evade or corrupt our race, sometimes plotting its downfall. 'The Old Ones', or 'Those Ones', are the disturbing general terms by which these creatures are known. They vastly exceed us in mental and physical prowess, yet occasionally interbreed with human females, preferring women of a decayed genetic type. The least encounter with the Old Ones often results in mental breakdown, and all reports of dealings with them are hushed. But their unspeakable powers are far from infinite. To achieve their aims, the Old Ones seek minerals in the hills of Vermont, infiltrate churches in seaport towns, and pursue occult manuscripts under the eyes of suspicious librarians. Their researches are linked not only with Lovecraft's fictional authors and archives (the mad Arab al-Hazred, Miskatonic University), but real ones as well (Pico della Mirandola, Harvard's Widener Library). Their corpses are carried away by floods, and even the mighty Cthulhu explodes, though briefly, when rammed by a human-built ship. There are also rivalries between the monsters, as becomes clear in 'At the Mountains of Madness'. The powers of the various Old Ones are no more uniform than they are infinite.

This balance in the monsters between power and frailty is mentioned to oppose any *Kantian* reading of Lovecraft. Such a reading is understandable, since Kant's inaccessible noumenal world seems a perfect match for the cryptic stealth of Lovecraft's creatures. His descriptions of their bodies and actions are almost deliberately insufficient, and seem to allude to dimensions beyond the finite conditions of human perception. His monsters are not just mysterious, but often literally invisible; they undermine our stock of emotional responses and zoological categories. The very architecture of their cities mocks the principles of Euclidean geometry. A few examples will indicate the style:

> When a traveler in north central Massachusetts takes the wrong fork at the junction of the Aylesbury Pike […] he comes upon a lonely and curious country […] Gorges and ravines of problematical depth intersect the way, and the crude wooden bridges always seem of dubious safety. When the road dips again there are stretches of marshland that one instinctively dislikes […][4]
>
> Odd wounds or sores, having something of the aspect of incisions, seemed to inflict the visible cattle […][5]
>
> [Wilbur Whateley] would sometimes mutter an unfamiliar jargon, and chant in bizarre rhythms which chilled the listener with a sense of unexplainable terror.[6]

And most compellingly:

> It would be trite and not wholly accurate to say that no human pen could describe [the dead creature on the floor], but one may properly say that it could not be vividly visualized by anyone whose ideas of aspect and contour are too closely bound up with the life-forms of this planet and of the three known dimensions.[7]

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[4] Ibid., 370-1. Italics added.

[5] Ibid., 375-6. Italics added.

[6] Ibid., 379. Italics added.

[7] Ibid., 389. Italics added.

At the climax of 'The Dunwich Horror', when Curtis Whateley briefly glimpses the formerly hidden creature on the mountaintop, he describes it as made of squirming ropes, shaped somewhat like a hen's egg, with dozens of legs like barrels that shut halfway as it walks – a jelly-like creature having nothing solid about it, with great bulging eyes and ten or twenty mouths, somewhat grey in color with blue or purple rings, and a 'half-face' on top.[8] In the later tale 'At the Mountains of Madness', the vast Antarctic city displays 'no architecture known to man […] with vast aggregations of night-black masonry embodying monstrous perversions of known geometrical laws.'[9] When this dead metropolis is first sighted from the air, the narrator assumes it must be a polar mirage:

> There were truncated cones, sometimes terraced or fluted, surmounted by tall cylindrical shafts here and there bulbously enlarged and often capped with tiers of thinnish scalloped discs; and strange, beetling, table-like constructions suggesting piles of multitudinous rectangular slabs or circular plates or five-pointed stars […] There were composite cones and pyramids either alone or surmounting cylinders and cubes or flatter truncated cones and pyramids, and occasional needle-like spires in curious clusters of five. All of these febrile structures seemed knit together by tubular bridges […].[10]

The near-incoherence of such descriptions undercuts any attempt to render them in visual form. The very *point* of the descriptions is that they fail, hinting only obliquely at some unspeakable substratum of reality. It is obvious why this might seem Kantian in its implications.

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[8] Ibid., 409-10.

[9] Ibid., 508.

[10] Ibid., 508-9.

Nonetheless, the Kantian reading fails. Even if we accepted a metaphysics splitting the world into noumenal and phenomenal realms, there is no question that the Old Ones would belong entirely to the phenomenal. The mere fact of invisibility is surely not enough to qualify the monsters as noumenal. The so-called Higgs boson of present-day physics, assuming it exists, lies beyond the gaze of current particle accelerators. No one has ever witnessed the core of the earth, or the center of the Milky Way which may or may not be home to a massive black hole. Countless other forces must exist in the universe that could be only decades away from discovery, while others will remain shielded from human insight in perpetuity. But this does not make them noumenal: these forces, however bizarre, would still belong to the causal and spatio-temporal conditions that, for Kant, belong solely to the structure of human experience. Let us grant further that the Old Ones may have features *permanently* outstripping human intelligence, in a way that the Higgs boson may not. Even so, this would be the result not of the transcendental structure of human finitude, but only of our relative stupidity. The game of chess is not 'noumenal' for dogs through their inability to grasp it, and neither is Sanskrit grammar for a deranged adult or a three-year-old. In 'The Whisperer in Darkness', the Old Ones even invite humans to become initiated into their larger view of the world:

> Do you realise what it means when I say that I have been on thirty-seven different celestial bodies – planets, dark stars, and less definable objects – including eight outside our galaxy and two outside the curved cosmos of space and time? […] The visitors are eager to know men of knowledge like yourself, and

> to shew them the great abysses that most of us have had to dream about in fanciful ignorance.[11]

Humans prepare to reach these deeper abysses, neither through Heideggerian *Angst* nor a mystical experience that leaps beyond finitude and reduces philosophy to straw, but through purely medical means: 'My brain has been removed from my body by fissions so adroit that it would be crude to call them surgery.'[12] The great horror of Lovecraft's universe lies not in some sublime infinite that no finite intelligence can fully grasp, but in the invasion of the finite world by finite malignant beings. For all the limits imposed on our intellect by Kant, he leaves us reassured that the finite and phenomenal world is insulated from horror, governed and structured by our own familiar categories. Far more troubling is Lovecraft's subversion of the finite world: no longer a kingdom led by innocuous rational beings, but one in which humans face entities as voracious as insects, who use black magic and telepathy while employing mulatto sailors as worse-than-terrorist operatives.

The Old Ones are anything but noumenal. Noumenal beings scarcely have need of buildings, whether Euclidean or otherwise. Noumenal beings are not dissected on the tables of polar explorers, do not mine for rocks in Vermont, and have no purpose mastering Arabic and Syriac dialects to consult the writings of medieval wizards. They would never speak in physical voices, not even with 'the drone of some loathsome, gigantic insect ponderously shaped into the articulate speech of an alien species […] [with] singularities of timbre, range, and overtones [placing it] wholly outside the sphere of humanity and earth-life.'[13] Michel Houellebecq, in a brilliant study of Lovecraft,[14] is correct to emphasize his absolute materialism: 'What is Great Cthulhu? An arrangement of electrons, like us. Lovecraft's terror is rigorously material. But, it is quite possible, given the free interplay of cosmic forces, that Great Cthulhu possesses abilities and powers to act that far exceed ours. Which*, a priori*, is not particularly reassuring at all.'[15]

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[11] Ibid., 468.

[12] Ibid.

The terror of Lovecraft is not a noumenal horror, then, but a horror of phenomenology. Humans cease to be master in their own house. Science and letters no longer guide us toward benevolent enlightenment, but may force us to confront 'notions of the cosmos, and of [our] own place in the seething vortex of time, whose merest mention is paralysing', and 'impose monstrous and unguessable horrors upon certain venturous [humans]'.[16] Confronted with the half-human offspring of the Old Ones, even the political Left will endorse the use of concentration camps: 'Complaints from many liberal organizations were met with long confidential discussions, and representatives were taken on trips to certain camps and prisons. As a result, these societies became surprisingly passive and reticent'.[17]

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13. Ibid., 434.

14. Michel Houellebecq, *H.P. Lovecraft: Against the World, Against Life*, trans. D. Khazeni, Introduction by Stephen King. (San Francisco: Believer Books, 2005).

15. Ibid., 32.

16. Ibid., 719. From 'The Shadow Out of Time.'

17. Ibid., 587. From 'The Shadow Over Innsmouth.'

To expand on a passage cited earlier:

> The most merciful thing in the world, I think, is the inability of the human mind to correlate all its contents. We live on a placid island of ignorance in the midst of black seas of infinity, and it was not meant that we should voyage far. The sciences, each straining in its own direction, have hitherto harmed us little; but some day the piecing together of dissociated knowledge will open such terrifying vistas of reality, and of our frightful position within, that we shall either go mad from the revelation or flee from the deadly light into the peace and safety of a new dark age.[18]

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[18] Ibid., 167.

Though ostensibly Kantian on a first reading, nothing could be less Kantian than this passage in its call for barriers to enlightenment, and its placement of 'terrifying vistas' not in some transcendent sublime, but in the electrons that form the pulpy torso of Great Cthulhu.

THE WEIRDNESS OF OBJECTS

The literary critic Harold Bloom shares the following anecdote:

> Some years ago, on a stormy night in New Haven, I sat down to reread, yet once more, John Milton's *Paradise Lost* […] I wanted to start all over again with the poem: to read it as though I had never read it before, indeed as though no one had ever read it before me […] And while I read, until I fell asleep in the middle of the night, the poem's initial familiarity began to dissolve […] Although the poem is a biblical epic, in classical form, the peculiar impression it gave me was what I generally ascribe to literary fantasy or science fiction, not to heroic epic. *Weirdness* was its overwhelming effect.[19]

Science fiction is found not only in 'science fiction', but in great literature of any sort. More generally, Bloom contends that 'one mark of an originality that can win canonical status for a literary work is a *strangeness* that we either never altogether assimilate, or that becomes such a given that we are blinded to its idiosyncracies.'[20] Although Bloom has little time for philosophy, which he views as cognitively less original than literature, his standard of canonical achievement seems equally valid for philosophical work. If there is one feature that unites the great works of philosophy, it is surely their inability to be fully assimilated, or their tendency to become such a given that we are blinded to their strangeness. Though Plato and Kant can be seen as restrictive establishment figures, their works are saturated with deviant images and nearly fantastic concepts; they exceed all possible interpretation, resist all attempted summary, and appeal to readers of any nationality or political orientation. The education of young philosophers builds on these works as on bedrock. And they come alive only when some gifted interpreter rediscovers their strangeness.

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[19] Harold Bloom, *The Western Canon*, 24-5. (New York: Riverhead Books, 2004). Italics added.

[20] Ibid., 4.

Pressing further, it also seems evident that the strangeness of works comes less from the works as a whole than from the weirdness of the personae that fill them, whether in literature, philosophy, or science. Though Don Quixote and Lear's Fool appear solely in literary works, they are no more reducible to extant plot lines than our friends are exhaustively grasped by our dealings with them. Characters, in the broadest sense, are *objects*. Though we only come to know them through specific literary incidents, these events merely hint at a character's turbulent inner life – which lies mostly outside the work it inhabits, and remains fully equipped for sequels that the author never produced. If a lost Shakespearean tragedy were discovered, dealing with the apparent suicide of the Fool (who disappears without explanation from the existing text of *King Lear*), the same Fool would have to be present in the new work, however unexpected its speeches. The same is true of philosophical concepts, which must also be viewed as characters or objects. While recent philosophy insists on precise definitions of every term, a genuine philosophical concept always eludes such precision. We could list the known features of Leibniz's monads in a laminated chart, yet the list includes contradictions, and surely leaves us hungry for more. The same holds true of argon in chemistry or the string in physics. A thing cannot be reduced to the definitions we give of it, because then the thing would change with each tiny change in its known properties, as Kripke has sharply objected.[21] A good rule of thumb is as follows: *unless* a character gives rise to different interpretations, *unless* a scientific entity endures changed notions of its properties, *unless* a philosopher is entangled in contradictory assertions over one and the same concept, *unless* a new technology has unforeseen impact, *unless* a politician's party is one day disappointed, *unless* a friend is able to generate and experience surprises, then we are not dealing with anything very real. We will be dealing instead with useful surface qualities, not with objects. Let 'object' refer to any reality with an autonomous life deeper than its qualities, and deeper than its relations with other things. In this sense, an object is reminiscent of an Aristotelian primary substance, which supports different qualities at different times. Socrates can laugh, sleep, or cry at various moments while still remaining Socrates – which entails that he can never be exhaustively described or defined.

My thesis is that objects and weirdness go hand in hand. An object partly evades all announcement through its qualities, resisting or subverting efforts to identify it with any surface. It is that which exceeds any of the qualities, accidents, or relations that can be ascribed to it: an 'I know not what', but in a positive sense. Against frequent efforts to dismiss objects as fantasies assembled by humans from a pre-given surface of experienced contents, I contend that reality is object-oriented. Reality is made up of nothing but substances – and they are *weird* substances with a taste of the uncanny about them, rather than stiff blocks of simplistic physical matter. Contact with reality begins when we cease to reduce a thing to its properties or to its effect on other things. The difference between objects and their peripheral features (qualities, accidents, relations) is

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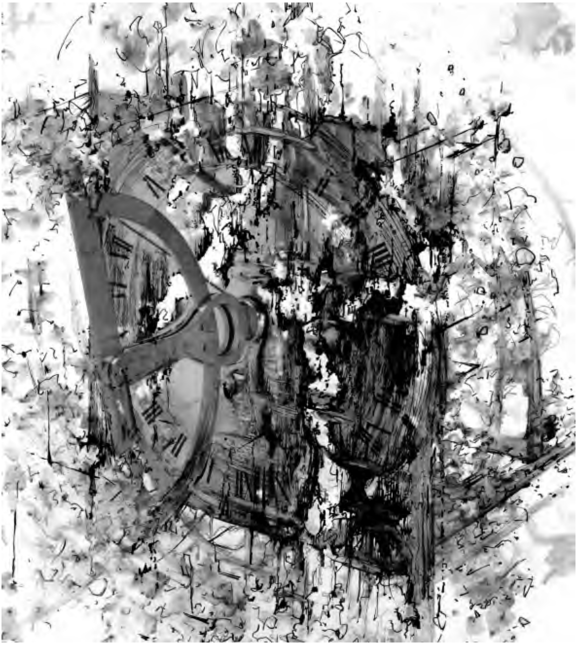
[21] Saul Kripke, *Naming and Necessity*. (Cambridge, MA: Harvard Univ. Press, 1996).



absolute. Though this thesis is deeply classical, it cannot possibly be 'reactionary', since the objects of which I speak resist all reduction to dogma, and in fact are the only force in the world capable of doing so.

INTENTIONAL OBJECTS

Few will object to the term 'weird realism' as a description of Lovecraft's outlook. *Weird Tales* was the periodical that spawned his career, and 'weird fiction' the term most often used for his own writings. Lovecraft was opposed to realism in the literary sense of James or Zola, their minute descriptions confined to the subtleties of human life. Yet he seems like a realist in the philosophical sense, hinting at dark powers and malevolent geometries subsisting well beyond the grasp of human life. By contrast, Edmund Husserl seems to be neither weird, nor a realist, and even looks like the opposite: a 'non-weird antirealist'. No reader, however emotionally unstable, is terrified by Husserl's works. Even in his life history, the sufferings we find stem from personal and political burdens, not from the family strain of madness that paralyzed the young Lovecraft and destroyed his parents. Moreover, when phenomenology is critiqued or abandoned, this is usually because of its wholehearted idealism. All of phenomenology results from a decision to 'bracket' the world, suspending reflection on real waves, genes, and chemicals in favor of what lies entirely within human consciousness. Ironically, this point has led some to compare Husserl with Kant as well. Here the comparison fails yet again, but for the opposite reason: while Lovecraft's monsters are too shallow to be noumenal, Husserl's intentional objects are too deep to be purely phenomenal.

Husserl often proclaimed his motto: ‘to the things themselves’. Though the phrase is partly misleading, it should be taken more seriously by those realists who find little of value in his thought. The first step is to remember that Husserl’s ‘things themselves’ are obviously not meant in the Kantian sense. His bracketing of nature leaves him with an immanent world of pure experience. Description (not *explanation*, as with realists) is taken to be the sole philosophical method. Furthermore, there is no room in Husserl for real things that might be viewed directly by God and that lie outside the parameters of human access to the world. All of this might seem to lead to a mere flattening of the noumenal into a special case of the phenomenal, as found in Fichte and his heirs. In his ontology, Husserl would seem to belong to the tradition of German Idealism; his own student Heidegger sometimes makes this claim, hinting vaguely that Husserlian phenomenology is the same basic project as Hegel’s *Science of Logic*. Some observers might even be seduced by the recurrence of the term ‘phenomenology’ in both Husserl and Hegel.

But despite Husserl’s fixation on the immanent world of appearance, he injects a dose of obstinate reality into the immanence. This occurs through his notion of intentional objects. The principle of intentionality is well-known: every mental act has some object, whether it be thinking, indicating, wishing, judging, or hating. This principle has not been correctly understood. It does not mean that Husserl somehow escapes idealism: his intentional objects remain purely immanent, and must not be confused with real forces unleashed in the world. The trees I perceive, the food I enjoy, or the swindlers I despise, remain phenomenal entities. After all, their real existence is bracketed, so that our description of them takes no account of whether they truly exist. Intentionality remains phenomenal. But Husserl's genuine difference from the idealists lies in the fact that intentional reality is made up of *objects*, which play no role at all for Fichte or Hegel. It is said that Husserl would lead his students through painstaking descriptions of a mailbox; perhaps on other days it was lampposts, inkwells, cats, rings, or vases. The point of such descriptions was 'eidetic variation', considering these objects from a variety of angles so as to approach their unvarying *essence* beneath all passing manifestation. The mere fact that intentional objects have an essence should prevent our seeing Husserl as a straightforward idealist, since 'essence' is normally a realist term, linked with the inherent features of a substance apart from all access to it. It is unthinkable that Fichte or Hegel would guide their students through minute descriptions of a specific solid object, since in their current of thinking objects have no stubborn essence of their own. 'Essence', for Hegel, is sublated into the higher unity of the concept, and Hegelians even like to accuse later continentals of a fixation on essence. By contrast, though Husserl brackets the world in order to focus on an immanent field of consciousness, the ego is not entirely master in this immanent realm. Cats and lampposts resist our first approach, demanding patient labours if their essence is to be gradually approached. While the shadows in Heidegger's thought lie buried beneath perception, Husserl's mysteries riddle the field of perception itself. Yet both thinkers allow for secrets to be harboured in the core of the things, and this is what separates them from idealism. Despite their regrettable focus on human reality, Husserl and Heidegger are object-oriented philosophers.

In one sense Husserl's obvious rival is psychologism, which holds that logical laws have only psychological validity. Husserl assaults this position in his massive prologue to the *Logical Investigations*, concluding that logic is objective through its ideal validity within the phenomenal realm. But an equally important rival is British Empiricism. *Logical Investigations* II is a detailed critique of the positions of Locke, Berkeley, and Hume. For all the differences between these three classic figures, it is safe to portray them as allied in advance against intentional objects. What comes first for the empiricists are isolated *qualities*, sometimes known as 'impressions.' By contrast, the tradition of phenomenology begins not with qualities, but with phenomenal *objects*. While the British school holds that objects are a bundle produced through the habit of linking diverse qualities together (Hume), or by imagining that hidden powers underlie qualities already seen (Locke), phenomenologists such as Husserl and Merleau-Ponty insist on beginning with the total *Gestalt* before any reduction to discrete tones and hues. For phenomenology, the slamming door and the black fountain pen precede their qualities, which gain sense only through a relative enslavement to those objects. Herein lies the greatness of phenomenology, which is more empirical than the empiricists. Experience is not of 'experienced contents', but of objects; isolated qualities are found not in the world we experience, but only in the annals of empiricism.

In *Logical Investigations* V, the rival is Husserl's own teacher Brentano, whether fairly or not. If Brentano held that all mental acts are grounded in some sort of presentation, Husserl twisted the formulation slightly, countering that

all mental acts are *object-giving*. The difference is subtle, but fateful. A presentation seems to put all its contents on the same footing. To represent a globe or a tower is to witness a specific configuration of colors, textures, shadows, and physical co-ordinates. But if we see experience as object-giving rather than presentational, we shift our focus toward the essential nucleus of the perception, stripping the paint and confetti from its outer shell through eidetic variation. And here we find the crucial difference between Husserl's intentional objects and the real objects of realist philosophers. Real objects, which play no role in the bracketed thinking of Husserl, subsist apart from their relations to anything else; no reality could be independent if it were generated by efforts to perceive or influence it. In this sense, it seems obvious that real objects must partly withhold themselves from all perception, description, registration, or cataloguing of their traits. A substance simply is what it is, and exceeds the endless summation of qualities that can be ascribed to it. But strangely enough, this is not true of Husserl's intentional objects, where an inverse relation holds. Without belabouring a point made elsewhere,[22] whereas real objects taunt us with endless withdrawal, intentional objects are always already present. A real tree would be deeper than anything that can be said or known about it, but the tree of intentional experience is entirely present from the start – it is always a genuine element of experience, affecting my decisions and my moods. If the real tree is never present enough, the intentional tree is always *excessively* present, its essence accompanied by the noisy peripheral detail that eidetic variation needs to strip away. The real object 'fire' is able to scald, burn, boil, melt, and crack other real objects, while the intentional object 'fire' has a very different function: it merely unifies a shifting set of profiles and surfaces whose various flickerings never affect its ideal unity. Real objects hide; intentional objects are merely weighed down with trains of sycophantic qualities, covering them like cosmetics and jewels.

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[22] See 'On Vicarious Causation', in **COLLAPSE II**, and *Guerrilla Metaphysics: Phenomenology and the Carpentry of Things* (Chicago: Open Court, 2005).

THE WEIRDNESS OF HUSSERL

The strangest defect of the books that Husserl published during his lifetime lies in how few descriptions they actually contain. Whatever he may have done in the classroom, one scours his principal works in vain for more than a handful of concrete examples. Husserl seemed content, in his major published writings, with hesitant manifestoes for phenomenology; Merleau-Ponty and Lingis, heirs of greater stylistic gifts, were left to put the method to the test. Consider the case of some massive artifact – say, a hotel complex such as the Nile Hilton, in my adopted home city. The phenomenologist might see it as follows: The hotel is not an arbitrary conglomerate pieced together from flecks of color and sound. What we first encounter is the hotel as a whole, its visible profiles all joined in allegiance to the total reality of the object. Observers may disagree over the exact boundaries of the facility, over where its style begins and ceases to reign, but all will agree that the hotel is present in consciousness as a unit. The various doors, plants, gates, windows, and guards are clearly imbued with a kind of hotel-being, since all would strike us quite differently if stripped from this zone and encountered elsewhere. We now circle the hotel, soaking up the feel of its various entryways: grand entrance in front, dusty two-guard access in back, glamorous terraces when viewed from the south at a distance, and grim windowless façade to the north. We explore the interior, passing from food court to travel agencies to weight room to rooftop lounge, finally knocking on random doors and asking to examine individual rooms. Never in these movements do we see the whole of the Hilton, yet never do we lose the sense of a general *style* to which the individual scenes belong. It is not important that moths and beetles would not also see it as a 'hotel', since we are dealing here not with objective reality, but only with our human *intention* of the hotel as a unified whole. Normally, we make no separation between an intentional object and the surface features through which it is announced. Though we only see one face of the hotel at a time, the presence of hotel and surface seem to be simultaneous, and joined together without fissure.

Yet this intimate bond between object and quality is an illusion, as both Husserl and Lovecraft are aware. Let's begin with a Lovecraftian version of the hotel. This requires an attempt to mimic his own literary style – a method of reverent parody that deserves to become a staple of philosophy. The following paragraphs might be found in an unwritten Lovecraft tale, 'The Nile Hilton Incident':

> Though apparently of recent date, the Nile Hilton is built around strange inner corridors of disturbingly ancient provenance. Its membership in the Hilton chain, meant to reassure travelers from the Occident, conceals grotesque legal maneuvers and deviant managerial practices of a purely local origin, and provides cover for a dubious history long expunged from brochures. The doormen are slumped and sullen in a manner atypical of Egypt, while their complexions speak vaguely of a strange admixture of Aztec and Polynesian blood not consonant with the known history of the city.
>
> Unnoticed by the casual witness, the building itself embodies subtle though monstrous distortions of sound engineering principle. Though the outer walls seem to meet at solid right angles, the hue of the concrete departs from accustomed values in a manner suggestive of frailty or buckling. The gaping air-shafts are striking for an edifice of such late construction, and

> seem fitted to an age when consumption and leprosy were still in abundance. For unknown reasons, several of the fire escapes would appear to issue beneath the surface of the ground. And though the rear façade displays no evident structural flaws, there is a sense of looming collapse in the area; one arising less from visual clues than from certain peculiarities of sound and odour which the management has refused to acknowledge. It is here that a faint but incessant thumping or scraping noise is combined with a scent joining the aroma of sandalwood to one oddly reminiscent of the corpses of bovines. In response to occasional complaints, the concierge makes ostentatious show of despatching inspectors; yet something in the *rhythm* of his response gives the unwonted impression of deceit.

Presumably, Merleau-Ponty was never a reader of Lovecraft. This is unfortunate, since their methods of description have a great deal in common. Although we normally encounter things clothed in a variety of costumes, we pass silently and directly through these garments to the thing as a whole, which seems to imbue them with its spirit. But in Lovecraft, the relation between a thing and its surface is perturbed by irregularities that resist immediate comprehension, as if the object suffered from a strange disease of the nervous system. In real life, an Egyptian doorman is usually found in a cheerful and careless pose, displaying the typical physiognomy of the southern populations of Aswan and Luxor. To describe him instead as 'slumped and sullen', as displaying racial features of distant or extinguished peoples, and especially to call attention to one's perplexity over these aberrations, leads to a breakdown in the usual immediate bond between the doorman and his qualities. A rare fissure is generated between the object and its traits. Although 'Egyptian doorman' remains a legitimate element of our experience, he is now a menacing kernel that seems to control his outer features like ghastly marionettes, rather than being immediately fused with them. Merleau-Ponty would agree that the durability of concrete is somehow legible in its colour, though the total emotional and perceptual effect of a wall is normally simultaneous and unified. But to suggest that something is amiss in the expected colour of a wall, something that faintly suggests imminent physical breakdown, is to decompose the usual bond between the phenomenon and the outer forms through which it is announced. Language is also able to hint at depth, at real things lying outside all access to them. Surprisingly, this is not the method of Lovecraft, whose materialism gives him a philosophy rooted in the surface, but one in which the relation between objects and their crusts is rendered problematic. His monsters are not deep in themselves, and function in his stories only to disturb the assumptions of human observers. One can imagine third-person tales of the Old Ones battling in outer space, aeons before the emergence of human beings. Such stories would yield more of fantasy than of horror, since we would miss the gradual awareness of human subordination that provides the Cthulhu mythos with its terror. There is nothing inherently compelling about a humanoid dragon with an octopus for a head; any teenager could draw such a thing, while scaring no-one. The horror comes instead from the declared insufficiency of the description, combined with a literary world in which this monster is a genuine player rather than a mere image. The description is horrific only insofar as it undermines any distinct image: 'If I say that my somewhat extravagant imagination yielded simultaneous pictures of an octopus, a dragon, and a human caricature, I shall not be entirely unfaithful to the spirit of the thing. A pulpy, tentacled head surmounted a grotesque and scaly body with rudimentary wings; but it was the *general outline* of the whole which made it most shockingly frightful.'[23] Whatever this 'general outline' may be, the narrator feels that his descriptions are at best 'not entirely unfaithful' to its spirit. But this is the very principle of phenomenological description, whose eidetic reductions never quite grasp the essence of the thing, and which differs from Lovecraft only in its usual avoidance of the theme of existential threat. In both cases, the known link between objects and their properties partially dissolves.

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[23] Lovecraft, *Tales*, 169. From 'The Call of Cthulhu.'

While there are palpable similarities between Lovecraft and Poe in their preference for moods of horror, too little has been said about their similarities of style. In both authors we find hesitant and flowery wording that not only paints their narrators as frail aesthetes, but effectively stunts the relation between things and their traits. In Poe's tale 'The Fall of the House of Usher', the narrator describes Roderick as having 'a nose of a Hebrew model, but with a breadth of nostril unusual in similar formations; a finely moulded chin, speaking, in its want of prominence, of a want of moral energy.'[24] To claim directly that there is a typical Jewish nose with a specific nostril size, or that the character of a person can be read from structures of the skull, would merely make one a racist and a phrenologist. But Poe's strange appeal to unexpected disproportions of nostril and chin manages to disassemble the complex amalgam of surface and inference that silently accompanies every new face. To say that Roderick can bear no sounds except the music of guitars would merely give an eccentric description, not a horrific one. The terror comes instead through Poe's meandering way of depicting the trait: 'there were but peculiar sounds, and those from stringed instruments, which did not inspire him with horror.'[25] Roderick's panpsychist theory of inanimate perception might be just a vitalist platitude if stated in a journal article. Yet Poe surrounds the idea with enlivening obstacles: 'His opinion, in its general form, was that of the sentience of all vegetable things. But, in his disordered fancy, the idea had assumed a more daring character, and trespassed, under certain conditions, upon the kingdom of inorganization.'[26] The phrasing should not be dismissed as belonging to a lost era of florid English style; the circumlocution is deliberate, and creates a gap between object and profile that is concealed in everyday experience. The same holds for the narrator's description of Roderick's macabre painting of an underground tunnel, in which 'certain accessory portions of the design served well to convey the idea that this excavation lay at an exceeding depth below the surface of the earth'.[27] And finally, Poe's descriptions of music are as impossibly vague as Lovecraft's stunted polar travel diaries. Foremost among Roderick's improvisations on the guitar is 'a certain singular perversion and amplification of the wild air of the last waltz of von Weber'.[28] If a musicologist were to specify the precise distortions of Roderick's melodies in a report commissioned by psychiatrists, or if we heard a recorded version of the music, the effect would be ruined. The point is not to pin down his exact deviations from mainstream musical practice, but to hint that something is terribly amiss in the relation between the music and its exact tones.

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[24] Edgar Allan Poe, *Poetry and Tales*, 321. (New York: Library of America, 1984.)

[25] Poe, *Poetry and Tales*, 322.

In Lovecraft as in Poe, the horror of things comes not from some transcendent force lying outside the bounds of human finitude, but in a twisting or torsion of that finitude itself. The immediate fusion between a thing and its tangible signals gives way to the detachment of a tortured underlying unit from its outward qualities. In similar fashion, cubist painting renders its figures paradoxically

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[26] Ibid., 327.

[27] Ibid., 325.

[28] Ibid., 324.

distinct from the amassing of planes and angles through which they are presented. It is no accident that only certain paintings by Georges Braque seem to approach a notion of what Lovecraftian architecture might look like,[29] and surely no accident that Ortega y Gasset links Husserl with Picasso.[30] That said, we should turn briefly from Lovecraft and Poe to the Husserlian version of cubism.

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[29] Among other instances, see Braque's 1908 canvas 'House at l'Estaque', best viewed in conjunction with Lovecraft's description of the Antarctic city.

[30] José Ortega y Gasset, 'On Point of View in the Arts', trans. P. Snodgress and J. Frank. In *The Dehumanization of Art* (Princeton, NJ: Princeton Univ. Press, 1968), 129-130.

What is most disturbing about intentional objects is that they are both *always* and *never* present. Husserl established that the field of perception is made up of objects, not sense data. Yet hotels, museums, and trees require the most laborious work of eidetic variation to free them of all noise, and even this method never succeeds. The hotel is present from the start, yet we never reach a truly exemplary vision of it, free of environmental accident. Nor are these accidents ever directly present. As soon as we shift our focus from the hotel as a whole to the peripheral dance of light along its façade, we have turned sunbeams or moon-rays into our new intentional object, and the eidetic reduction will now be blocked by further shimmering variations that do not affect the beams or rays as a whole. Intentional objects are everywhere and nowhere; they 'bubble and blaspheme mindlessly' at every point in the cosmos. Although vividly present as soon as we acknowledge them, intentional objects express their reality only by drawing neighboring objects into their orbit, and these things in turn are only present by enslaving still others. As Merleau-Ponty first observed, the structure of perception is not obvious in the least. There is no such thing as a directly given experience. Even less directly given would be the real objects lying outside all intentional experience, bracketed by Husserl and hence not considered in this article. Just as Lovecraft's horror has nothing to do with transcendent things themselves, the horror of phenomenology arises even though all transcendent reality is suspended. Lovecraft's heroes cannot maintain their faith in the familiar contract between things and their properties, since the creatures they encounter are never quite captured by any list of tentacles or strange vocal timbres. A weird reading of phenomenology (the only possible reading) loses faith not just in the given sense data of empiricists, but even in the clean separation between objects and qualities. What is present is never objects or qualities, but only a fission between one object and the satellite objects bent by its gravitational field, even if everyday perception deadens us to this fact.

Without having even considered the status of *real* objects, we find that intentional objects already have a weirdness that eludes definition. It is often falsely held that phenomena have definite qualitative features, which is the position of empiricism, not of Husserl. It is held even more widely, and just as falsely, that real objects must have definite material features and exact positions in space-time. These views form the apparent motive for recent philosophies of 'the virtual.' If real and intentional objects are both somehow actual, both fully enshrined in the world in a manner that could in principle be described, then both seem fully inscribed in a context or web of mutual interrelations. And since true realism requires that things be considered apart from all relations, the only solution would be to shift the scene of realism away from concrete objects and phenomena towards disembodied attractors, topological invariants, or other virtual entities, all of them outstripping any possible embodiment in specific entities.[31]

What this step misses is the already abominable weirdness of concrete objects, whether real or phenomenal. But Lovecraft and Husserl do not miss this point. Though the materialism of Lovecraft and the idealism of Husserl might seem to divide them, these doctrines go hand in hand. For we are never really sure just what an object is. Whether we define it as nothing more than electrons, or as just a shape present in consciousness, we replace the fathomless reality of things with an intellectual model of what their underlying reality ought to be. In this sense, realism tends to oppose the outlooks of Lovecraft and Husserl. Yet in a different sense, they save the weirdness of objects from its neglect by philosophies of the virtual. While such philosophies may deserve admiration for insisting on realism against any idealism or narrowly physical materialism, they are wrong to hold that objects are always utterly specific. Lovecraft (surprisingly) and Husserl (unsurprisingly) remain fixed on a material/phenomenal plane that prevents them from being full-blown metaphysical realists. But at least they grasp the weird tension in the phenomena themselves, always in tense dissolution from their qualities. It is a one-legged realism that misses the genuine hiddenness of things, but a weird realism nonetheless.

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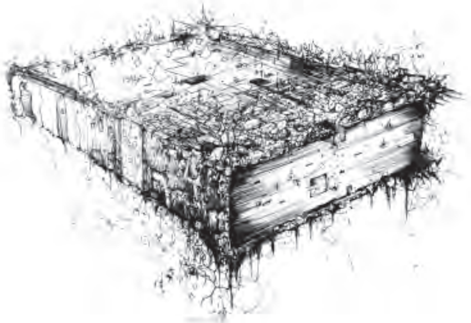
[31] See especially Manuel DeLanda's wonderful *Intensive Science and Virtual Philosophy*. (London: Continuum, 2002).

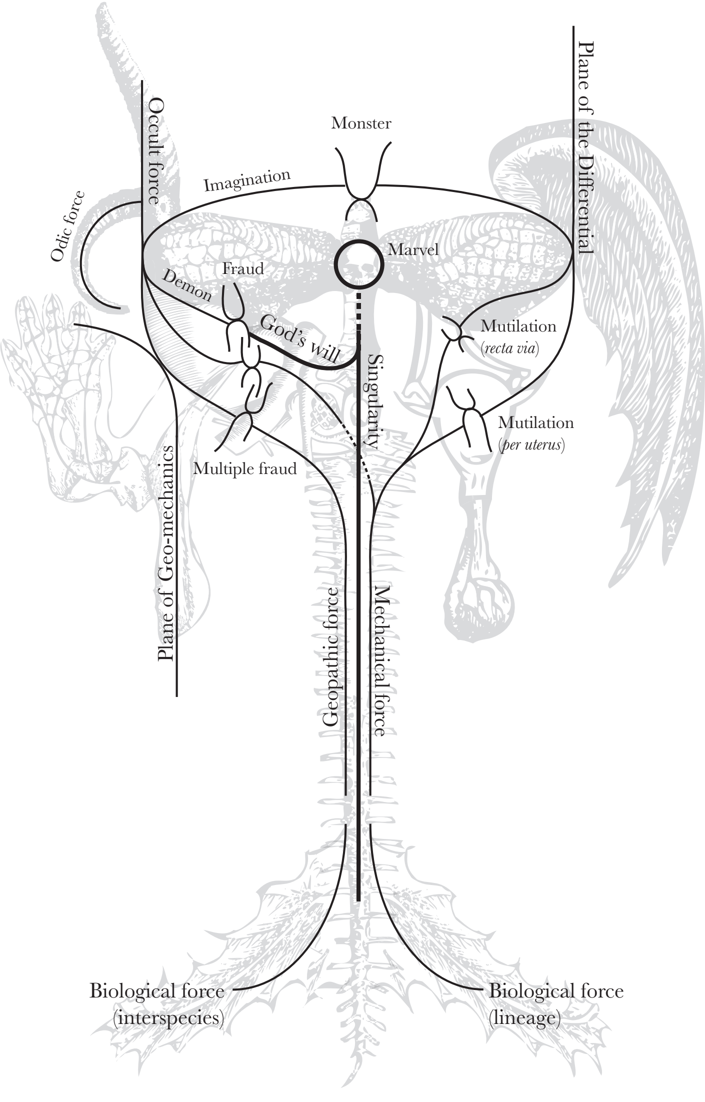


Arbor Deformia

Kristen Alvanson

Among manuscripts published and treatises written on teratology and cryptozoology, one work has been more influential than others: Ambroise Paré's *Des monstres et des prodiges*, written in the sixteenth century. Paré was a distinguished French surgeon, the royal surgeon of Henry II, Francis II, Charles IX and Henry III. *Monsters and Prodigies* was penned by Paré at the peak of the sixteenth-century teratological frenzy inherited from the occult and medical preoccupations of the Middle Ages. Written toward the later stages of his professional life as a surgeon, *Monsters and Prodigies* is a monstrous paean to arborescent models of taxonomy. For Paré, as a scientist who believed that his teratologic treatise should be incorporated with his works on surgery and practical medicine, the problem of taxonomy is more twisted and deformed than monsters and deformities themselves. Problems inherited from the Middle Ages concerning theological riddles, occult forces and fantastic fauna cannot easily be reconciled with Renaissance solutions. Therefore, for Paré what is deemed as truly monstrous is taxonomy itself: *How is it possible to build a monstrous order or taxonomy to bring all fiends, rogue beings, demonic deformities and divine marvels back into the fold?*

ARBOR DEFORMIA

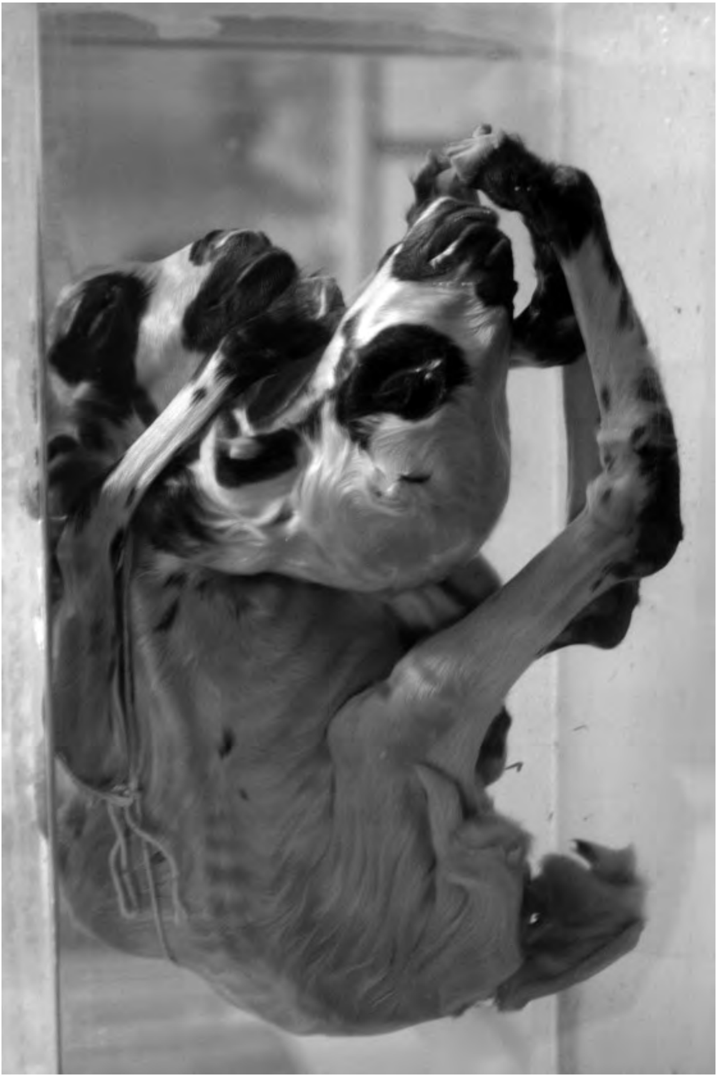

Monster
Imagination
Occult force
Plane of the Differential
Odic force
Marvel
Fraud
Demon
God's will
Singularity
Mutilation
(*recta via*)
Mutilation
(*per uterus*)
Multiple fraud
Plane of Geo-mechanics
Geopathic force
Mechanical force
Biological force
(interspecies)
Biological force
(lineage)

'Taxonomy as monstrous', 'hierarchy as deformity', 'category as schizophrenic order' and 'tree as *lusus naturae*' could all stand as partial characterisations of Paré's teratological system. In order to tackle the enigma of deformities, monsters and prodigies once and for all, Paré creates a paraphysical model in which (I) Singularity, (II) planes and (III) forces are the main components from which to concoct a taxonomic system. Forces derive from different fields or spheres and vary from occult-paranormal to mechanical-physical forces; in Paré's system, most of the taxonomies evolve out of interactions between these elements. These interactions include the application of forces to planes, the fusion of forces with each other or the conflict of certain forces with singularity. However, the force of Godhead or singularity is capable of developing taxonomies on its own. These elements can produce thirteen causes which incite abnormalities. Further classifying, Paré divides these causes into another four groups based on which deformities are identified: (i) marvellous causes, (ii) monstrous causes, (iii) mutilating causes and finally (iv) fraudulent causes. Marvelous causes are those which belong to the direct intervention of God and are divided into (1) wrath and (2) glory of God. Monstrous causes originate from the fusion of different forces or the application of different forces to certain planes; they are (3) too many seeds, (4) too little seed and (5) maternal imagination during pregnancy. Mutilations are mostly brought forth by the application of mechanical forces either directly to the embryo or through the womb; the rest originate from biological forces which themselves are divided into two sources, interspecies and hereditary. Mutilations include (6) deformity or smallness of the womb, (7) bodily postures of the mother during pregnancy, (8) unnatural pressure,

blows or even a blast of air to the womb, (9) hereditary or accidental illnesses, (10) rotten seed, (11) mingling of seeds belonging to different species. The fourth category of causes, fraudulent causes, are strictly related to occult forces: (12) through the artifice of wicked beggars, (13) demons and the Devil himself. Among these thirteen causes, 11 and 13 can form a categorical alliance – causes by unnatural conceptions (13a). The causes involving seeds (3, 4, 10, 11) can merge together to compose yet another offshoot, causes by unnatural seeds (13b). In this manner, Paré continues to add more branches, stems, branchlets, twigs and unnatural fruits to his taxonomy. Although Paré briefly touches on African and oceanic monsters, he emphasizes that the origin of monsters should be left hidden, referring to the cryptogenic essence of the monstrous.

The *Arbor Deformia* (see p.368) is a schematic designed after the Paréan system of teratological taxonomy. Taking taxonomy as the monstrous idea inclusive of all monsters and deformities, the *Arbor Deformia* is an arborescent model in the tradition of the early trees of knowledge, elements, demons and celestial bodies. The *Arbor Deformia* follows the tradition of arborescent distributions where the idea of the tree is the ratio of two operations, contraction and expansion, represented by two folds, roots and branches. In early arborescent models the tree is not a dichotomous totality but a proportional relation between the underground and elevated activities; it is also the perpetuation of asymmetries or deformities in symmetry or form. The non-dichotomous relation between the root and the branch is typified by the trunk as the middle-ground part of the model. Given that the tree is a ratio between underground and elevated activities, it can be infinitely deformed without losing its defining outlines. As a part of the ratio between roots and branches, new changes can be made within the existing range which is marked by the two poles, roots and branches. This enormous capacity for deformation is exemplified in the image of hollow trees. Hollow trees frequently appear in illustrations and paintings of the *Grotteschi* style, Arabesque–inspired ornamental engravings of the sixteenth century, not to mention the dead elm trees that feature in Italian Renaissance paintings. A thirteenth-century engraving from the *Ornamentale Vorlage-Blätter* made by the Flemish sculptor and draughtsman Cornelis Floris II depicts a tree which is not a tree, but a sport of nature. Alluding to the forbidden fruit of the Garden of Eden, Floris' tree is in the shape of a fruit bursting open with demons, monsters and serpents. It is a hollowness which only in appearance bears the burden of its tree-ness.

New forces and planes have been added to *Arbor Deformia* to include those causes of deformities which are absent in Paré's taxonomy. *Arbor Deformia* is comprised of five forces and two planes. Forces include (1) hereditary biological forces, (2) inter-specific biological forces, (3) mechanical forces, (4) occult forces, and (5) geopathic forces. The plane of the differential and the plane of geo-mechanics are the receptive planes for forces. The plane of geo-mechanics is not directly involved in producing deformities and monsters, but connects two different forces which can cause abnormalities: The plane of the differential expresses the embryonic stage of cell differentiation. A blow is a mechanical force; when it is applied to the womb during the embryonic differentiation of cells it can cause a deformity in the fetus and consequently, the newborn. For example, a mechanical shock transmitted to the limb buds



can later cause the baby to have seven toes on each foot and no elbows, because the limb buds contain in themselves the ideas of toes and elbows which will later differentiate into the actual toes and elbows. Excessive or unwanted application of mechanical forces to the embryo may cause a group of deformities called mutilations. In *Arbor Deformia*, marvels are created by singularities such as the direct intervention of God. The cases of deformities or inversion of internal organs which are not lethal are usually associated with the direct intervention of God and considered marvels. Jean Macé, a seventy-two-year-old soldier, was dissected after his death and found to be a perfect epitome of *situs inversus,* with his heart and spleen being on the right, the liver on the left. Joseph-Guichard Duverney, the French anatomist, declared the case a marvel because the original internal deformity was originally situated in the performed germ in such a way as not to cause death or mutilation.

Occult forces include a wide range of influences and emanations including imagination, electricity, odic and magnetic force, demonic influences, etc. The womb, according to Renaissance teratological models, is the organ which hungers for external forces.[1] Any ambiguous emotion or obscure force directed toward a woman will be absorbed and picked up by the womb. The classic medieval example of the occult influence of imagination upon the embryo is 'a woman looking upon an ape too attentively during her pregnancy and as a result giving birth to a baby with thick black hair covering the entire body and even inside the mouth'. Occult forces can conflict or join with other forces to cause deformities. For this reason, occult forces are mostly involved with fraudulent deformities. For example, electricity as an occult force can combine with a mechanical force and give rise to a fraud. A mother bat warmly breastfeeding its baby on an electricity wire has been electrocuted. The mechanical haptic bond between the mother and the baby has been captured by electricity; and hence, a motherly contact has been deformed to a monstrous fraud (see facing page). Occult forces can also work upon themselves to produce further frauds. A person who has spent a long time in absolute darkness can permeate a spectral image joined to his torso or the back of his head. Such spectral frauds might be in the form of a second head, a shape-shifting and conjoined twin, etc. Such auric or proto-ectoplasmic frauds are usually associated with odic,[2] magnetic or other occult emanations. Occult forces are able to conflict with singularity or alter the will of God into a fraud. A succubus can have sex with a man as he sleeps, turning his dream of being a man to the awakening of a water beetle.

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[1] According to Renaissance texts, if the female seed does not fruit, it will ferment by its own hunger, rot and turn into vermin which will devour or disfigure the womb (cf. Isabella de Moerloose's account in her autobiography, 1695).

In Far Eastern, especially Chinese, teratology, monsters can come to life through the combination of earthly forces and occult influences. A geopathic force or stress is usually defined in terms of harmful earth rays connected

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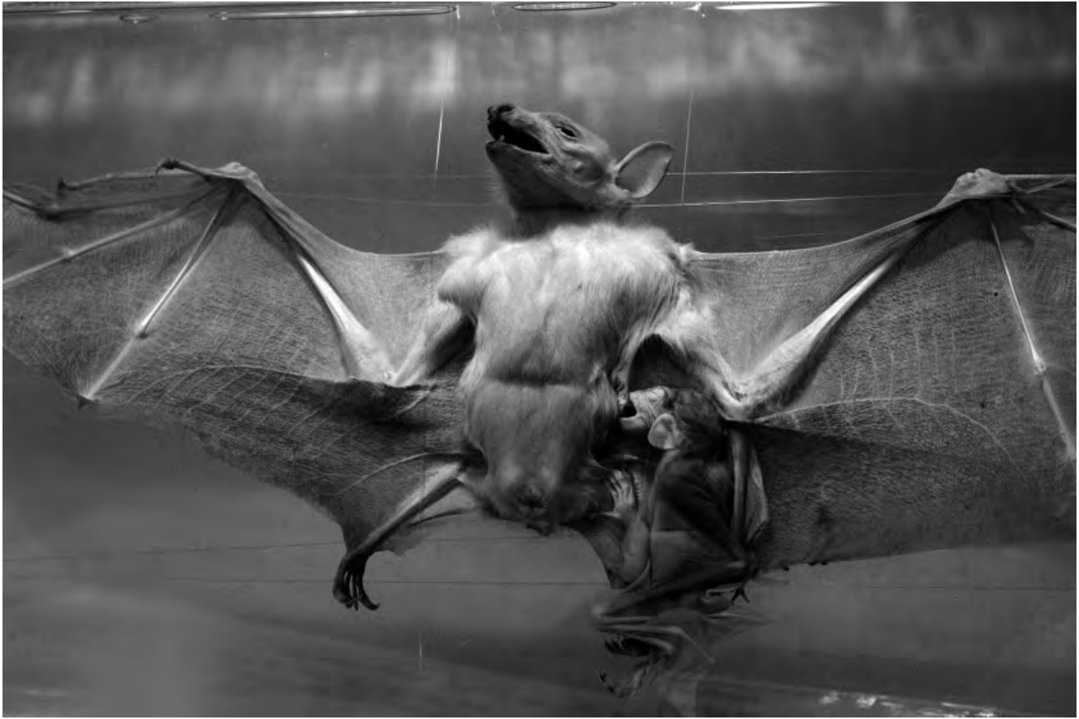
[2] Odic force is a name given in the nineteenth century by Carl von Reichenbach to a hypothetical vital force, a life flux which emanates from vital substances and is similar to electricity and magnetism. Odic force manifests itself most often in the mouth, the hands, the forehead and the occiput and has different laws of distribution than those of electricity: 'Odylo-luminous phenomena of great extent appearing over metal plates (electrified or unisolated) do not adhere to the metallic surface, as the electrical currents do, but flow over it as the aurora borealis does over the earth. Odylic currents do not flow merely from the points but also from the sides of bodies, even of jagged bodies, e.g. large crystals: electricity prefers a point for exit.' (Carl von Reichenbach)



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to the earth's electromagnetic fields, fault lines, minerals, underground caves, etc. These forces can combine with occult forces which influence the plane of geo-mechanics and cause particular deformities. A boy at the onset of puberty who walks along and over leylines or other energy lines can be influenced by earthly-occult radiations which might drive the boy mad or increase the rate of bone growth, enlarging the head or putting an end to his overall growth. In Chinese teratology, there have been cases of pregnant women who, after being exposed to a particular location such as a former altar for sacrificing humans or a house with a dark history, have given birth to extremely deformed babies. Since these deformities are caused by more than one obscure force they are categorized as the group of multiple frauds. The last two forces, the hereditary and inter-specific biological forces, make the organic fold of the tree over which non-organic forces grow and blossom. Unnatural conceptions between pigs and men or ants and lions are among inter-specific biological deformities. While deformation by a corrupt seed belongs to the hereditary forces or forces associated with the lineage. *Arbor Deformia* shows the proportion of its branches to its roots, of the inorganic arms to the organic appendages. Monsters, frauds, marvels, mutilations and multiple frauds are the fruits of this proportional relation.

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JAKE AND DINOS CHAPMAN
The collaborative works of brothers Jake and Dinos Chapman remain among the most consistently radical and invigorating forces in contemporary art. They have exhibited internationally and were recently the subject of a major retrospective at the Tate Liverpool in 2006-7 (See *Bad Art for Bad People*, ed. C. Grunenberg and T. Barson, London: Tate Publishing, 2006).

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Michel Houellebecq

As well as being the author of several bestselling novels, including *Atomised* (trans. F. Wynne, London: Heinemann, 2000) – filmed by Oscar Roehler in 2006 – and *Platform* (trans. F. Wynne, London: Heinemann, 2002), Michel Houellebecq has published several books of poetry (collected in *Poésies*, Paris: J'ai Lu, 2000) and various essays – notably his 1991 book on H. P. Lovecraft *Against the World, Against Life* (trans. D. Khazeni, San Francisco, CA: Believer Books, 2005). Houellebecq's most recent novel was *The Possibility of an Island* (2005, trans. G. Bowd, London: Weidenfeld & Nicolson, 2007). He now lives and works in Ireland.

Oleg Kulik

The practice of Oleg Kulik, who has been internationally acclaimed as one of the most radical artists working today, encompasses extraordinary live actions, manipulated photography and other media. Much of his past work has been concerned with exploring the subject of animal as human being or animal as a non-anthropomorphous Other. A book documenting Kulik's work since 1993 accompanied his 2001 performance in the UK (*Oleg Kulik: Art Animal*, Birmingham: Ikon Gallery 2001). He is represented by XL Gallery, Moscow (xlgallery@gmail.com).

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Thomas Ligotti has gathered a dedicated cult following and garnered critical acclaim and awards for his fiction, which includes the collections *Teatro Grotesco* (London: Random House, 2008), *Noctuary* (New York: Carroll and Graf, 1994) and *Songs of a Dead Dreamer* (London: Robinson Publishing, 1989). He is currently working on a volume of theoretical writings entitled *The Conspiracy Against the Human Race*.

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China Miéville is an author of weird fiction. He has won the Arthur C Clarke Award twice, for his novels *Perdido Street Station* (London: Macmillan, 2000) and *Iron Council* (London: Macmillan, 2004). His other books include a collection of short fiction, *Looking for Jake* (London: Macmillan, 2005), and a book for younger readers, *Un Lun Dun* (London: Macmillan, 2007). His non-fiction includes *Between Equal Rights: A Marxist Theory of International Law* (London: Haymarket, 2005).

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RAFANI

The art collective Rafani have exhibited extensively in the Czech Republic and elsewhere since their founding in 2000 by four students from Prague's Academy of Fine Arts. Their constitution states that they 'build on the everyday experience of wide social strata; we analyse it and look for points that go beyond the sphere of the mundane. With a conscious art form we attempt to reflect their interests, dreams, fears, and ambitions. What we express is in harmony with their ideas; we speak the language of bitter truth.'

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Steven Shearer is an artist who lives and works in Vancouver, Canada. Shearer exhibits internationally, with recent exhibitions including solo presentations at the IKON Gallery, Birmingham, The Power Plant, Contemporary Art Gallery, Toronto, and De Appel, Amsterdam, most recently showing at the New Museum, New York in a two person exhibition entitled *Double Album*.

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TODOSCH
Perhaps best known for his attempt to attack the 2000 Hanover Expo with a paramilitary convoy, artist Thorsten Schlopsnies, AKA Todosch, has also exhibited sculpture and graphic work, and has been involved in various musical projects, as well as staging live actions. See http://todosch.felix-werner.net/

*

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CONTRIBUTORS: **Kristen Alvanson, Jake and Dinos Chapman, Iain Hamilton Grant, Graham Harman, Michel Houellebecq, Oleg Kulik, Thomas Ligotti, Quentin Meillassoux, China Miéville, Reza Negarestani, Benjamin Noys, Rafani, Steven Shearer, George Sieg, Eugene Thacker, Keith Tilford, Todosch, James Trafford.**

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Sense and Nonsense

'The pendulum of the mind alternates between sense and nonsense, not between right and wrong.'

Carl Jung, *Memories, Dreams, Reflections*

'In order to be able to draw a limit to thought, we should have to find both sides of the limit thinkable (i.e. we should have to be able to think what cannot be thought). It will therefore only be in language that the limit can be drawn, and what lies on the other side of the limit will simply be nonsense.'

Ludwig Wittgenstein, *Tractatus Logico-Philosphicus*

'Philosophy must be ontology, it cannot be anything else; but there is no ontology of essence, there is only an ontology of sense.'

Gilles Deleuze, *Review of Logic and Existence*

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Volume 19 is a collection of papers dealing with the issue of sense and nonsense, in particular in relation to notions such as scepticism, immanence, and expression in philosophy, in the work of such thinkers as Wittgenstein and Deleuze. It also contains various articles on or by writers such as Badiou, Lacan, and Maimon, and a number of reviews of recent publications in continental philosophy.

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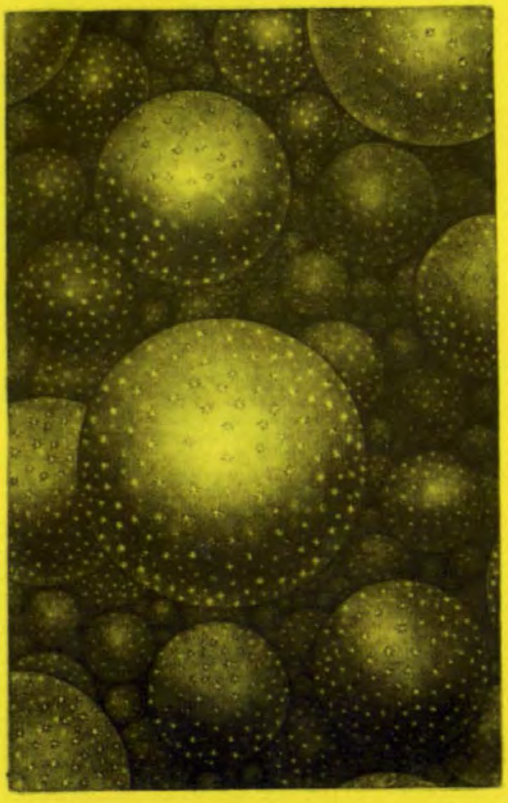

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VOLUME V

Edited by

Damian Veal

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Editorial Introduction

Damian Veal[1]

> [T]hough the medieval world was [...] immense, relatively to man and his planet, it was nevertheless definitely limited and fenced about. It was therefore essentially picturable; the perspectives which it presented, however great, were not wholly baffling to the imagination.[2]

> Copernicanism tore asunder the fit between the world and man's organs: the congruence between reality and visibility [...] The breakdown of the postulate of visibility – taken in its widest sense – is brought to a point by a kind of reversal: The visible world is not only a tiny section of physical reality, but it is also, qualitatively, the mere foreground of this reality, its insignificant surface, on which the outcome of processes and forces is only symptomatically displayed. Visibility itself is an eccentric configuration, the accidental convergence of heterogeneous sequences of physical events.[3]

Almost five hundred years after Nicolaus Copernicus' death, the notion of 'Copernicanism' continues to be a compelling one for science, philosophy and the popular imagination alike. However 'Copernicanism' stands for a legacy which is still contested, as the multiple perspectives collected in this, the fifth volume of **Collapse,** reveal; and as was amply demonstrated by some recent events.

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[1] I would like to extend my thanks to Robin Mackay for his comments and contributions to this introduction, in particular the sections on the work of Nigel Cooke and Keith Tyson. Thanks also to Ray Brassier for his critical comments.

[2] Arthur Lovejoy, *The Great Chain of Being* (Cambridge, Mass.,: Harvard University Press, 1936), 101.

[3] Hans Blumenberg, *The Genesis of the Copernican World* (Cambridge, Mass.: MIT Press, 1987), 642.

While in the penultimate stages of editing this volume in late November 2008, it was widely reported in the world's media that researchers in Poland had identified the remains of Nicolaus Copernicus by comparing DNA from a skeleton with that of a hair retrieved from one of the sixteenth-century astronomer's books. The findings, it was reported, were 'the culmination of four years of investigation and centuries of speculation about the final resting place of the man who challenged the Bible and medieval teachings of the church'.[4] The Catholic bishop who had instigated the archaeological search, however, knowing full well that Copernicus had never harboured any such heretical intentions, used the opportunity to point out that Copernicus had in fact been 'a deeply religious clergyman and cathedral canon who dedicated his main work to the Pope and presented his faith clearly'.[5]

The bishop of course neglected to mention the fact that it had taken no less than four and a half centuries and a succession of forty-four popes before one of latter took it upon himself to officially admit that Copernicus may actually have had a point.[6] Instead, he proposed that the discovery should lead humanity to reflect that centuries of conflict between scripture and empirical science had really

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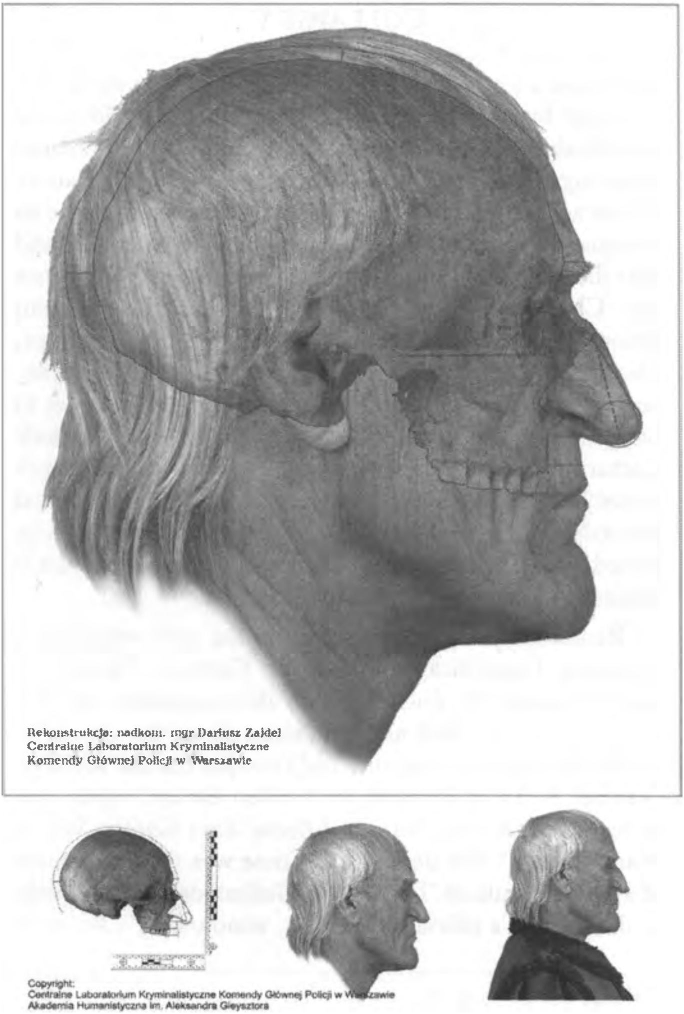
[4] *The Guardian*, Friday 21 November 2008.

[5] 'Bishop: Discovery of Copernicus' remains highlights his contributions', *Total Catholic*, 2 December, 2008.

[6] 'Vatican Science Panel Told By Pope: Galileo Was Right', *New York Times*, 1 November, 1992.



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Akademia Humanistyczna im. Aleksandra Gieysztora

Digital reconstruction of the head of Nicolaus Copernicus, on the basis of remains identified by Polish scientists in late 2008 as being those of the sixteenth-century astronomer.

only been a lot of fuss about nothing – a 'great misunderstanding' brought about by the fact that people had 'made the mistake of absolutising one philosophical vision without reflecting on new insights and discoveries'.[7] The implication, of course, was that no 'philosophical vision' ought to be so absolutised, and that we must finally come to understand that there is really no substantive conflict between science and Church doctrine at all – a conciliatory sentiment fittingly symbolised by the fact that Copernicus' remains, identified by means of advances made in late twentieth-century genetics and computer technology, are now set to be reinterred during the celebrations planned for Frombork Cathedral's 750th anniversary in 2010.[8] In thus ceremoniously returning Copernicus' remains to the consecrated grounds of this ancient place of worship, perhaps it is hoped that 'Copernicanism' itself, and the unholy forces it unleashed, might finally be buried as well.

Remarkably enough, this was not the only news report involving Copernicanism and the Catholic Church to appear during the final stages of the preparation of this volume. Just five days after the story about the identification of Copernicus' remains, *The Times* put out the headline 'Vatican Seeks to Rehabilitate Galileo Galilei', while *The Boston Pilot* ran with 'Vatican Official Says Galileo Was a Man of Faith'.[9] The occasion this time was the appearance of an article entitled 'Thank you, Galileo' on the front page of the Vatican's official newspaper, announcing a series of events planned by the Vatican for 2009 to coincide with the celebrations surrounding the 400th anniversary of Galileo's first observations with a telescope. Earlier in 2008, Pope Benedict XVI had been obliged to cancel a planned visit to Rome's principal university due to vehement protests from academics and students who had accused him of hostility towards science, citing his alleged endorsement of the Inquisition's condemnation of Galileo. (In a speech in 1990, the then Cardinal Ratzinger had cited the philosopher of science turned anarchist-cum-Dadaist Paul Feyerabend's comment that the verdict against Galileo had been 'rational and just'.)[10] Given the negative press following from this incident, it seems that the Vatican had thought it expedient to publicly 'reclaim' Galileo for the Church, very much in the way that the Polish bishop had used the identification of Copernicus' remains as an opportunity to posthumously bring him back within the fold.

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[7] 'Bishop', *Total Catholic*, op. cit.

[8] Ibid.

[9] *Times Online*, 26 November, 2008; *The Boston Pilot*, 5 December 2008.

Citing Pope Benedict XVI's statement that Galileo had been 'a man of faith who saw nature as a Book written by God', the author of the Vatican's newspaper article reiterated the sentiment of the Polish bishop, insisting that the Galileo celebrations should 'encourage people to consider seriously the relationship between faith and science; lead scientists to recognize the role faith played in Galileo's life; and lead theologians to recognize the contributions Galileo made to the church's attitude toward science'.[11] Having announced in November that a statue of Galileo was to be erected in the Vatican gardens, the Pope then used the onset of the Winter solstice on the 21st of December as an opportunity to remark upon not only the coincidence of Christmas with the solstice and 'the function of astronomy in marking out the rhythm of prayer', but to once again praise Galileo and his telescope for the way in which they had stimulated appreciation of God's work: 'If the heavens', said the Pope, 'according to the beautiful words of the psalmist, "proclaim the glory of God" (Psalm 19 [18]: 2), then the laws of nature, which over the course of the centuries many men and women of science have helped us to understand better, are also a great stimulus to contemplate with gratitude the works of the Lord.'[12] One can only surmise what the official Vatican line will be with respect to the imminent celebrations for the 200th anniversary of Darwin's birth and the 150th anniversary of *The Origin of Species* in 2009. Will it be claimed that Darwin too had been a 'man of faith', and that evolution likewise bears witness to the glory of the Lord's Creation?[13]

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[10] See, e.g., 'Pope pulls out of visit to Rome university after outrage at his views on Galileo and science', *The Guardian*, 16 January, 2008. The passage cited by Ratzinger is taken from Paul Feyerabend, *Wider den Methodenzwang*, 2nd ed. (Frankfurt am Main: Suhrkamp, 1983), 206. For helpful scholarly (rather than journalistic) treatment of the Feyerabend passage, and Ratzinger's citation of it, see Ernan McMullin, 'Quoting Feyerabend on Galileo', *Irish Theological Quarterly* 73, 2008: 164-73.

[11] 'Vatican Official Says Galileo Was a Man of Faith', *The Boston Pilot*, op. cit.

Of course, that Nicolaus Copernicus and Galileo Galilei were 'men of faith' is uncontroversial. Indeed, given that the Pope's comments were made in connection with the quatercentenary of Galileo's first use of the telescope, he might have done well to point out that, in his 1610 *Sidereus nuncius* (i.e., the book in which his first telescopic observations were reported), Galileo had enthusiastically declared that he had devised the telescope 'after being illuminated by divine grace.'[14] Moreover, as Hans Blumenberg and Karsten Harries have documented, the advent of the telescope in the seventeenth century was seized upon by the likes of Francis Bacon and Joseph Glanvill as an invention which promised a technological restitution of the perfect clarity of vision which humanity had supposedly lost with Adam's fall. Adam, surmised Glanvill,

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[12] See the news headlines for 21 December 2008: 'Pope Praises Galileo's Astronomy' (*BBC News*), 'From Heretic to Hero: Pope Pays Tribute to Galileo' (*ABC Online*), 'Pope Benedict XVI Celebrates Galileo's Astronomy' (*The Telegraph*).

[13] Given the fact that in April 2007 Pope Benedict gently 'corrected' Pope John Paul II's 1996 statement that evolution was 'more than a hypothesis', stating that while his predecessor 'had his reasons for saying this, it is also true that the theory of evolution is not a scientifically proven theory', this seems rather less than likely. See 'Pope Stokes Debate on Darwin and Evolution', *Times Online*, April 12, 2007.

> needed no Spectacles. The acuteness of his natural Opticks (if conjecture may have credit) shew'd much of the Coelestial magnificence and bravery without a Galilaeo's tube: And 'tis most probable that his naked eyes could reach near as much of the upper world, as we with all the advantages of art. It may be 'twas as absurd even in the judgement of his senses, that the Sun and Stars should be so very much less than this Globe, as the contrary seems in ours; and 'tis not unlikely that he held as clear a perception of the earth's motion, as we think we have of its quiescence.[15]

Glanvill's book was published just fifteen years before Olaf Römer's discovery of the finite speed of light in 1676 – a discovery scarcely less momentous than that of the

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[14] 'All these facts were discovered by me not many days ago with the aid of a spyglass which I devised, after being illuminated by divine grace.' Galileo Galilei, *The Starry Messenger*, in *Discoveries and Opinions of Galileo*, trans. S. Drake (New York: Anchor Books, 1957), 28.

[15] Joseph Glanvill, *The Vanity of Dogmatizing* (1661), cited in Harries, *Infinity and Perspective*, op. cit., 106. On seventeenth-century attitudes toward both the telescope and microscope, see also Catherine Wilson, *The Invisible World: Early Modern philosophy and the Invention of the Microscope* (Princeton: Princeton University Press, 1995).

Copernican revolution itself, and which was later adverted to in Mark Twain's posthumously published *Letters from the Earth*, wherein Satan, in one of the most cruelly cynical tirades against human vanity ever written, points out that at the beginning of Creation not even a single star would have been visible in the sky over the biblical Paradise, and that even at the end of a thousand years there still would not have been enough to 'make a show'.[16] Yet as Blumenberg suggests, Bacon's idea of making the recovery of Paradise into the goal of historical progress through science, and Glanvill's expectation that the telescope might ultimately enable man to recoup his prelapsarian intuitive prowess, should be understood less as the secularisation of an originally religious idea and more as a way of safeguarding an anthropology in which man and cosmos are seen as 'coordinated in such a way that no essential incongruence can be assumed between man's organic equipment and the constituents of reality'.[17] No wonder, then, that Bacon, the anti-Copernican, expressed such alarm at the idea of the finite speed of light:

> It seemed to him shocking (*dubitatio plane monstrosa*) that in looking at the starry heavens we could catch sight only of the past, something that might have long since ceased to be real – that the *tempus visum* and *tempus verum* [apparent time and true time] could split apart arbitrarily [...] that the presentation of the starry heavens, which man had so long related to himself as the one who was called to observe it, could be a mere appearance

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[16] Mark Twain, *Letters from the Earth* (New York: Harper & Row, 1962), 15. Twain wrote the book in 1909; it was not published until 1962.

[17] *The Genesis of the Copernican World*, op. cit., 629, cf. 635 and Part VI, Chapter 1: 'How Horizons of Visibility Are Conditioned by Views of Man', 622-642 *passim*.

> also in that it was not the homogeneous total reality that it presents itself as in intuition, but instead was nothing but an accidental section through the many layered depths of huge temporal differences.[18]

According to Blumenberg, the epochal significance not only of Copernicanism but also of what we might call 'Römerianism', is thus not so much that it entailed 'man's removal from the centre',[19] but rather that it rendered obsolete once and for all the medieval equation of reality and visibility,[20] thus revealing a seemingly unbridgeable chasm between our biologically-inherited perceptual faculties and the sheer scale and complexity of the universe. While Copernicus himself could still employ as a premise in arguing for the truth (rather than mere empirical adequacy) of his theory the idea that the universe had been created 'on our behalf' or 'for our sake' (*propter nos*) by a supremely good and orderly Creator,[21] such a teleological, anthropocentric conception of the universe became increasingly difficult to maintain in the wake of Römer's demonstration of the finite speed of light – that is, at least, for those who were cognizant of its implications. How, after all, could one continue to regard man as the privileged *contemplator caeli*, as the specially appointed witness of the wonders of creation, when the time required for the light to reach him from unknown star systems was longer than the entire duration of the earth?

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[18] Ibid., 542.

[19] As scores of historians have not failed to point out, this standard narrative is inherently implausible inasmuch as the medieval conception of the cosmos was less anthropocentric than *diabolocentric*, the earth being regarded as 'the filth and mire of the world, the worst, lowest, most lifeless part of the universe, the bottom story of the house' (Montaigne as quoted by Arthur Lovejoy, *The Great Chain of Being*, op. cit., 102) and the actual centre of the universe being identified with hell. As late as 1640 an English supporter of Copernicanism recognised one of the strongest current arguments against heliocentrism as proceeding from 'the vileness of our earth, because it consists of a more sordid and base matter than any other part of the world; and therefore must be situated in the centre, which is the worst place' (ibid.). Galileo himself, in the work already cited, took himself to be furnishing a refutation of 'those who argue that the earth must be excluded from the dancing swirl of stars for the specific reason that it is devoid of motion and of light. We shall prove the earth to be a wandering body surpassing the moon in splendor, and not the sink of all dull refuse of the universe; this we shall support by an infinitude of arguments drawn from nature' (*The Starry Messenger*, op. cit., 43). Thus, from the perspective of pre-modern cosmology and theology, Copernicanism, far from entailing the *demotion* of the earth and of man, actually amounted to their *exaltation*. For a brief but helpful survey of the evidence, see Dennis Danielson, 'The Great Copernican Cliché', *American Journal of Physics* 69 (1), 2001: 1029-35.

[20] This is what Blumenberg calls 'the postulate of visibility' in our epigraph.

In this regard, the fact that UNESCO elected 2009 as the International Year of Astronomy on the grounds that it is the 400th anniversary of Galileo's first telescopic observations speaks volumes with regard to what Blumenberg called 'man's optical neediness',[22] and is symptomatic of the extent to which we are still in thrall to what Popper called 'the Baconian myth' – that is, the idea 'that all science starts from observation and then slowly and cautiously proceeds to theories'.[23] Galileo's telescopic observations – observations which first made visible the moons of Jupiter, the ring of Saturn, the phases of Venus, and the craters and mountains of the moon – were certainly of great scientific and historical significance. However, 1609 witnessed another breakthrough in astronomy which was even more portentous, yet which has not even so much as been mentioned in relation to the forthcoming quatercentenary celebrations: namely, the publication of Kepler's *Astronomia nova*. Not only did this book lay the very foundations of modern astronomy and physics, but it did so on the basis of precisely that kind of resolute refusal to be taken in by the self-evidences of sensible intuition which Galileo professed to so admire in Copernicus.[24] Indeed, in comparison with Kepler's break with tradition in abandoning the 'Platonic' requirement that all celestial orbits be circular, Galileo's telescopic observation of the Jupiter system 'seems extremely conventional [...] an attempted *coup de main* of intuition, by means of the telescope, to carry the day for Copernicanism', with Galileo's medieval faith in what he called 'the certainly of sense evidence'[25] blinding him to the momentous achievements of Kepler.

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[21] In the Preface to *De Revolutionibus*, Copernicus states that the reason he set out to see if the assumption of a moving Earth would provide better explanations of celestial phenomena was that he had been 'annoyed with the philosophers, who while in other respects had made a very careful scrutiny of the least details of the world, had discovered no sure scheme for the movements of the machinery of the world, which was built for us by the Best and Most Orderly Workman of all' (*On the Revolution of Heavenly Spheres*, in [ed.] Stephen Hawking, *Standing on the Shoulders of Giants: The Great Works of Physics and Astronomy*, London & New York: Penguin Books, 2002, 10). The seeming paradox of this unequivocal statement of teleological anthropocentrism ('built for us' or 'on our behalf') as the motivating reason for the Copernican revolution is examined at length in Blumenberg's *The Genesis of the Copernican World*, op. cit.

[22] Blumenberg, *The Genesis of the Copernican World*, op. cit., 632.

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[23] Karl Popper, *Conjectures and Refutations* (London and New York: Routledge, 1963), 185.

[24] In his *Dialogue Concerning the Two Chief World Systems*, in response to Sagredo's expression of surprise that Pythagoreanism 'has found so few followers in the course of centuries' and that 'even Copernicus is not having any better luck with it in these latter days', Galileo-Salviato replies: 'No, Sagredo, my surprise is very different from yours. You wonder that there are so few followers of the Pythagorean opinion, whereas I am astonished that there have been any up to this day who have embraced and followed it. Nor can I ever sufficiently admire the outstanding acumen of those who have taken hold of this opinion and accepted it as true; they have through sheer force of intellect done such violence to their own senses as to prefer what reason told them over that which sensible experience plainly showed them to the contrary.' (This quotation is from the Third Day of Galileo's *Dialogue Concerning the Two Chief World Systems* [1632]; the English translation of the full text by Stillman Drake is available online at http://www.law.umkc.edu/faculty/projects/ftrials/galileo/dialogue.html.)

The idea that direct, first-person observation provides not only the ultimate *source* of knowledge but also its *fulfilment*, that reason and theory are only ever an anticipation of intuition (the latter being regarded as the very essence of a fully realised relation to reality), is one that has very deep roots in Western philosophy. Indeed, it is one which governs the traditional historiography of science whenever the demise of the Aristotelian philosophy of nature is attributed to the latter's allegedly speculative, non-empirical stance, being superseded by a thoroughly empirical approach to science. But on the contrary, as Blumenberg suggests, the downfall of Aristotelian physics is better described by the lapidary sentence of Heinrich Scholz: 'It perished as a result of its positivism'.[26] It is well known that the Aristotelian physics is in fact very close to the commonsense 'folk physics' of everyday experience, and 'is familiar to us in a way that Galileo's and Newton's never can be'.[27] What was needed to overcome the Aristotelian philosophy of nature was not simply more experience, or greater attention to the way things appear, but rather a different *kind* of experience, 'an experience which was already directed toward specific premises – selected and arranged in accordance with them – and placed under definite conditions: in other words, *experimental* experience':

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[25] Galileo Galilei, *The Starry Messenger*, op. cit., 28.

[26] Blumenberg, *The Genesis of the Copernican World*, op. cit., 394.

[27] Lewis Wolpert, *The Unnatural Nature of Science* (Cambridge, Mass.: Harvard University Press, 1991), 3.

> This type of experience never presents itself immediately, and is not exhausted in intuitive givenness. It confirms or disproves assumptions in regard to a definite and, at least in principle, measurable aspect of a total phenomenon. Experience that is controlled – not to say prepared or dissected – in this way cannot stand at the beginning of radical theoretical change. Instead, what stands at this beginning is a distancing from the immediacy of the life-world.[28]

It was precisely this transformation of the notion of experience that Kant recognised as the revolution which placed the study of nature 'on the secure path of a science', and upon which he modelled his own 'transcendental' revolution in metaphysics:

> When Galileo caused balls, the weights of which he had himself previously determined, to roll down an inclined plane; when Torricelli made the air carry a weight which he had calculated beforehand to be equal to that of a definite volume of water; or in more recent times, when Stahl changed metal into lime, and lime back into metal, by withdrawing something and then restoring it, a light broke upon all students of nature. They learned that reason has insight only into that which it produces after a plan of its own, and that it must not allow itself to be kept, as it were, in nature's leading-strings, but must itself show the way with principles of judgement based upon fixed laws, constraining nature to give answer to questions of reason's own determining. Accidental observations, made in obedience to no previously thought-out plan, can never be made to yield a necessary law, which alone reason is concerned to discover.[29]

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[28] Blumenberg, *The Genesis of the Copernican World*, op. cit., 394.

[29] Immanuel Kant, *Critique of Pure Reason*, trans. N. K. Smith (London: Macmillan, 1929), Bxii-xiii.

While one might agree with Popper that Kant's statement that '[o]ur intellect does not draw its laws from nature [...] but imposes them upon nature' must be modified as 'but tries – with varying degrees of success – to impose upon nature laws which it freely invents',[30] Kant's statement is significant for its recognition of the way in which the history of science refutes the Baconian myth that all science starts from pure observation. Once modified in the way suggested, one ends up with Popper's notion of science as the forwarding of risky conjectures and bold speculations which, while they may be 'in striking contrast to the everyday world of common experience', are 'yet able to explain some aspects of this world of common experience'.[31] This is a tradition to be valued for 'its ability to free our minds from old beliefs, old prejudices, and old certainties, and to offer us in their stead new conjectures and daring hypotheses'.[32] Such speculatively audacious attempts to '*explain the known by the unknown*' have immeasurably extended the realm of the known, adding to the facts of our everyday world 'the invisible air, the antipodes, the circulation of the blood, the worlds of the telescope and the microscope, of electricity, and of tracer atoms showing us in detail the movements of matter within living bodies'.[33]

It is precisely this willingness to question and even radically overturn the commonsense or intuitive image of the world that **Carlo Rovelli** identifies as the essence of the scientific enterprise in the first essay of the present volume, 'Anaximander's Legacy'. Drawing upon both his extensive historical erudition and his first-hand experience of research at the cutting-edge of contemporary theoretical physics, Rovelli meditates on the question 'What is Scientific Thinking?' and takes us on a tour through some of the most profound conceptual revolutions of the history of science. As one of the founders of loop quantum gravity – today widely recognized as the leading rival to string theory in the quest to unify general relativity and quantum mechanics – there is scarcely anyone alive today in a better position to reflect upon the counterintuitive nature of modern science than Rovelli. Providing as it does a stimulating overview of the way in which science continually 'redraws the image of the world' based on its perpetual 'rebellion against what appears obvious', Rovelli's essay is a fitting introduction to the 'Copernican imperative' to which this volume of **COLLAPSE** is devoted.

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[30] Popper, *Conjectures and Refutation*, op. cit., 259; emphasis added.

[31] Ibid., 137.

[32] Ibid., 136-7.

[33] Ibid.

By all accounts, Anaximander's studies were vast in scope, comprising a cosmogony, a history of the earth and the heavenly bodies, a proto-Darwinian account of the development of living organisms and the origin of species, studies in astronomy, meteorology and biology, a geography, as well as the first attempt to describe the structure of the universe in mathematical terms. But it was Anaximander's conjecture that the earth 'is held up by nothing, but remains stationary owing to the fact that it is equally distance from all other things'[34] that Rovelli singles out as the 'gigantic leap in our understanding of the world' which set in motion the naturalistic inquiry that ultimately evolved into modern science. Popper described this hypothesis as 'one of the boldest, most revolutionary, and most portentous ideas in the whole history of human thought',[35] and it is not hard to see why. While every account of which we have a record, including that of Anaximander's teacher Thales, pictures the earth as resting upon some support or other, Anaximander boldly conjectures, against the evidence of sense experience, that the earth is suspended in mid-space. Faced with the mutually contradictory commonsense beliefs that everything moves downwards, and yet that the earth is at rest, Anaximander in effect accepts the latter of these conflicting judgments and rejects the application of the former to the earth, and he does so on the basis of considerations of symmetry and geometrical structure. In short, Anaximander's ingenious answer to the conflicting judgements of common sense amounts to the first application of the Principle of Sufficient Reason of which we have any trace the history of thought: The earth does not fall, conjectures Anaximander, because has no *reason* to move in one direction rather than other. As Rovelli suggests, Anaximander's willingness to reject observation-based judgements in favour of mathematical and logical considerations in constructing his theory amounts to the invention of a completely new grammar for understanding the spatial structure of the universe, one in which the idea of *absolute direction* is abolished. By 'subverting the meaning of "up" and "down", which had provided the most intuitive and elementary way of organizing space and reality for countless generations of humans hitherto', Anaximander 'inaugurates the very process of *rethinking the*

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[34] Quoted in Popper, *Conjectures and Refutation*, op. cit., 186.

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[35] Popper, *Conjectures and Refutation*, op. cit., 186.

image of the world – the path of investigation of the world which is based on the rebellion against what is obvious' that is characteristic of the scientific enterprise.

How did Anaximander arrive at this remarkable theory? 'Certainly not', writes Popper, 'by observation'[36] but rather by critical engagement with his predecessor Thales – a type of critical engagement which, as Rovelli also suggests, seems to have been invented by the Ionian school. Thales founded a new school in which there was a new relation between master and pupil, one in which the former tolerated, perhaps even encouraged, criticism, one generation after another. It would be difficult to exaggerate the momentousness of this innovation in the history of human thought, representing as it does a break with dogmatic tradition and an admittance of a plurality of competing doctrines which all try to approach the truth by means of critical discussion. As Popper points out, this leads almost by necessity to the realization 'that our attempts to see and to find the truth are not final, but open to improvement; that our knowledge, our doctrine, is conjectural; that it consists of guesses, of hypotheses, rather than final and certain truths; and that criticism and critical discussion are our only means of getting nearer to the truth'.[37] This is a sentiment also strongly endorsed by Rovelli, according to whom it is the Ionian school's 'realization that we can have *valuable* knowledge, but at the same time that this knowledge can be partially wrong' that 'opens up the path for the immense development of subsequent speculation, which is the basis of Greek philosophy and modern science'.

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[36] Ibid., 187.

[37] Ibid., 203.

According to Rovelli, today we are 'in the midst of a reconceptualization of our world which is likely to prove every bit as far-reaching as those of Anaximander and Copernicus'. The revolutions of twentieth-century physics, if properly digested, entail 'a change of image of the world far more dramatic than that of Copernicus, and also a change of image of ourselves far more far-reaching than Darwin'.[38] Perhaps most dramatically, Rovelli predicts that we will discover that space and time do not exist at the most fundamental level, that they are in effect a reflection of our ignorance, 'convenient macroscopic approximations, flimsy but illusory and insufficient screens that our mind uses to organize reality'.[39] Moreover, he predicts that we will have to give up the notion that there are 'things' altogether, in favour of a way of thinking about nature that 'refers only to interactions between systems and not to states or changes of individual systems'[40] – an idea also ultimately prepared for by Anaximander's 'gigantic leap', and one which is has a strong affinity with those defended by Julian Barbour, James Ladyman and Gabriel Catren, also in this volume.

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[38] *Edge: World Question Center*, Annual Question 2006: 'What is Your Dangerous Idea?', online at http://www.edge.org/q2006/q06_print.html#rovelli.

[39] *Edge: World Question Center*, Annual Question 2005: 'What Do You Believe is True Even Though You Cannot Prove it?, online at http://www.edge.org/q2005/q05_2.html#rovelli.

[40] Ibid. For detailed treatment of these ideas see for example Carlo Rovelli, *Quantum Gravity* (Oxford: Clarendon Press, 2003); Carlo Rovelli, 'Halfway Through the Woods: Contemporary Research on Space and Time' in J. Earman & J. Norton (eds), *The Cosmos of Science* (Pittsburgh: University of Pittsburgh Press, 1997), 180-223; and 'Quantum Spacetime: What do we know?' in C. Callender and N. Huggett (eds), *Physics Meets Philosophy at the Planck Scale* (Cambridge: Cambridge University Press, 2001), 101-22.

The question Rovelli raises towards the end of his paper – namely, '*Is it possible to think a world without time?*' – is one that has preoccupied theoretical physicist and historian of physics **Julian Barbour** for the best part of five decades. Like the great philosopher-physicists of a century ago such as Ernst Mach, Henri Poincaré and Pierre Duhem, Barbour is not only a physicist but also an eminent historian of science, and it is clear that the breakthroughs he has been able to make in rethinking the foundations of physics are owed in no small part to his considerable historical and epistemological erudition. Having sacrificed a promising career in academia in order to devote himself to exploring his interest in dynamics unencumbered by the 'publish-or-perish syndrome', Barbour set himself the task of a fundamental rethinking of two basic questions that he felt had seldom been seriously asked, let alone satisfactorily answered: 'What is time?', and 'What is motion?' These are precisely the two questions that Leibniz and Mach had raised in their critique of Newton's absolute concepts, but had not answered definitively, and Barbour's entire adult life has been devoted to resolving them. In our interview we discuss with him the way in which his early reading of Mach provided a crucial stimulus to his life's work, ultimately leading him to the most counterintuitive conclusion imaginable: namely, that time *does not exist*. This is of course not a thesis which anyone is likely to take on trust, and in our interview Barbour not only recounts the motivations and influences that led him to embrace it, but also responds to some of the inevitable criticisms that have been voiced in connection with it. Of all the commonsense-defying ideas to be encountered in this volume, Barbour's are surely the most difficult to intuitively digest; and yet, as the reader will discover, they are also ideas to which those working in the most advanced areas of contemporary quantum gravity research, whether it be string theory or loop quantum gravity, are increasingly being drawn.

The problem of the relationship between a mathematicized reality and a human intuition which persists in asking 'how to make sense of this?' is also explored, visually and conceptually, in a unique collaboration between artist **Conrad Shawcross** and philosopher **Robin Mackay** in 'Shadows of Copernicanism'. As Mackay suggests, Shawcross's remarkable 2006 work *Binary Star* provides a potent visual challenge to the heliotropic tendency of the philosophical imaginary, an imaginary in which the sun has always stood as the metaphor for a singular *lumen naturale*, a unique source of enlightenment. For Mackay, *Binary Star* raises questions regarding the philosophical tradition's metaphorical anchorage of thought to apparently fixed and permanent characteristics of the physical world. If Rovelli suggests that the search for 'a fixed point on which to rest is [...] naïve, useless, and counterproductive for the development of science'[41] and Barbour's theory demands that we 'learn how to find our bearings when the solid reassuring framework of the Earth is not there',[42] Mackay suggests that the challenge of philosophical thought today amounts to coming to terms with a scientific worldview 'which disabuses us of every illusion of fixity and permanence'. In this regard, Shawcross's *Binary Star* demonstrates how the 'Copernican cliché' of a 'reversal of perspective between two heavenly bodies' remains tied to 'terrestrial' tropes of thought. If Tycho Brahe's destruction of the crystal spheres prompted Kepler to remark (as quoted by Barbour in our interview) that '[f]rom now on, the planets must find their way through the void like birds through the air' – a remarkably prescient comment in view of the recent discovery of enormous numbers of planet-sized bodies roaming freely in the void between the stars[43] – the physical picture of the world furnished by general relativity is one in which localisation with respect to a background spacetime, or to any fixed external reference system, has no meaning. Mackay suggests that art, given to the image and what is humanly intuitable, insistently inhabits the terrain of this fractured ground, of the gap opened up between mathematical models freed from the contingencies of human visibility and the efforts of intuition and the imagination to make sense of them; and that Shawcross's works mimic the efforts which philosophy must make to incorporate mathematical-scientific models of reality into the grain of language without ceding the latter entirely to mathematical abstraction. Thus the most profound content of the work, suggests Mackay, lies in a vacillation between object and model that indexes its necessary 'failure'.

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[41] 'Quantum Spacetime: What do we know?', op. cit., 121.

[42] *The End of Time*, op. cit., 71.

The idea that there exists an intimate correlation between reality and visibility, or between the actual and the intuitable, is not one which was left behind with the Middle Ages. Rather, it is one which remains deeply rooted in the human psyche. Not only for the first-person perspective of common sense, for which degrees of phenomenal availability are experienced as degrees of 'realness',[44] but even for significant numbers of contemporary philosophers, 'reality' and 'manifestation' are treated as highly correlative concepts, often even being employed interchangeably. While traditional empiricist and positivist philosophies took the limits of the real to coincide with the boundaries of the (humanly) observable, many self-styled 'critical' philosophers – philosophers, that is, who typically pride themselves upon their overcoming of the 'naïveté' of positivism – continue to persist in the opinion that phenomenology is ontology enough. While earlier philosophers, beginning with Kant, based their critical inquiries upon an extensive familiarity with the best scientific knowledge of their times, many contemporary philosophers, perhaps daunted by the vast and highly-specialised edifice of contemporary science, seem to believe that they can afford to forego the difficult task of acquainting themselves with the methods and results of the sciences altogether.

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[43] See, e.g., P. W. Lucas & P. F. Roche, 'A population of very young brown dwarfs and free-floating planets in Orion', *Monthly Notices of the Royal Astronomical Society* 314 (4), 2002: 858-64; and H. Cheongho, 'Secure Identification of Free-floating Planets', *The Astrophysical Journal* 644 (2), 2006: 1232-6.

However, as **JAMES LADYMAN** makes clear in our interview 'Who's Afraid of Scientism?', it is not only philosophers working in the Continental tradition who are guilty of such negligence. According to Ladyman and Don Ross in their recent book *Every Thing Must Go: Metaphysics Naturalized*,[45] many of the standard debates in contemporary analytic metaphysics – debates concerning, for example, causation, identity, part-whole relations, and the nature of time – typically involve little more actual science than was available to the early modern philosophers, or even the pre-Socratics.[46] In this regard, what today passes for metaphysics, whether in the Continental or analytic tradition, amounts to a continuation of what Ladyman and Ross call 'the metaphysics of domestication', a tradition 'which aims at domesticating scientific discoveries so as to render them compatible with intuitive or "folk" pictures of structural composition and causation'.[47] While such efforts at domestication are typically defended on the grounds that they provide *understanding* (read: 'rendering more familiar'), in contrast to science itself, which allegedly allows only for *explanation*, Ladyman and Ross argue that such metaphysics cannot be defended 'on the grounds that psychological repose and cultural familiarity are values that might be defended against the objective truth'.[48] However much 'the objective truth' might always be open to revision and correction, such refinement and extension of our knowledge is itself a process which is *internal* to the ongoing project of science itself, and not something that might be achieved by adopting an imaginary stance of philosophical anteriority floating entirely free of the sciences.

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[44] Thomas Metzinger, *Being No One: The Self-Model Theory of Subjectivity* (Cambridge, Mass.: MIT Press, 2004), 75.

[45] James Ladyman and Don Ross with David Spurrett and John Collier, *Every Thing Must Go: Metaphysics Naturalized* (Oxford: Oxford University Press, 2007).

In our interview, Ladyman expresses his exasperation with philosophers unable or unwilling to abandon the constraints of intuition and the manifest image, and who stubbornly insist upon pursuing metaphysics as if modern science had never happened. While many philosophers habitually decry any philosophical position that goes beyond a vague science-friendliness as 'scientistic', Ladyman argues forcefully for a radically naturalistic metaphysics based upon what he and Ross have provocatively called 'the scientistic stance'. As well as explaining why he believes it is incumbent upon philosophers to free themselves from the parochial conceptual prejudices devolving from an uncritical embrace of categories rooted in the manifest image, Ladyman also challenges the all too popular *doxa* that would align science with ideological conservatism. While some philosophers may still dream of 'some kind of new age spirituality that will re-enchant nature, de-alienate us and inaugurate some kind of postmodern arcadia', Ladyman argues that 'the actual alternatives to science are the ideologies of bigotry and superstition'.

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[46] Ibid., 20.

[47] Ibid., 1 and Chapter One *passim.*

[48] Ibid., 4.

As one of the leading voices in current debates in the philosophy of science, Ladyman has developed, along with Steven French, a distinctive brand of scientific realism he calls 'ontic structural realism', a position that would synthesize the virtues of empiricism and realism by denying the ontological priority of individual objects and properties in favour of the primacy of relational structures. While structural realism in the philosophy of science goes back at least as far as Henri Poincaré a century ago, Ladyman's position is distinctive inasmuch as it construes structural realism as a metaphysical rather than as a merely epistemological thesis. In other words, while Poincaré held that all that we can *know* are the structures of or relations holding between inscrutable objects in themselves, Ladyman argues that these structures are *all that there is*, thus closing the gap between epistemology and metaphysics entailed by Poincaré's quasi-Kantian position. Motivated as it is not only by the problem of theoretical change in the history of science, but also by reflection upon quantum mechanics and general relativity, one might expect that Ladyman's eliminativism with regard to individual objects and intrinsic properties entails a reductive physicalism. However, the project developed in *Every Thing Must Go*, whilst granting to physics a definite epistemological and ontological priority, aims at a unification of the sciences which proceeds by way of consilience rather than reduction. But how is it possible to defend a physics-based metaphysics which holds that there are no such things as 'things' without impugning the reality of the everyday lifeworld or the special sciences, both of which are of course richly populated with individual objects? This is just one of the questions explored in our interview.

As physics uncovers more and more of a reality which simply does not work according to the models of our intuitive picture of the world, cognitive neuroscience increasingly reveals the extent to which these models themselves depend more upon the nature of our cognitive processing systems than on the world which they purport to represent. In an interview with **THOMAS METZINGER**, we discuss the radical thesis presented in his magnum opus *Being No One* that 'no such things as selves exist in the world: Nobody ever *was* or *had* a self'.[49] Metzinger discusses the bases for and the ramifications of his position, and responds to criticisms of his radical eliminativist position with regard to the existence of selves. Like Ladyman, Metzinger too takes philosophers to task for prioritising 'armchair intuitions' about the nature of the mind over scientific discoveries, but also reflects upon the evolutionary provenance of such intuitions; that is, how 'certain forms of self-deception were adaptive and became superbly robust, spilling over into the enterprise of philosophy and science itself'. But if the 'Copernicanism' of neuroscience consists in its subtracting the real substrate of our 'selves' from all intuitive 'visibility', rendering it incongruent with our biologically-inherited patterns of thinking and rebarbative to efforts to 'make sense' of the world and our fellow humans, is there any way for our *cultural* fabric to 'digest' its deliverances? Here, Metzinger proves more than ready to address the potential social and cultural ramifications of his position: Against the frightening possibilities many find in the prospect of an accomplished science of the mind, he argues that, although it will inevitably entail a profound transformation in our self-understanding, advances such as his self-model theory present potential opportunities for ushering in a new age where society and politics can be informed by scientific discovery: 'Enlightenment 2.0'.

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[49] Thomas Metzinger, *Being No One: The Self-Model Theory of Subjectivity* (Cambridge, Mass.: the MIT Press), 1. See also J. Trafford, 'The Shadow of a Puppet Dance', in COLLAPSE IV (Falmouth: Urbanomic, 2008), 185-206.

This question of the 'toxicity' of Copernican thought makes explicit the connection between this volume's theme and that of its predecessor, with its suggestion that between the adventures of reason and the comfort of intuition may lurk 'concept horrors' best explored in the imaginings of writers and artists.[50] Painter **NIGEL COOKE**'s contribution gives us a glimpse of the territory in-between the two volumes. Over the last decade, Cooke's massive canvases have introduced their viewers to an 'interzone' of representation, where painting enters into a dialogue with its past that eschews the progressive dialectic of artistic modernism. With formal ingenuity and wit Cooke has invented a mode of landscape painting that depicts the landscape of representation itself, a plane of uneasy coexistence (cartoon vegetables suck disconsolately on cigarettes alongside severed heads smiling up from the undergrowth, before vast walls which serve as a support for weeping graffiti brains ...) whose effect is to disturb and parody received notions of the relative sophistication, meaning and value of images. The contemporary painter, suggests Cooke, faces an objectively 'moronic and hysterical'[51] situation which can be transmuted into opportunity only through a concerted complicity with its groundless condition. Accordingly, Cooke's latest works, exhibited as 'New Accursed Art Club', found the character of 'The Painter' himself absorbed into the canvas, as a vagrant stumbling through the remains of representation, a derelict motif encompassed in his own disorienting predicament. The new paintings Cooke has made for this volume of **Collapse**, entitled 'Thinker Dejecta', are haunted by a close relative of this shambolic figure – The Thinker, overburdened and undermined by what Julian Barbour describes as 'a journey into the totally unknown, in which shock

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[50] See **COLLAPSE** IV. Readers who enjoyed the perspective suggested by this volume may be interested to hear of R. Scott Bakker's *Neuropath* (London: Orion, 2008),

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a 'techno-thriller' inspired by Metzinger's work, which prompted Metzinger himself to warn, in hyperbolic mode: 'You should think twice before reading this – there could be some scientific and philosophical possibilities you don't want to know!'

[51] See the absorbing interview with Cooke in S. Malik, D. Leader, N. Cooke, and S. Goetz, *Nigel Cooke: Paintings 01-06* (London: Koenig Books, 2006).

follows shock', slogging on with an intellectual labour that only ever seems to bring him further down in the world. Nonplussed by the puzzling connection between his lofty intellectual flights and the degeneration of his condition, Cooke's thinker drifts in a wasteland, Kant's 'rational delight'[52] a distant memory, while a psychotic sun (recalling Shawcross's experiments in helio-eccentrism) beats down mercilessly on his fevered brow. As in Cooke's other work, the density of reflection compacted into these apparently cartoonish vignettes indexes the entangled motivations, glories and disorienting turns of philosophical thought, that enigmatic mélange of hubris, masochism, and addiction: A compulsion, Cooke suggests, whose crowning insight will be that man was ever its confused instrument rather than its master.

While many philosophers, especially those unacquainted with philosophy of science, assume that naturalism (or 'scientism') entails a radical kind of physicalist reductionism which is constitutively incapable of doing justice to the manifest image of the *Lebenswelt*, as James Ladyman makes clear, and as biologist **JACK COHEN** and mathematician **IAN STEWART** also affirm in our interview 'Alien Science', scientific realism does not necessarily entail impugning the status of everyday macroscopic objects. Cohen and Stewart's collaboration has produced a series of popular science books which are remarkable in their scope, epistemological subtlety and conceptual inventiveness. Much of their work has consisted in a close examination of the development in recent decades of the sciences of chaos and complexity, which seek to systematically account for the 'emergence' of high-level natural properties on the basis of the abstract microphysical principles described by modern science. It seems that reductionism alone cannot do justice to these macroscopic patterns, which retain a certain autonomy from their component parts, but the precise nature of their 'emergence' remains a vexed question. While Ladyman prefers to avoid the fuzzy term 'emergence' altogether, Cohen and Stewart have sought to develop a theory of emergence that avoids the invocation of any 'magical' properties that would not be fully causally determined by their underlying microphysical properties. Against the accusation that emergentism privileges those features which happen to be phenomenologically available to human beings, they insist that, far from being an anthropomorphic notion, emergentism rather registers our ignorance of the underlying mechanisms. If much of what we perceive is the result of the 'quick and dirty feature-detection systems' of the brain, this is only one of the ways in which nature, of which the human brain/mind is a part, 'collapses' the underlying chaos. Crucially for Cohen and Stewart, it is not only the human brain that perceives nature in terms of high-level structures and features: Just as the scientist singles out specific features of Mars, such as its orbit, position and mass, and models those features mathematically as a curve, a point and a number respectively, so does the sun 'see' Mars as a concentrated mass exerting a gravitational force, rather than as a collection of atoms and force vectors.[53] The human brain is a part of the natural world and the way in which it 'caricatures' the things which it comes into contact with is not unique to it. This recalls a position familiar to readers of **Collapse**, as Graham Harman has developed in previous volumes the argument that with an understanding of this 'caricaturing' one can prosecute realism in the macroscopic domain.[54] However, while Harman continues to reserve a special place for an a priori metaphysics which would treat of 'the same world as that of the various sciences but in a different manner',[55] and holds the categories of the manifest world to retain an ontological primacy over the discoveries of science, the work of Ladyman and Cohen and Stewart alike seems to suggest a metaphysics developed entirely on the basis of the deliverances of the sciences, without need for any such metaphysical 'overlay'.

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[52] See Kant, 'On Creation ...', this volume, 399.

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[53] Jack Cohen and Ian Stewart, *The Collapse of Chaos: Discovering Simplicity in a Complex World* (London: Penguin Books, 1994), 430.

As well as recounting the origins and significance of the key conceptual innovations of their co-authored works ('complicity', 'Ant Country', 'privilege', 'extelligence', etc.), and discussing the relationship of their work to philosophy, in our interview Cohen and Stewart also explain their criticisms of what they see as the overly conservative and unimaginative nature of much of contemporary astrobiology and cosmology. If, according to Rovelli, the strength of science 'resides not in any putative certainties uncovered, but rather *in a radical awareness of our ignorance*', one of the ways which contemporary cosmology has attempted to take into account the intrinsic limitations of the human perspective has been in terms of what is known as 'anthropic reasoning', which aims to rigorously take into account the fact that our evidence about the universe is restricted by the conditions which must be in place for us to be there to observe it in the first place. As Barrow and Tipler have pointed out, the Copernican revolution itself was initiated by the application of what is known as the 'weak anthropic principle': Copernicus rendered redundant the hypothesis of epicycles by explaining that the retrograde motion of the planets was due to the 'anthropic selection effect' consequent upon the fact that we were observing the planetary motion from the vantage point of the moving earth.[56] Subsequent to Brandon Carter's invention of the term 'anthropic principle' in the early seventies, an increasing number of scientists have turned to anthropic reasoning in order to account for the extreme unlikelihood of the advent of life and intelligence which seems to follow from the 'fine-tuned' nature of the fundamental physical constants of our universe. However, Cohen and Stewart have long been critical of the very idea that our universe is in any way 'fine-tuned', and in our interview they explain their charge that the very notion rests on little more than 'bad logic'.

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[54] See Harman's 'Vicarious Causality', in R. Mackay (ed.), **Collapse** II (Oxford: Urbanomic, 2007), 171-205 ', and 'On the Horror of Phenomenology: Lovecraft and Husserl', in **Collapse** IV, op. cit., 333-64.

[55] 'Vicarious Causality', op. cit., 174.

While Cohen and Stewart are vitriolically dismissive of the very idea of the putative 'fine-tuning' of our universe, astrophysicist **MILAN ĆIRKOVIĆ** remains unconvinced by their criticisms, which he regards as being largely based upon the outdated idea that anthropic reasoning is necessarily teleological and anthropocentric. In his 'Sailing the Archipelago', Ćirković sketches the philosophical foundations for an epistemologically and scientifically sophisticated approach to anthropic reasoning and fine-tuning which, while acutely aware of the kinds of problems emphasized by Cohen and Stewart, does not lead to the conclusion that anthropic reasoning is forlorn. Against the accusation that anthropic reasoning necessarily entails an anti-Copernican privileging of *Homo sapiens*, or of terrestrial, carbon-based life as the only possible kind, Ćirković begins his inquiries by taking seriously the idea that our own universe is only one region of a possibly infinite multiverse, thus 'dealing with the widest conceivable ensemble in which our universe can be embedded, in order to avoid assigning it any special status'. If during the history of science since the Copernican revolution we have witnessed the loss of special status for ever-wider and more encompassing environments, Ćirković suggests that now, in the twenty-first century, 'we should not be surprised to learn that there is nothing special about the whole of our cosmological domain – our universe – either'.

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[56] Barrow and Tipler, *The Cosmological Anthropic Principle* (Oxford: Oxford University Press, 1986), 3-4.

Comparing contemporary cosmologists, astrophysicists and astrobiologists to the great explorers of the European Age of Exploration, Ćirković argues that the fact that earlier voyages had come to the premature conclusion that our island is the only habitable one in no way suggests that the voyage itself is misbegotten: If they were wrong, it was not because of 'some ulterior and heinous agenda [...] [I]t was perfectly reasonable for them to think so – we might compare their rationality to that of a hypothetical ancient philosopher of Easter Island, pondering the huge ocean surrounding his home'. If we think of the range of possible parameters governing the laws of physics as describing a landscape of 'possible universes', then, Ćirković suggests, we have so far only charted the very small ‘island’ that is ‘habitable’ for us. However, this does not mean that we live on the *only* island in this space, or that the type of life for which our universe appears to be ‘fine-tuned’ is the only type of life possible. If a little humility is appropriate, argues Ćirković, given that we are only beginning to chart this vast topography, it would be absolutely premature to conclude that we are its only possible inhabitants.

While the detractors continue to accuse anthropic reasoning of anti-Copernicanism, Ćirković finds in their criticisms the relics of a Cartesian dualism which fails to take into account the fact that human bodies are ‘measuring instruments whose self-selection properties *must* be taken into account, just as astronomers *must* take into account the self-selection properties of optical telescopes’.[57] After all, if the human animal is fully a part of the natural world which science investigates, having evolved through various physical, chemical and biological processes, how can one justify ignoring their properties, or failing to take into account the very special nature of the conditions which had to be in place for those properties to evolve in the first place? Is all science which takes account of the nature of human beings *eo ipso* ‘subjective’ or ‘anthropocentric’, or might it not rather be the case that science *needs* to mention human beings in order to *be* objective?[58] Thus, far from being a prop to human self-importance, a 'reactivation [of] finalist thought', or a reversion to the doctrine of Copernicus' own teleological anthropology (as Quentin Meillassoux argued in an earlier volume of **COLLAPSE**),[59] Ćirković's work demonstrates how anthropic thinking merely stems from a deepening of the 'Copernican imperative' which imposes itself once physics begins to consider landscapes of physical possibility beyond the actual universe. Thus, contrary to the critics' charges, the anthropic programme of the investigation of observation selection effects, far from amounting to a 'betrayal of the Enlightenment', is rather 'the continuation of the Copernican revolutionary spirit in overcoming not only the apparent specialness of the Earth and of life on it, including humans, but of the very special laws, associated mathematical structures, and our universe in general'. While it may take generations of astrobiologists before quantitative precision is reached, Ćirković argues that the enormity of the task 'should not detract from the fact that the problem is a well-defined one from the start'.

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[57] ‘Such telescopes tell us about the radiation in the visible band of the electromagnetic spectrum, but it would be completely illegitimate to conclude from purely optical observations that all of the electromagnetic energy in the Universe is in the visible band. Only when one is aware of the self-selection of optical telescopes is it possible to consider the possibility that non-visible radiation exists. Similarly, it is essential to be aware of the self-selection which results from us being *Homo sapiens* when trying to draw conclusions about the nature of the Universe.’ (Barrow and Tipler, *The Anthropic Cosmological Principle*, op. cit., 3-4).

Whereas Cohen and Stewart enthuse about the possibility of the discovery of alien life – '[f]inding aliens (even bacteria) would be fantastic [; c]omplex aliens, at the level of a snail, would be amazing [; t]he level of intelligence of a cat – awe-inspiring' – transhumanist philosopher

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[58] This is a point forcefully made by Sherrilyn Roush in her excellent 'Copernicus, Kant, and the anthropic cosmological principles' in *Studies in the History and Philosophy of Modern Physics* 34 (2003), 5-35. This paper also sheds further helpful light on many of the connections between Copernicanism, Kantianism, and anthropic reasoning explored in this volume.

[59] Q. Meillassoux 'Potentiality and Virtuality', in R. Mackay (ed.) **COLLAPSE II** (Oxford: Urbanomic, 2007), 55-81, 78.

Nick Bostrom argues in 'Where Are They?' that such findings, far from being a cause for celebration, would in fact augur very badly for the future of the human race. Bostrom's work as an analyst of 'existential risk' here dovetails with his work on anthropic thinking, as he unravels the consequences that would follow from such a discovery. Were traces of life discovered elsewhere in our solar system – on Mars, say, or upon Jupiter's moon Europa – most people would of course be thrilled, perhaps even comforted to learn that we are not entirely alone in the cosmos. However, for Bostrom, no such news could be good news, and indeed the more complex life we found, the more depressing that news would be. On the basis of two well-known facts – namely, that our galaxy alone harbours billions of potential germination points for life, and yet that decades-worth of searching for traces of extraterrestrial life has consistently failed to detect any signs of intelligent life – Bostrom argues that there must exist a 'Great Filter' that renders the existence of advanced technological civilisations exceptionally improbable. The crucial question then becomes where this Great Filter might be located. If it is located in our evolutionary past, this would be good news, since it would suggest that the great fluke which ushered us into existence had already taken place. However, should we ever find evidence of life on other planets, and especially were we to find it to have independently evolved somewhere in our own solar neighbourhood, this would of course suggest that life is commonplace, meaning that the Great Filter still awaits us: a prospect that would leave our future chances of survival looking very bleak indeed.

Speaking about his early exposure to physics and mathematics, artist **Keith Tyson** has said: ‘once I could see myself as part of a network everything became clearer’.[60] But in using the structures of scientific experience to ‘explore the myth of individuality’, he adamantly maintains his right to creatively transform them. His work thus marries a keen attentiveness to the concepts of contemporary science with a tendency to appropriate them into conceptual ‘machines’ to steer his artistic practice, as in projects such as *Geno/Pheno* (2005).[61] Refusing to grant scientific conceptualisation any overarching role in his work, he instead sites it within a broader, transversal network of ideas whose dazzling multiplicity is reflected in works such as 2006’s *Large Field Array*. This work – whose title adverts to the Very Large Array on the plains of San Agustin, New Mexico, where twenty-seven massive radio telescopes combine their multiple viewpoints to produce high-resolution astrophysical imaging – consists of a ‘rhizome’ or ‘huge soup’ of elements arrayed in a vast grid according to lines of affinity traced by Tyson himself, and reflecting his own multiple interests, memories and experiences. Thus Tyson extends the cosmological ambition to address ‘everything’ to extra-physical forces: ‘We are the things that are carrying those forces. Including history. Including energy. All sorts of fields. So everything is the sum of all possible paths. And that’s what [*Large Field Array*] is about. All those intricate interrelations.’

The conceit of Tyson’s contribution to **Collapse** lies in making a short series of images stand for a similarly megalomaniacal ambition – that of employing the entire history of the universe as a pool of 'time-based media'. The work draws upon the Einsteinian model of four-dimensional spacetime, or 'blocktime' – Tyson explains: 'If we accept blocktime as a working model in which any position in time, space and possibility is a frame within a 3D animation, we could splice together single frames in the celestial cutting room as a kind of random sampler'. Ironically, the presentation of such an 'animation' as a series of stills on the page is all the more apt given Julian Barbour's thesis of the 'unreality of time', entailing as it does a modification of Einsteinian blocktime whereby Tyson's 'animation' would cease to be animated at all. Meanwhile, the inclusion in the images delivered by his 'random splicing' of disproportionately many images of our planet is perhaps as unlikely ('uncopernican') as it is comforting: but, as Tyson – an erstwhile gambler – has said, he doesn't believe in chance, or at least only as a name for a human constraint which is there to be explored. Here again, the universal reach of science is twinned with a sanguine acceptance of the artist's own unique location in time, space and history.[62]

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[60] K. Tyson *Studio Wall Drawings 1997-2007* (London: Haunch of Venison, 2007), 2.

[61] See K. Tyson *Geno/Pheno* (NY: Pace Wildenstein, 2005).

Of course, for many philosophers the notion of 'Copernicanism' as entailing a subtraction of scientific knowledge from the conditions of intuition will seem utterly alien. For 'Copernicanism' in philosophy has become a byword for what is in effect understood, in Kant, to be a recentring of the universe precisely around the power of cognitive synthesis harboured by the knowing subject. By making phenomenal reality orbit around a transcendental subject which is supposedly distinct from and yet indissociable from the human subject, Kant is deemed to have inaugurated what Quentin Meillassoux has recently denounced as a 'Ptolemaic counter-revolution' that re-installed human experience at the centre from which Copernicanism had displaced it.[63] However, in his 'The Phoenix of Nature: Kant and the Big Bounce', **Martin Schönfeld** presents us with a vivid picture of Kant profoundly at odds with this recent popular characterisation of him as a conservative, anti-Copernican thinker, by way of an examination of his 1755 work *Universal History of Nature and Theory of the Skies.*[64] Here we encounter a radically anti-anthropocentric, anti-Christian, naturalistic, and speculatively audacious Kant who pushes 'Copernicanism' to its limits, abolishing the hand of God from the Newtonian cosmos and introducing history and evolution into it. This is Kant as the Copernican revolutionary who as early as 1755 strongly anticipates the fundaments of what became the Standard Model of modern cosmology only in the 1920s. More specifically, Schönfeld introduces the reader to an undeservedly neglected idea from Kant's early cosmology ('the Phoenix of Nature'), one which takes on surprising significance in view of the very latest hypotheses and findings of contemporary (quantum loop) cosmology: 'the Big Bounce'.

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[62] 'The Wu Way', interview with Dominic van den Boogard, available online at http://www.keithtyson.com/#/projects/largefieldarray/writings/.

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[63] See Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, Tr. R. Brassier (London and New York: Continuum 2008), Chapter Five.

[64] It is strongly recommended that this essay be read in connection with Schönfeld's more in-depth treatment of Kant's 1755 work and its context in his superb 'Kant's Early Cosmology' in G. Bird (ed.), *A Companion to Kant* (Oxford: Blackwell, 2006), 47-62. See also Schönfeld's *The Philosophy of the Young Kant* (Oxford: Oxford University Press, 2000), and his entry for the *Stanford Encyclopedia of Philosophy*, 'Kant's Philosophical Development', online at http://plato.stanford.edu/entries/kant-development/

To accompany his piece, Schönfeld also provides a new translation of the chapter from the *Universal History of Nature* in which the Phoenix of Nature appears: 'On Creation in the Total Extent of its Infinity in Space and Time'. This work will certainly come as a surprise to those familiar only with Kant's critical works, or with a contemporary *doxa* aligning Kant unproblematically with an idealism that is constitutively incapable of breaking out of the 'correlational circle' in order to take the measure of the 'Great Outside'.[65] Its astonishingly prescient cosmology of 'island universes' and the birth and death of 'worlds' presents a truly awe-inspiring vision of the cosmos, thought-provoking even to those familiar with the latest developments in astrophysics. Popper called the *Universal History of Nature* 'one of the greatest contributions ever made to cosmology and cosmogony',[66] and as Schönfeld notes, Kant's daring conjectures have been to a significant extent vindicated in their general outlines by modern cosmology.

Embarking as it does upon what Kant, with tangible enthusiasm, calls 'the greatest and most awesome subject imaginable',[67] the *Universal History of Nature* sketches what Blumenberg calls 'a monumental panorama of the endless evolution of worlds, still from the point of view of a faculty of reason that, so to speak, adopts the standpoint of divinity and identifies itself with the divine view of the world'.[68]

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[65] Again, see Meillassoux, *After Finitude*, op. cit.

[66] Popper, *Conjectures and Refutations*, op. cit., 240.

[67] From the Preface of *Universal Natural History and Theory of Heaven*, trans. Ian Johnston, available online at http://records.viu.ca/~johnstoi/kant/kant2e.htm.

[68] Hans Blumenberg, *The Legitimacy of the Modern Age* (Cambridge, Mass.: MIT Press, 1985), 212. The following passage contains several close paraphrases of Blumenberg's text; sources are indicated in the footnotes.

Here man appears, 'among the immense vortices of the self-propagating worlds, as but an ephemeral episode. This whole infinite extravagance of a "world of worlds", of galaxies and supergalaxies, is conceived in relation to omnipotence, as the latter's demonstration of itself to itself'.[69] Though still partially in thrall to the teleological metaphysics of the 'great chain of being', and speaking of 'degrees of perfection', it is clear that Kant sees no connection between man's history and this process of improvement. Whereas Romantic thinkers such as Friedrich Schlegel took the unfinished nature of the world to indicate that man's vocation was to play a role in completing it, for Kant there is no such anthropocentric teleology in play. That the world is ever 'unfinished' has nothing to do with human action but is due to its having been created by an inexhaustible power, which Kant speaks of, in Spinozistic fashion, as either 'God' or 'Nature'. Man, 'who seems to be the masterpiece of creation', finds his place with the 'world of worlds' precisely where there is an already 'perfected world structure', among others still in the process of coming into being or disintegrating.[70] In a startling anticipation of Ćirković's position, Kant holds that the universe is not made for man, but that the infinite process of the evolution of worlds creates temporary 'habitable zones'. Habitability is not a lasting and ubiquitous feature of the bodies of the universe, but is only the result of the fact that the total reality, in analogy to the distribution of habitability on the earth, also has its 'temperate zones'.[71]

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[69] Ibid.

[70] Ibid., 212-3.

[71] Blumenberg, *The Genesis of the Copernican World*, op. cit., 591.

As Kant explains in one of his letters, it was the cosmological problem of the finitude or infinitude of the universe that led him to his theory of knowledge in the first *Critique*,[72] and as Schönfeld suggests, one should not underestimate the degree of continuity between this early work and the later critical philosophy. This is borne out by a comparison of the two passages below, the first from the *Universal History of Nature*, the second from the *Critique of Pure Reason*:

> If the size of a planetary system in which the Earth is hardly seen as a grain of sand fills the understanding with astonishment, how delightfully astounded we will be when we examine the infinite crowd of worlds and systems which fill the totality of the Milky Way. But how much greater this wonder when we know that all these immeasurable arrangements of stars once again create a numbered unity, whose end we do not know and which is perhaps, like the previous one, inconceivably large and yet, once again, only a unit in a new numbered system. We see the first links of a progressive relationship of worlds and systems, and the first part of this unending progression already allows us to recognize what we are to assume about the totality. Here there is no end, but an abyss of a true infinity, in which all capacity of human thought sinks, even when it is uplifted with the help of mathematics.[73]

> The observations and calculations of astronomers have taught us much that is wonderful; but the most important lesson that they have taught is has been by revealing the abyss of our ignorance, which otherwise would never have been conceived to be so great. Reflection on the ignorance thus disclosed must

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[72] As noted by Popper, *Conjectures and Refutations*, op. cit., 240-1.

[73] *Universal Natural History and Theory of Heaven*, op. cit., Part One, 'On the Systematic Arrangement of the Fixed Stars'.

> produce a great change in our estimate in the purposes for which our reason should be employed.[74]

If Rovelli suggests that the problem is that we 'use concepts that we have developed in our very special environment (characterized by low velocities, low energy ...) and we think the world as if it was all like that',[75] this is also a sentiment shared by Kant, who puts the order and structure we see down to 'anthropic' considerations regarding our spatial and temporal location in the universe. Whereas 'from our perspective in the Universe, it would seem as if we looked at wholly completed creation and, so to speak, at an infinite array of systematically connected world-orders [...] if we could step outside this evolved sphere, we would see chaos' and a 'random scattering of elements'.[76] Similarly, in Part Three of *Universal History of Nature*, itself devoted to speculations regarding the inhabitants of other planets, Kant compares the worldview of human beings with that of a louse inhabiting the head of a vagrant:

> Let us judge in an unprejudiced manner. This insect, which in its way of living as well as in its lack of worth expresses very well the condition of most human beings, can be used for such a comparison with good results. Since, according to the louse's imagination, nature is endlessly well suited to its existence, it considers irrelevant all the rest of creation which does not have a precise goal related to its species as the central point of nature's purposes. The human being, who similarly stands

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[74] *Critique of Pure Reason*, op. cit., A575/B603.

[75] *Edge: World Question Center*, Annual Question 2006: 'What is Your Dangerous Idea?', op. cit.

[76] See Kant, 'On Creation ...', this volume, 396.

> infinitely far from the highest stages of being, is sufficiently bold to flatter himself with the same imaginative picture of his existence as essential.[77]

It should be borne in mind that Kant never completely abandoned even some of the most speculative views expressed in the *Universal History of Nature*. Thus, in the celebrated conclusion of the *Critique of Practical Reason* he speaks of 'an unbounded magnitude with worlds upon worlds and systems of systems',[78] and in the *Critique of the Power of Judgement* likewise of 'the Milky Way, and the immeasurable multitude of such Milky Way systems, called nebulae'.[79] Indeed, as **Iain Hamilton Grant** points out in his 'Prospects for Post-Copernican Dogmatism', it would be a matter of considerable irony if a *soi-disant* 'Copernican' revolution in philosophy should have put an end to the project of a *Universal History of Nature*. However, there is of course no doubt that the critical philosophy brought about a hugely significant transformation in Kant's epistemological approach, and in this regard Grant suggests that the 'dogmatism' against which Kant contrasts his critical conception of philosophy is none other than the naturalism of his own 'pre-critical' writings. This raises a number of important questions regarding the relationship between transcendental philosophy and a naturalistic ontology, questions which are skilfully examined in Grant's paper.

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[77] *Universal Natural History and Theory of Heaven*, op. cit., Part Three, 'An Attempt, Based On Natural Analogies, at a Comparison Between the Inhabitants of Different Planets'.

[78] *Critique of Practical Reason* (Cambridge: Cambridge University Press, 1997), 133 [*Ak*: 162].

[79] *Critique of the Power of Judgement* (Cambridge: Cambridge University Press, 2000), 140 [*Ak*: 256].

Exploring the paradoxes and antinomies that result from the attempted combination of transcendental philosophy and a physics-based ontology as it arises in Kant and post-Kantianism, Grant finds transcendental philosophy, as defended by both Kant and Fichte, to be itself 'dogmatic' according to its very own criteria. Taking into account Kant's late revisions of his critical philosophy in the light of advances in the natural sciences, Grant argues that transcendentalism's susceptibility to naturalistically driven ontological change inevitably pushes a rationally consistent transcendental philosophy in the direction of Schelling's 'transcendental naturalism'.

In 'A Throw of the Quantum Dice Will Never Overturn the Copernican Revolution', **Gabriel Catren** also draws upon Schelling's *Naturphilosophie* in proposing what he calls a 'speculative overcoming' of recent quasi-Kantian interpretations of quantum mechanics. Rather than being limited to a mathematical account of the correlations between 'observed' systems and their 'observers', or pointing to the inherent 'transcendental limits' of physical knowledge, Catren argues that quantum mechanics furnishes a complete and realistic description of the intrinsic properties of physical systems, an ontology which exemplifies the Copernican deanthropomorphisation of nature. While Catren is sympathetic to Quentin Meillassoux's suggestion that Kant's Copernican revolution ultimately eventuated in a kind of 'Ptolemaic Counter-Revolution', and argues for an explicitly 'pre-critical' approach to the interpretation of quantum mechanics, he is also severely critical of Meillassoux's a priori arguments regarding 'necessary contingency'. Indeed, Catren finds Meillassoux guilty of recapitulating a paradigmatic gesture of 'Kantian' critique: that is, of presuming to stipulate, in purely philosophical terms, what physicists will never be able to do. Through an ingenious appropriation of resources from the history of philosophy and the models of mathematical physics, Catren succeeds in providing an interpretation of quantum mechanics that seems able to satisfy the often mutually-exclusive requirements of philosophical intelligibility *and* mathematical coherence. While Catren's interpretation is doubtless controversial in its suggestion that it enables us to recover the 'classical' notions of 'decontextualised objects' and 'intrinsic properties' from within quantum mechanics – a thesis which would seem to run directly counter to the kind of interpretation developed by the likes of Ladyman – there is no doubt that Catren's essay presents a challenging thesis, and outlines a project for a 'speculative physics' that deserves to be followed closely.

If in Cooke's errant figure of the dejected cognitive labourer wandering a scorched earth we see the human thinker bent under the epochal 'humiliations' dealt by Copernicus, Darwin and Freud, **ALBERTO GUALANDI** discovers a certain 'errancy of the human' to be the very source of its cognitive prowess. In contrast to Grant and Catren's bold proposals for a Schelling-inspired 'speculative physics' which would push the Copernican deanthropomorphisation of nature to its limits, Gualandi argues for the need to establish a new 'circular and communicative' theoretical interface between science and philosophy which would be capable of both integrating the natural and the human sciences and overcoming the antinomy between Kant's 'Copernican revolution' and that of Copernicus himself. Exploring the features common to certain speculative philosophies of nature in 1960s France and problems facing current evolutionary biologists, Gualandi introduces a 'neotenic conception of the human animal' capable of taking into account what he calls 'the necessary complementarity between the *critical* and *eccentric* dimension of man'. While it would be impossible to do justice to this superbly rich and thought-provoking paper here, we would note that it brings into focus the many reasons why the notion of 'Copernicanism' is still important for philosophy and for the sciences today, and will certainly repay careful and repeated reading.

Whereas Gualandi insists on the human and embodied nature of all knowledge, and adverts to the unsurpassability of Kant's Copernican revolution, **PAUL HUMPHREYS** proposes that computational science is fast displacing humans from the centre of the epistemological universe, a revolution which will eventually produce as radical a transformation in our self-image as did the Copernican revolution itself. Beyond the implicitly anthropocentric epistemologies of an empiricism which would limit the knowable to what is accessible to a set of biologically-contingent devices and a realism whose criterion of reality invokes independence from human minds, Humphreys considers the possibility of a purely automated science for which the division between what is and what is not accessible to the human mind would be, ironically, an entirely 'artificial' one. While Kant rejected the idea of obtaining knowledge of the world as it is in itself on the grounds that it would require us to have 'a faculty of knowledge altogether different from the human [...] in other words, that we should be not men but beings of whom we are unable to say whether they are even possible, much less how they are constituted',[80] Humphreys' paper suggests that such beings may already be among us. If we have not yet entirely relinquished the hope of one day being able to 'finally penetrate the barriers that have stood between between us and the rest of reality', Humphreys argues that the sooner we understand how 'some instruments and some computers confront reality non-conceptually' the better. Might not this also prove to be a necessary part of the task of what Metzinger calls 'Enlightenment 2.0'? In this regard, it seems appropriate to close this introduction with a citation from the conclusion to Kant's *Universal History of Nature*: 'We do not really know what the human being truly is today. [...] How much less would we be able to guess what a human being is to become in the future!'

We would like to conclude by offering our most sincere gratitude to all of our contributors and collaborators, whose wholehearted commitment to this project has consistently been above and beyond the call of duty. We hope that the fragments of the 'big picture' assembled in this unique volume will compensate them for their efforts.

Damian Veal,

Mexico City, January 2009.

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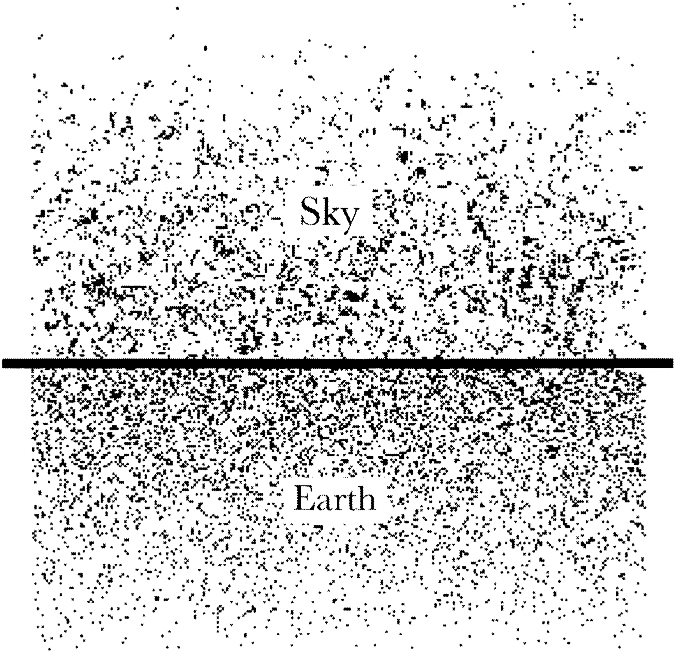
[80] *Critique of Pure Reason*, op. cit., A277-8/B333-34.


Sky
Earth

Anaximander's Legacy[1]

Carlo Rovelli

I. ANAXIMANDER

It all started twenty-six centuries ago, on the coast of what is now Turkey. Every civilization in the world had an image of the world like that in Fig. 1: *Up* there is the sky, *down* there is the Earth. Below the Earth, to prevent it from falling, there is more Earth. Or else a turtle standing upon an elephant, as in some Asian myths; or maybe gigantic columns, like those mentioned in the Bible. This was the picture of the world common to the civilizations of Egypt, Babylon, India, China, Africa; as well as to the Jews of the Old Testament, the natives of Australia and North America, the Mayans, the Incas, and every other ancient culture of which we have a trace.

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[1] Freely extracted from the forthcoming book, *Anaximander of Miletus and the Nature of Scientific Thinking*. (Text revised by Ray Brassier and Damian Veal.)

Then came a man, living in Miletus, who suggested something else: the world is rather more like this:

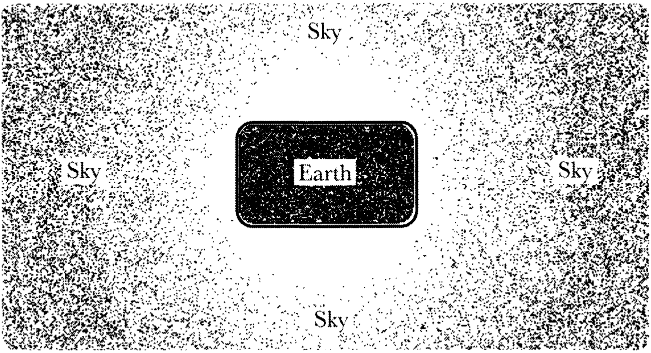

Figure 2

That is, the sky is not just above us: it is all around us, including below us. The Earth is not the lower half of the universe: it a big stone, floating in the middle of the sky without falling. The man who proposed this major change in our understanding of the world was Αναξιμανδρος, Anaximander. In a rather short time, Anaximander's idea is recognized as correct. Only a generation later, Pythagoras, or someone of his school, improves upon the model by making the Earth spherical (an easy move, after Anaximander's step). Another couple of generations later and Plato, in the *Phaedo*, presents the idea as the most reasonable one and shortly after Aristotle proposes very convincing arguments, based upon observations, in support of the idea. The idea becomes universally accepted around the Mediterranean, and subsequently by all other civilizations, one by one, as they come into contact with it.

How was Anaximander able to make this gigantic leap in our understanding of the world? At first sight, it doesn't seem too hard: evidence abounds. For instance, the Sun sets in the west in the evening and reappears in the east in the morning: so where does it go? More precisely, if we observe a starry night, we see all the stars rotating slowly and magnificently around the Polar star. Some stars, close to the Pole star, are always up in the sky; others, a bit further away, hide for a while beyond far-away mountains; still others disappear for a short while beyond the horizon, only to reappear a little further east. Isn't it rather obvious that there must be empty space, down there, so they can keep going?

Image: © Josch Hambsch

Anaximander to understand that the sky above us continues below us? Civilization had existed for millennia by Anaximander's time. Why had nobody realized this earlier?

Why had no-one among the Egyptians, or Babylonians, or Jews, all undoubtedly clever people, noticed this? Why had the Chinese, with their splendid civilization and with several millennia of the Imperial Astronomical Institute, failed to understand that the Earth floats in the sky, so that they had to wait until as late as the seventeen-century, when Jesuit astronomers arrived in China, to realize it? Evidently, this was not such an easy step to take. So why was it so hard?

Because it contradicts common-sense. If there is nothing below the Earth, why doesn't the Earth fall? Anaximander's genius, and the reason why he was able to convince the world of his idea, consisted in coming up with an answer to the obvious objection to the idea of a floating Earth. His answer was marvellous: The Earth does not fall, because it has no *reason* to fall; things fall 'towards the Earth', but the Earth itself has no preferred direction or any special reason to fall. In other words, Anaximander proposed a completely new grammar for understanding the spatial structure of the universe. There is no longer a universal 'up' and 'down' (Fig. 3) – rather, 'up' and 'down' are *relative* to the Earth (Fig. 4). Things fall towards the Earth itself. Hence the Earth itself has no special reason, or preferred direction, for falling.

Anaximander's greatness consists in this: Starting from remarkably little, he redraws the entire cosmos. He transforms the very grammar of the way we understand the universe, subverting the meaning of 'up' and 'down', which had provided the most intuitive and elementary way of organising space and reality for countless generations of humans hitherto.

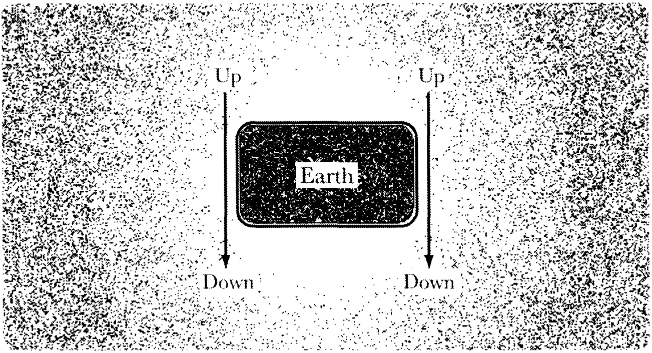

Figure 3

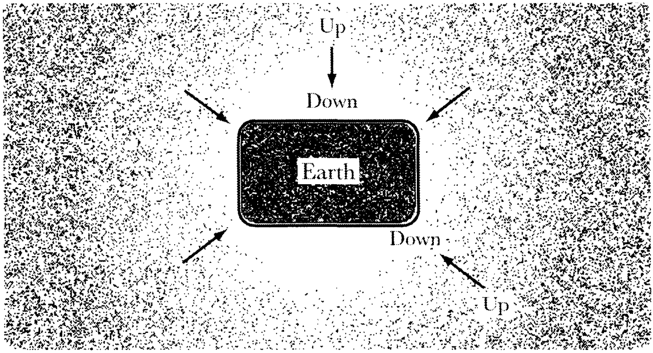

Figure 4

No, says Anaximander: *Things are not as they appear to us.* The world differs from the way it seems at first sight. Common sense is deeply misleading. Our intuitions are based upon our limited experience: Think more openly, look further away. There is no 'up' or 'down' in the universe; only in our little garden do things seem to be that way.

When properly utilized, reason liberates us from our partial and limited point of view, profoundly restructuring our understanding of the world. This is what science does.

Anaximander's idea that the Earth is in fact floating in the middle of the sky alone would suffice to make him one of the most decisive figures in the entire history of human thought. But in fact his heritage is considerably broader than that. Anaximander also paves the way for astronomy, geography, meteorology and biology. With Thales, he initiates the naturalistic enquiry which, over the centuries, will slowly evolve into modern science. More importantly, however, in doing so he also inaugurates the very process of *rethinking the image of the world* – the path of investigation of the world which is based on the rebellion against what appears obvious; the recognition that knowledge begins with the realisation that common sense can be misleading. In this regard, Anaximander is one of the major wellsprings of all scientific and, more generally, rational thinking.

II. WHAT IS SCIENTIFIC THINKING?

Scientific thinking is a passionate exploration of new ways of conceiving the world. Its strength resides not in any putative certainties uncovered, but in *a radical awareness of our ignorance*. It is this awareness that allows us to continuously question what we think we know, and thereby to learn more. Such thinking is fluid and capable of continuous evolution. It has the capacity to subvert the order of things and to continuously redraw the world.

Scientific theories are not arbitrary constructions whose only truth content lies in their verifiable and verified consequences. Rather, they are the eyes through which we view and understand the world. Science can neither be grounded in, nor its truth-value reduced to, its verifiable predictions – nor to its hypothetical-deductive method, or to its operational protocols. Quantitative predictions, calculations, techniques, operations, falsifications ... all these are *tools*: important and incisive tools; pieces of evidence; instruments of clarity; ways to try to avoid mistakes; techniques to detect false assumptions; and so on. But they are only *tools*, and only some of the tools which come into play in science. They serve an intellectual activity whose substance is to be found elsewhere.

Numbers, techniques, predictions and calculations are all indispensable for suggesting, for testing, for validating, for confirming, and for utilizing discoveries. But there is nothing technical in the content of these discoveries: the Earth floats in space; the cosmos does not pivot around the Earth; matter is made up of protons, electrons and neutrons; there are hundreds of thousands of galaxies in the universe, each made up of hundreds of thousands of stars; rainwater comes from the evaporation of water from seas and rivers (another discovery by Anaximander); fifteen billions years ago the entire visible universe was compressed into a ball of fire; similarities between parents and children are transmitted by a DNA molecule which is carried by each of our cells; our brains comprise a million million synapses that jump when we think; the unlimited complexity of chemistry basically consists in combinations of simple electrical forces between protons and electrons; since all living beings on our small planet have common ancestors, we are related to ladybugs ... These are all *facts* about nature which were deeply counterintuitive for our common-sense worldview not so long ago; facts which have effected a profound change in our vision of the world and of ourselves. Their scope and relevance is vast, direct, and inhuman. This is what science is.

Scientific knowledge is the ongoing process that brings about an in-depth modification of our way of conceptualising the world by selectively questioning our assumptions and beliefs the better to propose new ones that promise to be more effective. Scientific thinking consists in re-drawing the world anew over and over again before our eyes. It is learning how to look further; learning how to conceive and envisage the world differently. Science is primarily an exploration of new forms of thinking.

Thus, before being technical, science is visionary. Anaximander, who was ignorant of mathematics, was the necessary step before we could arrive at the sophisticated mathematical astronomy of Hipparchus and Ptolemy. Nicholas of Cusa and Giordano Bruno opened up the way for Galileo and Hubble. The young Einstein asked what the world would look like if observed while riding a light wave, and told us in his best work of popularization that he saw spacetime as a huge jellyfish. Science is always conjuring up new worlds, before going on to discover that some of these fit reality better than our old prejudices.

Science's reconceptualisation of the world is continuous. The great conceptual revolutions, like those of Anaximander, Copernicus, Darwin or Einstein, are only its most visible moments. But the way in which we structure and conceive our understanding of the world today is profoundly at odds with that of a citizen of Babylon three thousand years ago.

And this transformation is the result of the gradual accumulation of many small modifications. Some of these steps represent definitive acquisitions: We no longer dance when we want it to rain. Others are only partially established: we know that our universe has been expanding rapidly for around fifteen billion years, but some still stubbornly insist that the world has only existed for six thousand or so years simply because the Bible says so. And other steps have been made by the research community, but have yet to become common currency: The structure of spacetime revealed by Einstein's work is quite different from the one with which most of us are familiar. It will take time to adapt, just as it took time to accept Copernicus' discovery. But the world will keep changing around us, as we discover more and more aspects of it. The visionary force of scientific thinking lies in its capacity to see further, and to expose our innumerable prejudices.

But in our attempt to think the world and to uncover hitherto unexpected aspects of it, we never begin entirely from scratch: We are always guided by the enormous amount of knowledge that we have already acquired. Our awareness that there might be something wrong with this knowledge – with the very conceptual structure in terms of which it is formulated – does not alter the fact that this knowledge provides the basis for everything we think and is the source of our intellectual strength. We can only transform it from within; not from the outside. As we compare this knowledge with our ever-changing experience of the world, as we confront different parts of our vast and complex body of knowledge with one another, our knowledge is increased, consolidated and strengthened.

This means that scientific advances are never simply directed against past knowledge: They are always also grounded in it. When Einstein was faced with the problem of the apparent incompatibility between Maxwell's equations and Galilean relativity, he could, in good Kuhnian spirit, easily have dismissed the relativity of velocity; or, alternatively, the universal validity of Maxwell's equations. But that's not what he did. Rather, he steadfastly maintained his faith in the validity of the core factual content of *both* the Galilean and Maxwellian theories – precisely that core factual content which is supposed to change freely at every step forward, in Kuhn's *vulgata*. But Einstein assumed that these theories should be valid well beyond the regime in which they had been tested. The combination of these seemingly contradictory hypotheses was sufficient for him to derive a new synthesis, special relativity; but at the price of dropping a *third* hypothesis, previously always tacitly assumed but never made explicit: that of the absolute value of simultaneity. Until that moment, this third hypothesis had been construed as an *a priori* of thinking, a veritable pillar of common sense.

Einstein did not carry out his revolution by discarding the old theories and proposing a new one. Rather, he carried it through by taking the old theories seriously and by questioning something in the general conceptualisation of the world. He did not proceed by finding new solutions in a game with clearly defined rules, but rather by changing the rules of the game itself.

This is not an isolated example. Copernicus does not abandon Ptolemaic astronomy in order to re-organise the phenomena; rather, he absorbs Ptolemy's system in depth, preserving epicycles and deferents, and it is within the folds of the old theory that he discovers the golden key – something unexpected should be abandoned: the fixity of the Earth. Similarly, Dirac predicts anti-matter on the basis of his faith in special relativity and quantum theory; Newton derives universal gravitation by taking seriously Kepler's third law and Galilean acceleration, virtually without *any* additional empirical input. In Einstein's greatest *coup de génie*, 1915's general theory of relativity, he discovers that spacetime is curved solely on the basis of special relativity and Newtonian gravity. And so on. In all of these examples, it is faith in the factual content of previous theories (the factual content that much contemporary philosophy of science disdains) which leads to discovery. And it is common sense that pays the price at each step.

From this perspective, we cannot identify three centuries of Newtonian science with science *simpliciter*, as we so often do. Rather, the past three centuries have been more like a pause along the way, in the wake of a major success. In questioning Newton's conceptualisation of the world, Einstein did not question our ability to understand reality. He simply made a new beginning upon the existing path; the path that had been that of Maxwell and Faraday, of Newton, of Copernicus, of Ptolemy, of Hipparchus and of Anaximander; questioning over and over again our naïve image of the world in order to keep deepening and refining it; recognising that our common sense is superficial and misleading; that the world is more vast, more beautiful and ultimately more understandable than the little garden of our everyday intuitions. We learn to see further by recognizing our mistakes.

Each of the steps taken by these great figures, as well as those taken by many more minor figures, gradually transforms our image of the world – sometimes in great depth. They can even modify the very rules upon which we base our understanding of the world. At each step, we obtain an improvement in our map of reality, drawn in new colours. At each step, we understand the world a bit better.

Let me briefly return to Anaximander. Among his numerous major contributions to human knowledge, there is one which is purely methodological; one which is perhaps the least evident but also the most far-reaching. Anaximander has a 'Master': Thales. Thales was a major figure in ancient Greece, so revered as to be included in the list of the 'Seven Sages', together with Solon, who wrote the first democratic constitution of Athens, and various other personages that the Greeks considered as their *maitres à penser*. Anaximander is a follower of Thales: he shares the same interests, the same naturalistic approach to the world, the same topics of investigation ('What is the principle out of which everything is made?'). It is clear that Anaximander's reflection begins from and is deeply rooted in that of Thales. This is not unusual in the ancient world, where great Masters (Confucius, Jesus, Pythagoras ...) often founded influential schools and had famous disciples (Mencius, Paul of Tarsus ...). But although such disciples would sometimes develop and expand the ideas of their Masters, they would certainly never question those ideas. Mencius never questions Confucius. Paul never questions Jesus. Not that criticism was absent from the ancient world: it was very present indeed, and sometimes bloody: just read what the

Bible has to say about Babylon's great culture. But there was no third way between ferocious criticisms and reverential study. This is where Anaximander's attitude towards Thales initiates a new approach. Anaximander accepts Thales' idea that everything in the world consists in a single 'principle', but rejects the idea that this principle could be water, as it was for Thales. He accepts the idea that the Earth might be like a large floating stone, but removes the ocean upon which Thales thought it was floating. And so on ...

This is to say that while Anaximander relies heavily upon Thales' speculation, building upon it, he does not hesitate to declare that Thales is wrong. There is a sophisticated theory of knowledge underlying this attitude: The realization that we can have *valuable* knowledge, but at the same time that this knowledge can be partially wrong; and, in any case, that it can always be improved. In other words, Anaximander realises that knowledge can be uncovered by relying upon what we know, but also by uncovering *mistakes* in what we believe to be true. This is precisely the attitude of any good detective. In adopting it, Anaximander opens up the path for the immense development of subsequent speculation, which is the basis of Greek philosophy and modern science. After Anaximander, Pandora's box is open: Every Greek feels free to challenge the received view and to propose an alternative in what might at first appear to be a cacophony, but is in fact the most spectacular development in the emergence of a formidable array of new and better ways of understanding the world.

III. The Current Revolution and Loop Quantum Gravity

Today, we are in the midst of a reconceptualisation of the world which is likely to prove every bit as far-reaching as those of Anaximander and Copernicus. Einstein's theory has effected a profound transformation in our understanding of what space and time are. Quantum mechanics has effected a profound transformation in our understanding of matter and energy. These theories are now almost a century old, and have been very widely corroborated: they furnish the basis for much modern technology. But we have not yet attained a fully credible theory within which the two theories can be coherently understood in their relation to one another. Our understanding of the world has once more become deeply confused and fragmented. There is currently an ongoing theoretical effort striving to discover the new sought-for synthesis and there are candidate theories which look promising, for instance the theory on which I work, called *loop quantum gravity*.

These theories demand of us, once again, a readiness to transform our understanding of the world in depth. Just as Anaximander asked his contemporaries to accept the idea that the Earth can float without falling, and Copernicus asked his contemporaries to believe that the Earth rotates on itself at great speed, once again our common sense is going to be questioned; once again, we cannot *and must not* rely too much upon our simple intuition, if we want to be able to see deeper into reality. We will have to rely instead upon our observations, our capacity for rational thought, and our imagination. We will have to rely upon our vast body of acquired knowledge about the world, which codes everything we know about it, even as we recognise that several pieces of the story might in fact be wrong. And we will have to keep searching. We have no fixed ground. Our intelligence is our only guide.

General relativity has taught us that space and time form a quasi-material continuum; a field very much like the electromagnetic field: A sort of fluid that suffuses everything. We have learnt with quantum mechanics that all fields, including the spacetime field, must have quantum properties, which means a granular structure and a probabilistic dynamics.

Loop quantum gravity is a tentative mathematical theory for describing this *granular* and *probabilistic* spacetime. The best way to understand it is to think about it as a substance formed by quanta ('atoms of space'), which fluctuate probabilistically and which are not to be thought of as immersed *in* space and evolving *in* time, but rather as what makes up space and whose relations make up time.

The resulting picture of the world is one in which space and time are no longer primary concepts. They are not the 'home' of reality and the 'flow' along which things happen. Rather, they are approximate and derivative concepts, like the concept of temperature or the concept of the surface of a liquid: Concepts which disappear in a more elementary description of reality. *Can we think the world without time?*

IV. IS THERE NO TIME IN THE FUTURE?

Time is the hardest concept to modify in our intuition. We already know all too well from Einstein's work the extent to which our intuition that time flows equally and universally all over the universe is badly misleading: Two twin brothers can travel separately and meet again when they are different ages.

But if our current tentative theories about quantum gravity are correct, we will have to modify a good deal about our concept of time. Indeed, we will have to learn to think the world at its most elementary level (at least for the time being) *without making any reference to the notion of time at all.* This means that we must reinterpret dynamics as a theory of relations between variables, instead of as a theory of the evolution of variables in a preferred independent time-variable.

The only fragment that remains of the book written by Anaximander reads:

> εξ ων δε η γενεσις εστι τοις ουσι, και την φθοραν εις
> ταυτα γινεσθαι
> κατα το χρεων
> διδοναι γαρ αυτα δικην και τισιν αλληλοις της αδικιας
> κατα την του χρονου ταξιν

Its (disputed) translation is as follows:

> All things originated one from the other, and perish the ones into the others,
> following necessity
> And they render justice to one another, and pay one another for injustice
> in conformity with the order of time

Much has been read into this text. It is possible that this is the first enunciation of the idea of natural law. Pythagoras, shortly after, added the remarkable idea that laws must be written in mathematical terms; Plato instructed his students to search for such mathematical laws in the regularities of the heavens, leading to that spectacular scientific success which is Alexandrian astronomy – which, in turn, once revived by Copernicus, paved the way for modern science.

For twenty-six centuries, Anaximander's prescription to search for laws that describe how things change *in time* ('in conformity with the order of time') has been strictly adhered to, and has proved immensely fruitful. But it may be that we now need to challenge even this most fundamental rule of the game: Today, the fundamental physical laws are no longer being sought in the form of laws of evolution in time, but rather in the form of laws of relations between physical variables.

In doing so, we are not betraying Anaximander's legacy, but celebrating it once again: knowledge is not attained by revering the Masters and scrupulously following their lead; it is attained by absorbing at the most profound level what the Masters have to teach, the better to uncover where they might be wrong.

V. WHAT DO WE KNOW WITH CERTAINTY?

If the condition of our search for knowledge is the recognition of the limitation and the uncertainty of our present understanding, where can we find the solid ground upon which to base our certainties?

I think that, notwithstanding the impressive amount of knowledge that we have been able to accumulate so far, there is nothing in our knowledge that is ultimately grounded in a solid bedrock. And it is my opinion that the attempt by philosophical inquiry to unearth a metaphysical or methodological starting-point from which some certain indubitable knowledge could be derived, is misbegotten.

We have learnt that there is no such thing as 'pure experience' – the experience which Bacon elevated into the principle of his new religion of science – capable of grounding certainty. Nor is there any 'pure reason' of the kind upon which Descartes hoped to rely, but which led him to such an erroneous physics. Both Baconian empiricism and Cartesian rationalism had a polemical objective: to supplant the tradition upon which Scholasticism had relied with a new source of epistemic validity. The explosive and liberating power of these philosophies freed thinking from the prison of tradition, reawakening the freedom of ancient Greek inquiry and opening the doors to modernity. This openness to criticism is their immense legacy. But today we know only too well that there is no absolutely certain foundation upon which to ground all our knowledge. Every time we believed ourselves to have uncovered one, we have been disappointed. Neither pure experience, nor pure reason, nor a transcendental inquiry into the conditions of knowledge, nor strict verificationism, nor anything else will be able to provide us with an absolute guarantee against the pervasive influence of our faulty ideas and limited assumptions.

But the antiscientific irrationalism that pervades so much of contemporary culture is, in my opinion, as short-sighted as the eighteenth-century faith in scientific certainties: the lack of certainty is not the weakness of scientific thinking, but rather its strength. Scientific theories are not credible because they are definitive: they are credible because they represent the best knowledge about the world we are able to attain at any given moment. And it is precisely because we refuse to consider them definitive that we are capable of constantly improving them. As John Stuart Mill put it in *On Liberty*:

> The beliefs which we have most warrant for, have no safeguard to rest on, but a standing invitation to the whole world to prove them unfounded.

'Reality' itself is a flimsy notion, but what an effective one! How could we do without it? Our thinking is thinking about reality. We refer to it, relate to it. What else we are dealing with if not reality? Everything we know is something we know about reality. That about which we know – that is reality. It is that which continues to surprise us, to disclose itself to us anew, and about which we imagine there is still so much to learn – perhaps aspects of which we will never learn about or be able to understand. Reality continues to appear to us other than we had thought. And in the evolution of our love story with it lies the growth of our knowledge. It has aspects of a dream but, as in the marvellous words of Hippolyta:[2]

> … all the story […] told over,
> And all their minds transfigur'd so together,
> More witnesseth than fancy images,
> And grows to something of great consistency;
> But, howsoever, strange and admirable.

I think that our mistake is to fear this fluidity and to search for certainty. To select a fixed point upon which our restlessness could finally come to rest would be not only naïve, indeed counterproductive for our thirst for knowing; it would be dishonest. Science is the human adventure that consists in exploring novel ways of thinking the world; it should always be ready to subvert any certitude we think we have gained thus far. The fearful side of this adventure consists in fully recognizing and assuming our ignorance. It is my conviction that to accept our ignorance is not only the royal road to knowledge: It is also the most honest and the most beautiful one. The emptiness and the corrigibility that it entails do not make our life and our knowledge less meaningful: They make it more precious. It is an adventure that was begun twenty-six centuries ago, so far as we can tell, by Anaximander – or, if not by him, by somebody else living in Miletus at that time. It is, I think, amongst the most enchanting of human adventures.

And of course, yes: Anaximander was right:

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[2] Shakespeare, A *Midsummer Night's Dream*, V, 1.

Earth seen from Apollo 17 (Image: NASA)

The View from Nowhen

Interview with Julian Barbour

In his first major book, The Discovery of Dynamics (1989), *theoretical physicist and historian of physics Julian Barbour described the process of discovery and progress in science* as *'a journey into the totally unknown, in which shock follows shock'.*[1] *A decade on, in* The End of Time (1999)[2] *he put forth in popular form his thesis, developed over some decades, regarding what he had come to believe would be the next great shock to our commonsense picture of the world – namely, that the concept of time would cease to have any role in the foundations of physics. More starkly expressed, Barbour predicts that the next great revolution in our understanding of the universe will entail the realisation that time does not exist – a thesis which, if true, would be shocking indeed. The question, of course, is whether it is true; and, if it is, how we could ever possibly find a way to test and confirm such a seemingly outrageous hypothesis. In our interview with Barbour, we ask him about the motivations which led him to develop his radical position, the paradoxes and problems which arise in trying to make sense of it, and his own eccentric position in relation to mainstream academic theoretical physics.*

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[1] Julian Barbour, *The Discovery of Dynamics: A Study from a Machian Point of View of the Discovery and the Structure of Dynamical Theories* (Oxford: Oxford University Press, 2001), 58; originally published as *Absolute or Relative Motion? Vol. 1: The Discovery of Dynamics* (Cambridge: Cambridge University Press, 1989).

[2] Julian Barbour, *The End of Time: The Next Revolution in our Understanding of the Universe* (London: Weidenfeld and Nicolson, 1999).

Collapse: Before tackling the details of your thesis regarding time and timelessness, we would like to start by asking you to say something about your own intellectual journey 'into the totally unknown'. Your reading of Ernst Mach's *The Science of Mechanics* in 1963 seems to have been a crucial turning point. You have said that this book made a profound and lasting impression on you, and it's clear that your subsequent intellectual trajectory has been profoundly marked by Mach's ideas. What was it, precisely, about Mach's book that you initially found so compelling? Was it simply the persuasiveness of his arguments against the Newtonian notion of absolute space, or was there more to it than that?

Julian Barbour: It is certainly true that Mach's writings, especially his *Mechanics*, were extremely important in providing the stimulus for my life's work. I found his critique of Newton's notion of absolute space totally persuasive. Perhaps luckily for me, Mach never formulated in any detail an alternative to it, though he certainly gave suggestive hints. The field was therefore free for me to develop. However, in doing so I departed strongly from Mach's ideas about how one should actually do science. In his view, one should carefully observe natural phenomena, identify characteristic phenomena that recur repeatedly, and formulate science as the economic representation of these phenomena. Mach distrusted theory, especially the attempt to advance in science by means of analytical dynamics. In fact, I totally disregarded this aspect of Mach's thinking when formulating Machian theories. They rely heavily on the techniques of analytical mechanics, above all the principle of least action.

Mach was also important in strengthening my belief – already formed before encountering his work – that the Newtonian concept of time needed revision. Few people have noted that the first half of Mach's critique of Newton's concepts deals with time and includes his remark: 'It is utterly beyond our power to *measure* the changes of things by *time*. Quite the contrary, time is an abstraction, at which we arrive by means of the changes of things.'[3] Much of my work has been devoted to the transformation of this qualitative statement into a quantitative theory of duration. This also finally led me to the radical ideas presented in *The End of Time*.

C: One might be surprised here that you neglect to mention the fact that, while Mach indeed did not himself develop a detailed alternative to the Newtonian notion of space and time, *Einstein* certainly did, and that he did so on the basis, at least in part, of Machian ideas. While the degree to which, and in what precise respects, Mach's ideas exercised an influence on Einstein have long been a matter for debate, there is no doubt that Einstein himself was of the opinion that Machian epistemology had exercised a crucial influence upon him. In an article from 1916 he even went so far as to say that certain passages from Mach's *Mechanics* 'show that Mach clearly recognised the weak spots in Classical Mechanics and was not far from requiring a General Theory of Relativity', adding that '[i]t is not improbable that Mach would have come across Relativity if, at the time when he was in his prime, physicists had concerned themselves with the significance of the constancy of the speed of light'.[4]

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[3] E. Mach *The Science of Mechanics: A Critical and Historical Account of Its Development*, trans. K. Menger & T. J. McCormack (Chicago: Open Court, 1988), 273.

Whether or not Einstein was correct about this, the popular view seems to be that, while Mach's ideas undoubtedly influenced Einstein to some extent, those ideas were nevertheless motivated by a combination of ideas which have long since been rendered obsolete by developments in both physics and the philosophy of science: not much more, then, than a mere historical curiosity. However, your early comparison of Mach's ideas with the papers which Einstein had written while he was developing his general theory of relativity led you to the conclusion that Einstein had been formulating his theory on lopsided foundations, and that it was the problems relating to what Einstein called 'Mach's Principle' which had been inadequately developed. You have described Mach's Principle as the idea that 'the locally observed inertial properties of particles arise not from some independently existing absolute space, but rather from the combined effect of all the dynamically significant masses in the universe.'[5]

JB: Yes, the idea that only *relative* configurations exist; a position that had already been adopted, incidentally, by Leibniz.[6]

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[4] Cited in Elie Zahar, 'Mach, Einstein, and the Rise of Modern Science', *British Journal for the Philosophy of Science* 28, 1977: 196.

[5] Julian Barbour, 'The Development of Machian Themes in the Twentieth Century' in J. Butterfield (ed.), *The Arguments of Time* (Oxford: Oxford University Press, 1999), 83.

[6] See Julian Barbour, 'The deep and suggestive principles of Leibnizian philosophy', *The Harvard Review of Philosophy* 11, Spring 2003: 58. This and other papers by Barbour which treat issues discussed in this interview are available to download at Barbour's website, platonia.com.

C: So you set out to explore what a truly 'Machian theory', wholly faithful to this principle, might look like. In order to directly confront problems that Einstein had failed to think through sufficiently, it would be necessary to return to first principles regarding the Machian problem of inertia. But how would this rethinking of the Machian foundations of general relativity ultimately lead you to the radical thesis of the total elimination of time and change from fundamental physics?

JB: You correctly summarize the reasons why I felt that it was necessary to go back to first principles. I very soon came to the conclusion that, while what Einstein had done in creating general relativity was brilliant, he had not clearly formulated what needed to be done in order to implement Mach's ideas directly. This led me to hope that a direct approach might lead to a new theory of gravity different from Einstein's. For several years Bruno Bertotti and I worked to create such a theory, only to discover that the theory we had found was general relativity in an unfamiliar guise. This was initially a disappointment for both of us; for a while I turned to politics, while Bertotti turned decisively to space-based searches for gravitational waves. Luckily for me, Lee Smolin encouraged me to consider the implications of our work for attempts to create a quantum theory of gravity. As the years pass, I become more and more hopeful that the Machian aspects of general relativity that Bertotti and I uncovered will prove to be useful in that regard.

I arrived at my radical idea in two stages, the first of which involved a theory of time in classical physics, the second a consideration of the implications of the insights gained in the first for a quantum theory of the universe.

A key notion in classical dynamics treated by the methods of variational mechanics is the configuration space of a closed dynamical system. It is the collection of all possible configurations that the system can have. One can take such a system to model a universe. In Newtonian particle dynamics, a configuration is defined by the separations between the particles as well as by the position and orientation of the complete collection of particles in absolute space. The first step to a Machian theory is to insist that the separations alone define the configurations. The Machian (relative) configuration space of the universe, then, is the set of all such relative configurations; I call it the RCS (of the universe). A *history of the universe* is any curve in its RCS.

Now we must think about time. According to Newton, it is absolute and flows uniformly without any reference to what is happening in the universe. But we could never say that time passes if we did not observe change. The hands of a clock must move. Moreover, the curve in the RCS is a record of *all* changes in the universe. There is no further change not already coded in the curve that would enable us to say how fast the universe moves along it. History is not the curve traversed at some speed; it *is* the curve.

In this Machian kinematics, the dubious aspects of Newtonian dynamics have been eliminated: overall position and orientation have been eliminated, as has the ‘invisible flow’ of time. However, geometrical separations are retained and so too is a unique succession of configurations. This is not a really radical change, since succession of configurations is the most important feature of time that we gain from direct experience. Using this Machian kinematics, Bertotti and I were able to create a Machian theory that differs in its predictions from Newtonian theory when applied to the complete universe but is able to reproduce Newtonian theory for a subsystem of the universe like a galaxy or the solar system.

The radical step comes when one considers potential applications to a quantum theory of the universe. In my view the greatest revolution in physics occurred when Schrödinger introduced his wave function. In classical physics, we have curves in some configuration space traversed at some speed with respect to an external time; in Schrödinger's wave mechanics we have a wave function on the same configuration space, and the wave function varies with respect to the same external time. But if there is no external time and we want to retain the notion of a wave function, which has been so outstandingly successful, it seems to me that we must take seriously the idea that in the quantum mechanics of the universe we have a *static* wave function defined on some relative configuration space. There is no external time with respect to which it can evolve.

The question then is how to make sense of that!

C: One of the ways in which you have attempted to make sense of it is by picturing this 'relative configuration space of the universe' in terms of what you call 'Platonia', which you describe as a kind of timeless and frameless arena comprising 'the collection of all possible Nows'. Before trying to come to grips with that, however, perhaps we can take a moment to unpack a little of what you have just said regarding the reasons you came to suspect that failure to resolve Mach's problem regarding inertia (with which Einstein had struggled between 1907 and 1918, but ultimately abandoned) might be intimately connected to the obstacles confronting the attempt to construct a workable quantum theory of gravity. You came to the conclusion that the lack of progress in resolving certain problems in the foundations of dynamics related to Mach's Principle, on the one hand, and stagnation in the field of quantum gravity research, on the other, might have a common origin. Einstein had favoured an indirect approach to the Machian problem based on his conviction that the history of science had demonstrated the impracticability of dispensing with coordinate systems. But the logic of Mach's own approach seemed to require precisely that they be dispensed with, in order to formulate the laws of motion directly in terms of relative distances and relative velocities without recourse to any distinguished local frames of reference. In effect, this would amount to a direct implementation of Mach's Principle, according to which the inertial properties of local matter are determined by the overall matter distribution in the universe. It was Einstein's early neglect of such explicitly *cosmological* considerations – that is, considerations regarding the universe as a whole understood as a single dynamical entity – which, you suggest, resulted in a failure to appreciate the deep 'relational' structure of general relativity. Could you spell out a little more what this strongly 'relational' interpretation of general relativity entails, and in what way you regard the previous failure to appreciate it as having posed a fundamental obstacle to progress in quantum gravity and quantum cosmology research?

JB: This is a longish story, so I will only give some of the essentials. From about 1911 Einstein always thought in terms of curved four-dimensional spacetime and believed that, if he could find a law describing the structure of spacetime that had the same form in all coordinate systems, Mach's requirement would be automatically satisfied. This is because such a law would not single out any special coordinate system in which the laws of nature take a distinguished simplest form in the way Newton's laws do in an inertial frame of reference. Einstein called his requirement the principle of general covariance and was convinced that it had deep physical significance. However, soon after general relativity had been created, Kretschmann pointed out that any law that makes physically meaningful statements about the world must be expressible in a generally covariant form. Einstein immediately accepted this argument and argued, rather feebly I believe, that it still had great heuristic value. It is also worth mentioning that the most important part of Einstein's theory, his tensor field equations, were not created by him but were taken over more or less intact from mathematicians. He did make one brilliant modification to the Ricci tensor that his friend Grossman proposed, but he never 'unpacked' the tensor that he employed (the Einstein tensor) to see exactly what it does do. Unlike Newton, he did not create his theory in its entirety *ab initio.*

To see what actually happens in general relativity, you have to work out how the structure of three-dimensional space changes as you move through spacetime. This was first described at the end of the 1950s by Dirac and Arnowitt, Deser, and Misner (in the ADM Hamiltonian formalism developed as a first step to the canonical quantization of general relativity). Without realizing there was any connection with this work, around 1979 Bertotti and I started to think what a Machian theory of the evolution of three-dimensional Riemannian geometry would be like. We constructed a theory in which not only spatial change but also time would be relational, only to discover a year later that we had effectively rediscovered general relativity in a Lagrangian form equivalent to the ADM formalism. This showed that in its most basic structure GR is Machian and, moreover, in a sense not anticipated at all by Einstein. More recent work that I have done with Niall O'Murchadha, Edward Anderson, Brendan Foster, and Bryan Kelleher[7] has shown that what I call the two Machian requirements – that both time and change are relational – are extremely powerful, much more so that Bertotti and I thought thirty years ago. They lead to conditions that any Machian theory must satisfy; in the case of dynamical Riemannian three-geometry, these are extremely restrictive.

C: Your interpretation of the radically relational structure of general relativity draws heavily upon not only Mach's ideas, but also those of Henri Poincaré. It was Poincaré, you suggest, who demonstrated more clearly even than Mach what the requirements of a theory of relative motion must be. In a thought experiment remarkably reminiscent of Plato's allegory of the cave which appears in the chapter entitled 'Relative and Absolute Motion' of his 1903 book *Science and Hypothesis*, Poincaré speculates about whether there would ever have been a Copernicus to infer the motion of the earth on its axis if the latter were continually surrounded by a thick blanket of impenetrable clouds, and we thus had no means of observing the stars. Poincaré, of course, did not yet know anything of the possibilities of space travel or of non-optical (e.g. radio) astronomy; yet he argues that, while we would have had to wait a much longer time than we did for the coming of a Copernicus, 'this Copernicus would come at last'.[8] After centuries of accumulating complications analogous to Ptolemy's glass spheres in order to explain such phenomena as centrifugal forces, the flattening of the poles, the asymmetric motion of cyclones, and Foucault's pendulum experiment, suggests Poincaré, 'the long-expected Copernicus would sweep them all away with a single blow, saying it is much more simple to admit the earth turns round'.[9]

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[7] Several papers related to this research can be accessed at Barbour's website, platonia.com.

This is a remarkable thought experiment in many ways, not least with regard to Poincaré's suggestion that we might indeed be in an analogous situation, with regard to the universe as a whole, to that of these imaginary physicists in relation to the solar system – that is, that we might be mistaking for fundamental physical constants what a greater knowledge of our cosmic environment would reveal to be merely a function of our limited terrestrial perspective.[10] However, the main questions Poincaré seeks to raise with this thought experiment concern the Newtonian notion of absolute motion:

> If the sky were covered with clouds, and if we had no means of

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[8] *Science and Hypothesis* in Henri Poincaré, *The Value of Science: Essential Writings of Henri Poincaré* (New York: The Modern Library, 2002), 89.

[9] Ibid., 90.

[10] Ibid., 92-3.

> observing the stars, we might, nevertheless, conclude that the earth turns round [...] And yet, would there in this case be any meaning in saying that the earth turns round? If there is no absolute space, can a thing turn without turning with respect to something; and, on the other hand, how can we admit Newton's conclusion and believe in absolute space?'[11]

Would you like to comment on this thought experiment, and to say why you regard Poincaré's epistemological reflections on relative and absolute motion to have been so crucial in working out the necessary requirements for formulating a fully relational mechanics?

JB: Personally, I do not find this particular discussion quite so significant as the one, also in *Science and Hypothesis*, in which he pinpointed the way Newton's absolute space shows up in the evolution of the observable separations between the bodies of the solar system: the separations and the rates of change of the separations do not suffice to predict the future evolution as one would expect if only the separations had physical significance. Poincaré notes that even if astronomers could not see the stars, but only the sun and the planets, they could deduce absolute motions from their observable positions. The same thing holds, *mutatis mutandis*, for the example in which the earth is completely covered by clouds. The observable motions of the bodies that one can see can be represented so much more simply if one postulates an invisible absolute space. Poincaré was profoundly troubled by this, but being a conservative scientist he concluded that we must simply accept this fact that is so ‘repugnant to the philosopher’. It is odd that he nowhere (to my knowledge, certainly not in *Science and Hypothesis*) mentions Mach, and did not conjecture that the universe as a whole might satisfy his improved form of the relativity principle free of the repugnant feature.

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[11] Ibid., 89.

Reading your quote from Poincaré again, I note his question ‘can a thing turn without turning with respect to something?’ This suggests to me that he was unaware of the notion of an inertial system that Ludwig Lange had introduced in 1885 and to which Mach had given considerable prominence in later editions of the *Mechanics.* Lange had shown how an inertial system is determined by observable separations of material objects; objects meaningfully rotate relative to the matter-determined inertial system. The concept is sophisticated: moving matter itself determines the frame of reference in which the laws governing the motion take their simplest form. Mach still felt that although Lange had put Newton on a sound epistemological basis, his mechanics was not relative enough; this was a gut intuition that Poincaré shared.

Coming back to his analysis and why I think it is so important: because it provides a precise criterion that a Machian theory must satisfy. Consider a system of bodies. A relative configuration of these bodies, taken to represent the universe, is determined by a set of separations between them. The set of all relative configurations forms the relative configuration space (RCS) of the system. For mechanics to be fully rational, in Poincaré’s view, a point in the RCS and a rate of change of that point in the RCS should determine the evolution uniquely. Such data do not suffice to do that in Newtonian theory because they contain no information about the angular momentum in the system; that is coded in the velocities in absolute space, which are not uniquely determined by the relative velocities. Poincaré still kept an external time in his analysis and spoke of the rate of change of the relative separations. In a timeless Machian theory, there should not be any such external time. Therefore, the condition for a fully Machian theory should be: a point and a *direction* at that point in the RCS of the universe should suffice to determine the evolution. Although Einstein read *Science and Hypothesis* closely, Poincaré's analysis seems to have made no impression on him. He never formulated Mach's principle in such a way. I think all the innumerable arguments about Mach's principle would never have arisen had Einstein been sensitive to what Poincaré had written. In a closed universe (for which arbitrary unnatural boundary conditions do not arise), Einstein's theory perfectly satisfies both parts of the Machian condition. Only if one insists that size should be relative does a very curious non-Machian feature of general relativity show up: expansion of the universe should have no meaning, in flagrant contradiction to all the successes of the modern theory of the expanding universe. Scale is absolute in general relativity – a last vestige of Newton's absolute space.

C: Are you claiming, then, that the observable universe is *not* in fact expanding? If that is the case, how then to account for the masses of mutually corroborative evidence, starting with cosmological redshift observations, which suggest that it is?

JB: I admit that much evidence supports the theory of the expanding universe very impressively. The point that I want to make is that this is mysterious. A notion of absolute size is built into the mathematics of general relativity and matches observations very well. In accordance with our present picture, the universe is doing *two* things: it is getting larger and changing its shape (it is becoming more inhomogeneous). I would be much happier with a theory in which the universe is only changing its shape and through a presently unknown mechanism this is giving rise to the effects currently explained by expansion. I live in hope of finding such a theory, or stimulating someone to do so, but am not optimistic given the success of the standard model.

C: But even if such an explanation someday becomes possible, so that we drop the hypothesis of expansion and are left only with the idea that the universe is 'changing shape' and 'becoming more heterogeneous', how is it possible to think the latter without presupposing notions of time and motion? Or to put the question in more general terms, how, in a theory according to which there is no time, change or motion in the universe, is one to account for the apparent ubiquity of such phenomena? Doesn't the suggestion that time, motion and change do not really exist run the risk of landing oneself in a rather extreme form of idealism? One might of course say that such experiences are an 'illusion', but even illusions – indeed, we might even say, *especially* illusions – require explanations, and all the more so when what is being claimed to be illusory is that which we have always taken to constitute the fundamental fabric of reality.

JB: Your question only becomes acute when we pass from classical physics to my conjecture of a static quantum universe. In this context, we have to understand how our familiar notions of time and motion arise. Now evidence for time and motion comes in two forms. First, we directly see things move; second, we deduce passage of time and change from records, which in themselves are unchanging. The latter evidence for time is no threat to my idea. As to the former, I think it need be little different from the fact that we see colour. Scientists do not think colour exists in the physical world but do not deny that it is somehow given to us in consciousness. I put motion on a par with colour. Since Galileo, we have had the distinction between primary and secondary qualities. The primary qualities, related to geometry, shape, and motion, are believed to exist in the material world while colours and sounds exist only as mental states. The primary qualities are believed to 'excite' the secondary qualities in our minds. Scientists work happily with the division of qualities and the conjectured relationship between them. I am proposing that motion should cease to be a primary quality and become a secondary one.

C: But even if we can somehow make sense of the idea that motion is a secondary quality pertaining, as you say, only to mental states – a proposal which would obviously involve enormous difficulties compared to the case of colours, heat and so on – isn't it the case that those mental states themselves, those *experiences* of primary qualities, must always have a certain *temporal duration*?

JB: I do not think this is necessarily so. A theory like mine must propose structure in the physical world that is correlated consistently with experience. If I have in front of me simultaneously two snapshots showing a football match with the players and ball in slightly different positions, I can work out from that static information how each player and the ball have moved between the two snapshots. I argue that the physical correlate of what we experience as motion is stored in the instantaneous brain configuration as two (or more) such 'snapshots'.

C: Regarding 'snapshots': In *The End of Time* you claim that the world is made up of 'instants of time' which you call 'Nows', and you liken them to 'three-dimensional snapshots' such as 'could be constructed if many different people took ordinary two-dimensional snapshots of a scene as the same instant'. As an example, you write: 'I feel an itch at the same time as seeing a moving object in a certain position. All the things I see, hear, smell and taste are knit together in a whole. "Knitting together" seems to me the defining property of an instant. It gives it unity'.[12] However, again, even if it makes sense to speak of a durationless visual 'snapshot', surely hearing a sound, at least, is not something which can happen without a certain duration? Moreover, if what I see when I feel an itch is a star many millions of light-years away, while my experience of seeing the light from the star and feeling the itch might be said to be simultaneous, the idea that the star and I make up a unified 'instantaneous present' is obviously false. In this respect, then, the 'Now' would seem to be something which has its locus only in one's experience of the world, yet you are surely not claiming that reality is somehow dependent upon experience or consciousness – which, again, would amount to a very extreme form of idealism. Doubtless these questions at least partially result from taking the metaphor of a 'snapshot' too literally, but then could you say something by way of warding off such (perhaps somewhat inevitable) misinterpretations of your position? Perhaps your idea of 'time capsules' might shed some light on this?

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[12] *The End of Time*, op. cit., 18.

JB: One can argue that all concepts in theoretical physics, including the most abstract ones in quantum mechanics, are suggested by experience. Here 'suggested' is vital. Close your eyes and open them for about half a second before closing them again. You do experience something very like seeing a snapshot. Accumulated experience then leads us to the idea that bodies have instantaneous positions in space and that a collection of bodies is characterized at each given instant by a configuration that can be likened to a 3D 'snapshot'. In the theoretical concept, geometry plays a decisive role; it holds the world together. For me the key notion is of a plurality within a unity (a deeply suggestive expression often used by Leibniz). As I employ it, the notion comes from direct experience but is honed by abstraction to a precise theoretical concept. For example, before the finite speed of the propagation of light was discovered it was natural to assume that we see everything at the same instant, even the most distant star. Astronomers take account of the speed of light to correct apparent positions and obtain instantaneous positions in some particular frame of reference. Although it is often argued that configurations at some instant lost physical significance in Einstein's relativity theories, especially the general theory, this is not true because appropriate initial data on a spacelike surface determine a complete spacetime in general relativity. The spacelike surface is in fact a 3D curved Riemannian space. Thus, after much abstraction (which nevertheless retains the essential idea of unity within plurality) my 'snapshot' becomes such a space with matter distributed within it. The collection of all possible such 'snapshots' is my Platonia, the space of possible configurations of the universe. The reason why I identify this space – the configuration space of the universe – as all-important is because it plays a central role in both general relativity and quantum mechanics. Though others might not agree, I do not see how either theory can survive if it is not retained in some form or other.

Thus, when I speak of itches and sounds experienced simultaneously with images of objects, that is only to get across the idea of an instantaneous plurality within a unity. The insistence on 'instantaneous' in the refined concept comes from the success of the notion of instantaneous configuration in both relativity theory and quantum mechanics. In *The End of Time* I attempt to close the circle and show how our experiences might be explained by the special configurations that I call 'time capsules'. If, as I conjecture, the quantum mechanics of the universe gives a high weight (probability) to time capsules, which are instantaneous configurations that contain what seem to be mutually consistent records of a past that unfolded in accordance with the currently known laws of physics, and if conscious experience is correlated with instantaneous configurations, then one can understand how experience suggests refined concepts and a theory that in turn has the potential to explain the original experiences.

C: Isn't it empirically incoherent to claim that the empirical conditions necessary in order to confirm a given hypothesis are, according to the very hypothesis itself, non-existent or illusory? In order to even qualify as a candidate theory, is it not required that the would-be theory make novel and testable predictions? And yet, doesn't the very notion of testing a prediction fundamentally presuppose the notion of time, and of the identity of a world and an observer over time? For without these, what sense would it make to say that a prediction unconfirmed at an *earlier* time had come to be confirmed or falsified at a *later* time? In this regard, the philosopher Richard Healey has suggested that your interpretation of general relativity ends up undercutting its own epistemic credentials, since 'we can have no empirical reason to believe such a theory if it cannot explain even the possibility of our performing observations and experiments capable of providing evidence to support it'.[13]

JB: Think of Copernicus: The motion of the sun across the sky and the retrograde motions of the planets relative to the stars are empirical conditions and were used by Copernicus to argue that they were illusions. Ultimately, science is not really about prediction but *explanation* and *confirmation.* A theory is confirmed by comparing in the same instant data that we call the outcome of an experiment and data that we call a record of the earlier conditions. Theories are always confirmed in the present. Geologists, for example, developed a theory of the deep past without making any experiments. All their conclusions were drawn from present data. Cosmologists are currently developing an account of cosmology in the same way. Even experiments at the LHC are ultimately interpreted by theoreticians from data sets acquired from the experimentalists. Records are always a vital part of the story. Information is all of the same kind; we divide some of it into effects and some into records.

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[13] Richard Healey, 'Can Physics Coherently Deny the Reality of Time?' in Craig Callender (ed.) *Time, Reality and Experience* (Cambridge: Cambridge University Press, 2002), 308; cf. Jeffrey Barrett, 'Empirical Adequacy and the Availability of Reliable Records in Quantum Mechanics', *Philosophy of Science*, 63, 1996: 49-64; and Jeffrey Barrett, *The Quantum Mechanics of Minds and Worlds* (Oxford: Oxford University Press, 1999), esp. 162.

I may add that John Bell (of the famous inequalities) remarked, in a discussion of Everett's 'many worlds' interpretation of quantum mechanics, that 'we have no access to the past, but only to present memories. A present memory of a correct experiment having been performed should be associated with a present memory of a correct result having been obtained. If physical theory can account for such correlations in present memories it has done enough – at least in the spirit of Everett'.[14] This seems to me a complete and succinct response to Richard Healey's difficulty. It seems to me that it is for psychological reasons that people have difficulty with such a position as mine; I do not see where there is a flaw in the logic or methodology of science properly understood. Indeed Bell himself had difficulties in this respect, in my view. In later comments on Everett he says that in his opinion the 'really novel [but unappreciated] element in the Everett theory [...] is a repudiation of the concept of the "past", which could be considered in the same liberating tradition as Einstein's repudiation of absolute simultaneity'.[15] He goes on to give a wonderful account (on which I draw heavily in *The End of Time*) of how time capsules as I define them can emerge with high probability from a timeless quantum-mechanical treatment of the formation of alpha-particle tracks in cloud chambers. But when he comes to the end, he dismisses Everett's theory (despite the brilliant support his gloss has given to it) as a 'radical solipsism [...] It is always interesting to find that solipsists and positivists, when they have children, have life insurance'.[16] This is clearly rejection for psychological reasons. For my part, I am not a solipsist and retain virtually all the ontology of impeccable realists – except that ever-elusive time.

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[14] John S. Bell, *Speakable and Unspeakable in Quantum Mechanics* (Cambridge: Cambridge University Press, 1988), 95-6.

C: The mathematician and cosmologist George Ellis has charged you with 'sneaking in a standard concept of time through the back door' since the very idea of 'the reading of records in some order presupposes a concept of time operational in the mind – which surely cannot occur if the brain is part of a static, unchanging world.'[17] Ellis thus finds you guilty of exempting the mind from the physics which you claim governs the way things work, and thus of

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[15] Ibid., 118.

[16] Ibid., 136.

[17] George Ellis, book review in *Studies in History and Philosophy of Modern Physics* 33, 2002: 380.

'allowing the human mind to transcend the basic worldview that is supposed to govern the way nature works'.[18] Do you reserve a special ontological place for the conscious mind?

JB: We are clearly learning a great deal about the workings of the brain, but how anything ultimately comes into consciousness is, to my knowledge, still a complete unknown. However, let me make this comment: Boltzmann's explanation for our sense of the direction of time relies on difference of structure: a state with higher entropy is perceived as being later in time than one with lower entropy. This implies that the brain compares two structures and on the basis of the structures alone decides which is later and presents it to us later in consciousness. My view is hardly different; in fact I am not sure if it is in any way different. I propose that, in the immense complexity of our brain, there are, in any instant, configurations of neurons that in the traditional view scientists would regard as occurring in a definite time-order. I am merely saying that they can be put naturally in that order solely using their intrinsic structure; in the process of presenting the stored information to us in consciousness, the brain does not need access to an externally supplied time-order. It constructs it from the information available in one instant. I put such arguments in *The End of Time*, especially Chapter Two, and still think they are reasonable, despite what George says. He argues that I allow 'the human mind to transcend the basic worldview that is supposed to govern the way nature works'. I would answer that, when it comes to essentials, I am in the good company of Boltzmann, and that the Wheeler-DeWitt equation (which is the putative fundamental equation of quantum gravity) suggests that it is the 'basic worldview' that may need to be changed.

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[18] Ibid.

C: Ought we take this as a kind of avowal, then, that you are indeed suggesting that the mind in some way transcends the physical world? There are, of course, very many neuroscientists, cognitive scientists, evolutionary biologists and philosophers who will strongly demur at your suggestion that the nature of the relationship between consciousness and the brain is still 'a complete unknown'. But even if that *were* the case, wouldn't even a superficial knowledge of the history of science over the past two centuries lead one to expect that we are not dealing with anything essentially refractory to physical explanation here, or anything intrinsically more 'mysterious' than, say, motor control? Before the advent of molecular biology, for example, many people thought it was unimaginable that to be a living thing could consist in a particular organization of 'dead' molecules, and many today have similar difficulty imagining how consciousness could be a function of the brain, and it's hard not to see the two cases as being closely analogous. As the philosopher of neuroscience Patricia Churchland points out, '[f]rom the vantage point of considerable ignorance, failure to imagine some possibility is only that: a failure of imagination – one psychological capacity amongst others [...] It is not an interesting metaphysical fact about the universe nor even an epistemological fact about the limits of scientific knowledge'.[19] Of course, you know this very well, since your own thesis is so radically counterintuitive. But the point is that any form of metaphysical dualism just doesn't look like a scientifically respectable option nowadays.

JB: I certainly grant that very exciting advances are being made in the study of the relationship between brain activity and conscious experience. But this always leads to the recognition of *correlations.* Kepler remarked long ago that if certain phenomena are invariably correlated, this may occur for two reasons: certain of the phenomena are the cause of the others, or else all the phenomena have a common unidentified cause. Thus, it is not necessarily the case that the correlations now being found *explain* the conscious state. Your example of motor control shows that complex automata can and do exist, but I do not think that understanding of the control mechanism could ever suggest that an automaton is self-aware. As Leibniz said in his *Monadology*, '*perception* [...] *cannot be explained mechanically*, that is to say by figures and motions. Suppose that there were a machine so constructed as to produce thought, feeling, and perception, we could imagine it increased in size while retaining the same proportions, so that one could enter as one might a mill. On going inside we should only see the parts impinging upon one another; we should not see anything which would explain a perception.'[20]

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[19] Patricia Churchland, 'Can Neurobiology Teach Us Anything About Consciousness?', *Proceedings and Addresses of the APA* 67 (4), 1993: 27.

[20] G. W. Leibniz, *Monadology* paragraph 17, in *Philosophical Writings* (London and Vermont: Everyman, 1973), 181.

Despite all the recent advances in brain research, I do not think anything overthrows Leibniz's argument.

Thus, I believe one should keep an open mind about the true connection between the brain and experience. As to metaphysical dualism, it seems to me deeply rooted in modern quantum mechanics, which posits a *wave function* defined over *the space of possible configurations* (of whatever physical system that one is considering). I do not see how one can get more dualistic than that. Moreover, the precise connection between these two remains obscure because of the profound interpretational problems in quantum mechanics. Of course, the dualism I have just mentioned is not between mind and matter, but it is still a fundamental dualism.

C: I note that when talking about the way in which the psychological impression of time and motion is created a moment ago, you spoke about the *brain* rather than the mind doing all the work, and thus seem to accept that consciousness is indeed subserved by neurobiological mechanisms.

JB: This is more or less correct. If I use the word *mind*, it is inadvertently (except in idioms). I prefer *experience* or Leibniz's term, *perception*. But I would say *correlated with*, not *subserved by*. The position that I adopted in *The End of Time* is conventional: the conscious state is correlated with the brain state, by which I mean with an instantaneous configuration (positions of atoms) of the brain. The only role of the wave function that I attributed to experience is to make it (the wave function) determine the probability of particular experiences. I am now wondering if the wave function might not play a richer part in experience alongside the instantaneous configuration. But these are all tentative ideas. The only difference between my view and the conventional one is that I remove *motion* from the overall state of the physical world with which I propose experience to be correlated. This contrasts with the standard view that correlates experience with *positions* and *motions*. Position is clearly much more fundamental than motion, for motion is change of position.

I may also mention that there are people with what is said to be a neurological malfunction that makes them see the world as a succession of snapshots. I know one such person; she is currently cured of the problem, but it was so extreme in her case that she would sometimes experience the snapshots in the wrong chronological order, so that crossing a road was life threatening. She contacted me having read my book and found that my concept of Nows resonated deeply with her experience. This suggests to me that deepest-level experience may be snapshot-like and that continuous experience is a higher-level phenomenon.

C: One might wish to maintain, in quasi-Kantian terms, that time is only a mode of intuiting reality rather than something pertaining to the world as it is in-itself. However, it's still rather difficult to see how even that mode of perception – understood as an *internally* rather than *externally* supplied time-order – can take place in a entirely static world. You say that 'in the process of presenting the stored information to us in consciousness, the brain does not need access to an externally supplied time-order', but even here one cannot help but be struck by the fact that you are still talking about a *process* – namely, a process of making comparisons and drawing inferences about relative temporal ordering. It's difficult to see how that can be squared with the idea that the physical world is entirely static – unless, that is, we somehow exempt the activity of brain from the very physical world of which it forms a very minute part, an idea which seems inherently absurd.

JB: No, I would not advocate that. Of course, I do have difficulty in expressing atemporal notions in familiar language, which is so permeated by temporality. A French man did write a whole book without using the letter *e*, but writing one using only the verb *to be* does not appeal to me. It may help to note that for millennia theologians and millions of believers have been happy with the idea that God is eternal, unchanging, and omniscient (and therefore presumably self-aware). I do not want to invoke theology to bolster a scientific theory, but this does at least show that my basic proposal is not without precedent. I believe I am part of a universe far larger than myself; I know I am self-aware; ergo I conclude that the universe is self-aware. We have long lived with the idea of the block universe that results from taking Einstein's relativity seriously. So self awareness resides in eternity.

C: What happens to the idea of *evolution* according to your theory, whether we're talking about the evolution of the universe, or biological evolution? How could a brain, for example, evolve in a purely static world, and why would it be fitted out with sophisticated but delusive experiences of a world of change in which things have happened, and indeed which are happening now? What, after all, could these experiences be *good for*? – a question for which the theory of evolution by natural selection provides an extremely plausible set of answers, but which seems inherently baffling on the basis of your own conjecture of a timeless universe.[21] Does your theory require one to 'explain away' the massive amounts of mutually corroborative evidence for evolution, just as it would seem to require explaining away all the evidence which seems to indicate that the universe is expanding, or do you think it might be possible in some way to construct a 'timeless' theory of evolution?

JB. We are talking about such big issues, we must take one thing at a time. The theory of evolution relies heavily on chemistry and that posits for the (classical) universe an extraordinarily special beginning, for otherwise there are great difficulties with the second law of thermodynamics and the arrow of time, which is deeply reflected in all of evolutionary theory. Now, in *The End of Time* I did put forward what I believe is the first potential explanation for the arrow of time from first principles. It is based on a quantum theory of the universe from which the appearance of a classical universe can in principle arise. I relate the great asymmetry of experience – between the past and the future – to an inescapable profound asymmetry in the space of possible configurations of the universe. Although my book has clearly attracted much interest because of its denial of time, virtually no one has commented on this idea.

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[21] This objection is borrowed from Jeremy Butterfield's extensive review of Barbour's book, 'The End of Time?', *British Journal for the Philosophy of Science* 53 (2), 2002: 289-330.

As to chemistry, many researchers in quantum gravity have proposed a mechanism whereby timeless quantum gravity can be compatible with the emergence of the conditions for chemistry governed by standard quantum mechanics. Thus I think I can provide the broad framework needed for evolution to be represented in eternity. The point is that every possible configuration of the universe is present in my Platonia: actual dinosaurs in one place in Platonia and fossils of dinosaurs in different configurations in another place, both of which can in principle have high probability as measured by the wave function of the universe. In principle, that is enough to have evolution emerge. Of course, there is a huge way to go from a qualitative outline to detailed confirmation.

C: While you said you earlier that you think science is more about explanation and confirmation than prediction, you of course do not deny that any candidate theory in physics must be able to make novel predictions, and in *The End of Time* you say that 'even clear disproof of my theory would be exciting for me'.[22] Hypothetically, then, what kinds of findings might be able to disprove or falsify your theory? Could you provide examples? What would *testing* your theory involve?

JB: I am hesitant to say that my theory makes any predictions at the moment because it is as yet more in the nature of an outline of a theory. However, I do have the clear proposal that there is a static wave function of the universe that concentrates its associated probabilities on configurations of the universe that I call *time capsules*. These are static material configurations containing what appear to be mutually consistent records of a history that unfolded from a special past (highly uniform Big Bang) into the universe that we see around us. In principle, this suggestion could be supported or clearly disproved by mathematics. It is certainly the case that time capsules as I define them are ubiquitous. So this is the most obvious field for testing of my theory. I also think it is just possible that developments in brain research might support my conjecture that experience of motion is correlated with instantaneous brain configurations.

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[22] *The End of Time*, op. cit., 17.

C: At the beginning of *The End of Time* you compare your theory of the non-existence of time to the Copernican revolution in cosmology in the following terms:

> The pattern of the first great revolution will be repeated. Copernicus, Galileo and Kepler taught us that the earth moves and rotates while the heavens stand still, but this does not change by one iota our direct perception that the heavens do move and that the Earth does not budge. Our grasp of the interconnections of things was, however, eventually changed out of recognition in ways that were impossible to foresee. Now I think we must, in an ironic twist of the Copernican revolution, go further, to a deeper reality in which nothing at all, neither heaven nor Earth, moves. Stillness reigns.[23]

A further comparison with Copernicanism appears at the beginning of the fifth chapter, where you suggest that the kind of mental preparation needed to understand Poincaré's ideas requires one to undertake a radical transformation in one's biologically-inherited mode of thinking:

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[23] *The End of Time*, op. cit., 14.

> I hope you will be able to change from a way of thinking to which we have been conditioned by the fact that we evolved on the stable surface of the Earth to a more abstract way of thinking that would have been forced upon us had we evolved from creatures that roamed in space between objects moving through it in all directions. We have to learn to find our bearings when the solid reassuring framework of the Earth is not there.[24]

If the total disappearance of time from our worldview indeed turns out to be the ultimate denouement of Copernicanism – that is, if time itself, rather than being retained in our world-picture, albeit at some less fundamental level, must rather 'go the way of the [Ptolemaic] epicycles'[25] – what are the implications of this for our commonsense, intuitive picture of the world? Is it really possible that a creature whose imagination and cognitive capacities evolved, as you say, on the stable and reassuring surface of the earth, could ever be capable of coming to terms with the implications of such a revolution in anything more than the most purely abstract way? The philosopher Paul Churchland has suggested a way in which we might train ourselves to perceive our place in the solar system in properly 'Copernican' terms, thereby freeing not only our minds but also our *eyes* from 'the tyranny of a flat immobile Earth' and finding ourselves 'at home in the solar system for the first time'.[26] However, the prospect that we might ultimately be able to undertake an analogous experiment in the 'expansion of perceptual consciousness' in such a way as to become at home in a physical universe in which time does not exist seems not only remote, but fanciful in the extreme.

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[24] *The End of Time*, op. cit., 71.

[25] http://www.edge.org/discourse/davies_loops.html

[26] Paul Churchland, *Scientific Realism and the Plasticity of Mind* (Cambridge: Cambridge University Press, 1979), 30, 34 and Chapter Two *passim*.

JB: Half of my ontology is very conservative and barely different from Newton's: the universe can exist in many different configurations. They can be thought of as like snapshots that a child can pick up and examine. I am not introducing a difficult concept here. A continuous succession of such snapshots is epistemologically identical to a Newtonian history of the universe if it satisfies a certain law that can be formulated without any notion of enduring time. Our direct experience of time is not of duration but of succession, and I can easily show that a timeless lawful succession leads to the emergence of a well-defined duration effectively identical to Newton's absolute time.

The other half of my ontology comes from quantum mechanics and will be easy for physicists, if not children, to grasp: the wave function defined on a configuration space. I think it is highly relevant for my programme that Schrödinger originally found a *timeless* equation for his wave function. It explains *all* nuclear, atomic, and molecular structures that we find around us. It was even used by Max Born (before Schrödinger proposed an equation that describes evolution of the wave function in Newtonian time) to describe processes regarded as dynamic.

I regard quantum mechanics as a theory that explains structure. Close and open your eyes for a second; you see a structure, a snapshot. What I aim at is a theory that explains the presentation to us of such structures that involves only a timeless comparison of such structures and does not posit *evolutionary* laws and their initial conditions. The fundamental law is a law of structure selection in which structures are favoured by virtue of their structure and nothing else. It is not totally unlike a child selecting the most interesting snapshots among a large collection. To make the connection with experience I propose that awareness is correlated with single snapshots (which can be arbitrarily complex and contain, as it were, snapshots within snapshots). The standard view is that awareness is correlated with a succession of snapshots, which I replace by my 'snapshots-within-snapshots' snapshots. This idea is beautifully illustrated in the film about my ideas shown on Dutch television, *Killing Time*.[27]

Perhaps it will help if I say that Newtonian theory (and even Einstein's theories to a large degree) is like a law that forces an object to follow a path at a definite speed through a landscape once it is set going at some point in the landscape with a definite direction and speed; this is the initial condition, without which nothing can be done with the law. It is easy to show that the speed part of this initial condition is redundant if one considers the whole universe. History is then not a path traversed as some speed but merely a path. The huge change introduced by quantum mechanics is that the notion of a definite path is eliminated and replaced by the wave function that 'samples', or 'looks at', all possible points in the landscape. This can be done in a timeless fashion that is precisely analogous to the way that quantum mechanics determines atomic and molecular structures.

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[27] A link to this film can be found on Barbour's website, platonia.com; it is also available via *YouTube*.

C: While it's of course impossible to predict the eventual social and cultural ramifications of any scientific revolution, I wonder if you have anything to say about the possible consequences which the notion of 'the end of time' might bring about were it ultimately to become as widely accepted as the idea that the earth revolves around the sun is for us today?

JB: That is impossible to answer. All I can say is that life could be less hectic and more contemplative. People in the parts of Platonia where my theory is accepted should cherish the Now more than in this overworked region. To go back to what I said about theology: In the Middle Ages busy kings still spent hours in daily prayer because they believed deeply in eternity and its primary importance. Today, many would reject their beliefs. However, mathematicians have rational grounds for believing in eternal mathematical truths. Theoretical physics has a definite tendency to go in the same direction – on rational grounds. Indeed, it can hardly avoid doing so, since it uses mathematics, and mathematics that is only occasionally true is not much use.

C: You have already mentioned Leibniz a few times, and at the outset of *The End of Time* you describe your 'central idea' as being inspired by the Leibnizian idea that the world is to be understood 'not in the dualistic terms of atoms (one kind of thing) that move in the framework and container of space and time (another quite different kind of thing), but in terms of more fundamental entities that fuse space and matter into the single notion of a possible arrangement, or configuration, of the entire universe'.[28] According to this Leibnizian notion, 'the world does not consist of infinitely many essentially identical things – atoms moving in space – but is in reality a collection of infinitely many things, each constructed according to a common principle yet all different from one another. Space and time emerge from the way in which these ultimate entities mirror each other'.[29] This is an idea which, you suggest 'has the potential to turn physics inside out – to make the interestingly structured appear probable rather than improbable'.[30]

One might be surprised to see a contemporary theoretical physicist drawing so explicitly upon early eighteenth-century rationalist metaphysics in order to rethink the foundations of contemporary physics in this way. However, far from being a mere eccentricity on your part, your application of Leibnizian ideas to fundamental physics and cosmology have exercised a considerable influence upon leading contemporary physicists and cosmologists. Lee Smolin, for example, to whom you introduced Leibnizian and Machian ideas when he was visiting Oxford in 1980, and with whom you subsequently collaborated in an attempting to formulate Leibnizian monadological ideas in precise mathematical form, has gone on to develop, along with Carlo Rovelli and

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28. *The End of Time*, op. cit., 16.

29. *The End of Time*, op. cit., 240.

30. Ibid.

others, relational theories of quantum gravity and quantum cosmology which are today regarded as the principal rivals to string theory. In this way, in the form of Loop Quantum Gravity and Relational Quantum Mechanics, ideas of distinctly Leibnizian inspiration stand at the very cutting-edge of contemporary theoretical physics. Could you say something about how you came to realise the great potential for the application of Leibnizian metaphysics to contemporary physics, how your interpretation of Leibnizian ideas relates to your central notion of 'Platonia' as 'the relative configuration space of the universe', and about the key differences between your approach to quantum gravity and quantum cosmology and those of Smolin and Rovelli?

JB: In fact, most of my key ideas were developed and presented in my first paper in *Nature* in 1974 before I read any of Leibniz's writings, which happened in 1976-77. My long journey of conceptual exploration began in 1963 with the chance reading of a newspaper article about Dirac's attempts to quantize gravity. This led me to ask myself seriously: What is time? Soon after that I read Mach's great *Mechanics* and this led me to add the question: What is motion? By 1972 I had worked out the framework of a Machian theory of time and motion in classical physics. This has since been elaborated but not fundamentally changed. The notion of relative configuration space (RCS) of the universe that I published in 1974 is Platonia. What I found exciting in Leibniz was a deeper intellectual underpinning of my scheme. Above all, Leibniz insisted that real things must have distinguishing attributes, which was not the case for Newton's identical points of space.

What underlies Leibniz's ontology is the conviction that there is no reality without variety. Indeed, reality *is* variety. Leibniz also has this wonderful conjecture that the actually realized universe is more varied than any other conceivable universe. Stimulated by my enthusiasm for Leibniz, Lee Smolin managed to find a way to express this idea mathematically and we together developed a theory of Maximal Variety.[31] I do think it manages to capture the kind of scheme for which Leibniz was striving. It has generated a fair amount of interest, but as of now does not seem to have any obvious applications in physics.

As regards differences between my approach to quantum gravity and the present approach of Smolin and Rovelli, they concern the antithesis of the discrete and the continuous. When Lee met me, he was already convinced that at the deep microscopic level space must be discrete. As I recall, he had come to this view from his early exposure to the problems of infinities in quantum field theory, which he felt could only be cured by an underlying discrete theory. This was a formative experience to which I had not been exposed. I was initially sympathetic to the idea that the continuum of experience should emerge from a discrete foundation, but rather soon came to the conclusion that the problems to be overcome were great and probably insurmountable. In this respect, Lee and I continue to differ, but we are each inspired by relational examples drawn from Leibniz: a discrete genealogical tree in Lee's case, the continuous distances between bodies (as discussed by Leibniz in the Leibniz–Clarke Correspondence) in my case.

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[31] Julian Barbour & Lee Smolin, 'Extremal variety as the foundation of a cosmological quantum theory' (arXiv: hep-th/9203041). This paper can be accessed via Barbour's website, platonia.com.

C: In *The End of Time* you admitted that the idea that time does not exist is still 'only a prospect on the horizon', albeit one which might well ultimately turn out to comprise the next great revolution in our understanding of the universe.[32] Since the publication of your book almost a decade ago, 'the small but growing number of physicists' who 'have begun to take the idea that time truly does not exist'[33] seems to have increased considerably. There seems to be a general feeling abroad amongst those searching for that veritable Holy Grail of contemporary physics – that is, a workable theory of quantum gravity – that something fundamental is missing, a common erroneous assumption which needs to be rooted out, and that this erroneous assumption very likely concerns the nature of time.[34] Carlo Rovelli has compared the situation which has existed in fundamental physics over the past century to the 150-year period between Copernicus and Newton – that is, a period of an 'unfinished revolution' – predicting that the next great synthesis, this time bringing together general relativity and quantum mechanics, will require us to learn how to think of the world 'in completely nontemporal terms'.[35] Similarly, Lee Smolin has suggested that the problem of time in quantum cosmology forces one 'to confront the possibility that time and change are illusions', and that we may ultimately 'have to come to terms with a world which, at the most fundamental level, must be described in a language in that includes no words for time'.[36] And indeed even the most aggressive champions of string theory seem now to have come round to the idea – an idea which you have been insisting upon for decades – that any feasible theory of quantum gravity will have to be formulated in background-independent terms[37] and that this might well require the complete elimination of the notion of space and time as a basis for our description of reality.[38] In light of this, are you now more optimistic than you were ten years ago that something like the picture you have developed over the past four and a half decades will ultimately triumph? How do you envisage the next fifty years of development in fundamental physics panning out, and what do you expect to be the chief obstacles in the way of completing the ‘unfinished revolution’ of the past century?

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[32] *The End of Time*, op. cit., 14.

[33] *The End of Time*, op. cit., 39.

[34] Cf. Lee Smolin, *The Trouble With Physics* (Boston & New York: Houghton Mifflin Company, 2006), 256.

[35] Carlo Rovelli, 'Halfway Through the Woods: Contemporary Research on Space and Time' in J. Earman & J. Norton (eds), *The Cosmos of Science* (Pittsburgh: University of Pittsburgh Press, 1997), 180-223; 'The Century of the Incomplete Revolution: Searching for General Relativistic Quantum Field Theory', *Journal of Mathematical Physics*, Special Issue, 2000 (arXiv: hep-th/9910131v1); and 'Anaximander's Legacy', this volume.

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[36] *The Life of The Cosmos* (Oxford: Oxford University Press, 1997), 286.

[37] See for example Brian Greene, *The Fabric of The Cosmos* (London and New York: Penguin Books, 2004), 485-491.

[38] Thus David Gross, described by Smolin as 'one of the most aggressive and formidable champions of string theory' (*The Trouble With Physics*, op. cit., xv), in a recent interview: 'In string theory I think we're in sort of a pre-revolutionary stage [...] we still haven't made a very radical break with conventional physics. We've replaced particles with strings – that in a sense is the most revolutionary aspect of the theory. But all of the other concepts of physics have been left untouched [...] at some point, a much more drastic revolution or discontinuity in our system of beliefs will be required. And this revolution will likely change the way we think about space and time, maybe even eliminate them completely as a basis for our description of reality – that is, leave us regarding them rather as emergent approximate concepts that are useful under certain circumstances. That is an extraordinarily difficult change to imagine, especially if we somehow change what we mean by time, and is probably one of the reasons why we're still so far from a true understanding of what string theory is. [...] Something is missing that is most likely not just another technical development, another improvement here or there, but something that truly breaks with the past. And all the indications are that it has to do with the nature of space and time.' (David Gross, 'Viewpoints on String Theory', at http://www.pbs.org/wgbh/nova/elegant/view-gross.html).

JB: It is certainly encouraging that more and more people seem to be taking my ideas seriously. I am currently in the process of writing up everything I have learned in a monograph with the provisional title *Mach’s Principle, General Relativity, and Gauge Theory*. Thanks to a generous grant from the Foundational Questions Institute,[39] I am now able to collaborate with more young researchers. However, I am not too optimistic that the Holy Grail will be grasped in my lifetime. I suspect that the main difficulty may well be technical complexity or absence of experimental data that can act as a useful guide. However, major conceptual developments are also probably needed. I see two places where conceptual breakthroughs might occur. One concerns the role of complex numbers in quantum gravity. In the quantum mechanics discovered in the 1920s, they entered through the time-dependent Schrödinger equation; it is a fundamentally complex equation. However, there is neither time nor the imaginary *i* in the Wheeler–DeWitt equation, which founds quantum gravity. Numerous papers have proposed essentially the same way to get the *i* back into laboratory physics but I believe that they are all seriously flawed. The other possibility is the one that I already mentioned relating to the failure of general relativity to be scale invariant, so that size is absolute.

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[39] See www.fqxi.org.

C: In his recent book *The Trouble With Physics*, Smolin argues that the lack of progress in physics over the past three decades – in stark contrast to the preceding two hundred years of explosive growth in the field – can in large part be attributed to a certain style of doing science which, while it was well-suited to the problems which physics faced in the middle part of the twentieth century, is ill-suited to the kinds of problems it faces now. Smolin characterises this style as 'pragmatic and hard-nosed', favouring 'virtuosity in calculating over reflection on hard conceptual problems' and contrasts this with the profoundly different way in which Einstein, Bohr, Heisenberg, Schrödinger and the other early-twentieth-century revolutionaries did science, whose work 'arose from deep thought on the most basic questions surrounding space, time, and matter' and who saw themselves as 'part of a broader philosophical tradition, in which they were at home'.[40]

These are sentiments which would certainly have been endorsed by Mach, who put Newton's inability to recognise the equivalence of all inertial frames down to the fact that he lived in 'an age deficient in epistemological critique'[41] and who was the first occupant of the first academic chair explicitly devoted to the philosophy of science. Einstein himself would likewise often extol the virtues of a background in critical epistemology and the history and philosophy of science as providing 'that independence from prejudices of his generation from which most scientists are suffering', holding this 'independence created by philosophical insight' to be 'the mark of distinction between a mere artisan or specialist and a real seeker after truth'.[42] While letting the philosopher do the philosophizing 'might be the right thing to do when the physicist believes he has at his disposal a rigid system of fundamental concepts and fundamental laws which are so well established that waves of doubt can not reach them [...] it can not be right at a time when the very foundations of physics itself have become problematic'. At such times, insisted Einstein, 'the physicist cannot simply surrender to the philosopher the critical contemplation of the theoretical foundations; for, he himself knows best, and feels more surely where the shoe pinches. In looking for a new foundation, he must try to make clear in his own mind just how far the concepts which he uses are justified, and are necessities.'[43]

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[40] *The Trouble With Physics*, op. cit., xxii-xxiii.

[41] *The Science of Mechanics*, op. cit., 571.

In your own intellectual formation, was it your extensive background in the history and epistemology of physics that enabled you, unlike the vast majority of your contemporaries in theoretical physics, to break genuinely new ground? Like yourself, Mach and Poincaré were not only physicists, but also distinguished historians of science, who drew upon the full extent of that history in order to develop their epistemological insights. To what extent do you agree with Smolin and Einstein that the cultivation of such a deep philosophical and historical background is necessary in periods of scientific revolution?

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[42] Quoted in Don Howard, 'Einstein as a Philosopher of Science', *Physics Today* 58 (12), 2005: 34-40.

[43] Ibid.

JB: In the present period, I am sure that Lee and Einstein are right. I love Einstein's comment that, in crisis periods, the task of philosophizing must fall to the physicist, who feels 'where the shoe pinches'. That is surely correct. In my experience, the philosophers tend to try to clarify existing concepts, often ones that the physicists introduced quite some time ago. But the history of science shows that virtually all great breakthroughs have been made by researchers working intensively at the cutting edge. Mostly they can work within an existing paradigm, but at crisis points that fails them. In this case, something new must be tried. It is always the case that revolutions retain much of the old framework and replace parts that have become suspect with genuinely new proposals. In such circumstances a thorough knowledge of the historical development is a huge help.

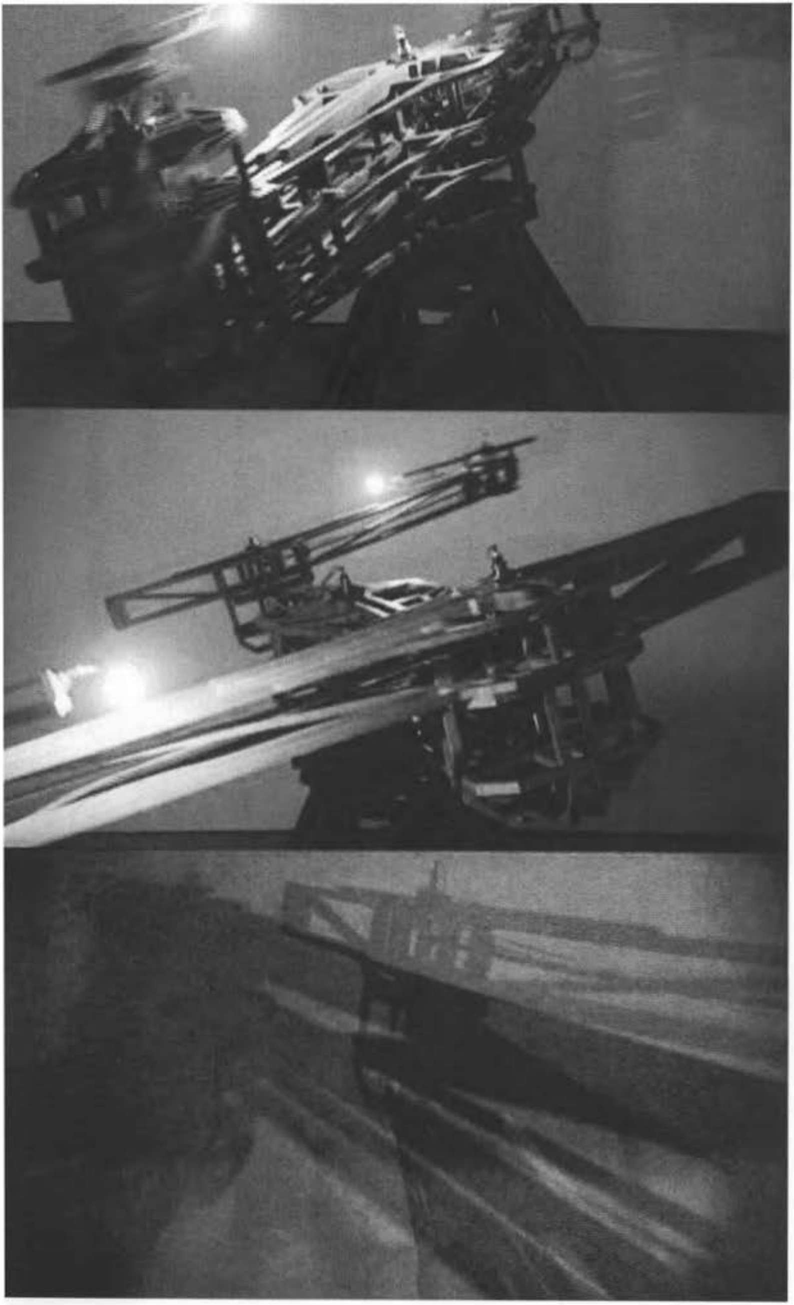
One sees this especially clearly in the discovery by Kepler of his first two laws of planetary motion; it has been a major inspiration for me. Kepler knew the great work of Hipparchos and Ptolemy intimately, but could see that Copernicus's daring proposal to put the earth in motion forced us 'to philosophize about these things differently'. Kepler combined the new and the old in his struggle to explain the wonderful observational data that Tycho Brahe had made. Brahe's 'destruction' of the crystal spheres previously believed to carry the planets make an immense impression on Kepler and prompted him to a remark that is very apposite in the present search for a background-independent formulation of quantum gravity. He said: 'From now on the planets must find their way through the void like the birds through the air'. Einstein's abolition of absolute space and time puts us in a similar position. I like to put it this way: We must understand how the universe can 'swim in nothing'. It is perhaps here that I may be able to make a useful contribution to current research, in which it has become a commonplace to say that quantum gravity must be 'background-independent' because general relativity has that property. What I think is not adequately appreciated is the precise dynamical structure that does make general relativity background-independent. People do not check out the detailed way in which the theory 'swims in nothing'. Nearly all of my work has been devoted to that project.

C: Do you think that you would have been able to make the kind of profound contribution you have made to the foundations of physics had you, all those years ago, and like just about every other theoretical physicist, taken a position in an academic physics department?

JB: I think I definitely made the right decision to stay out of academia. Every now and then, young researchers do ask me for advice about the possibility of going independent. I emphasize that I was lucky but also that I did make one key decision correctly: to earn my living by a well-paid but boring job (translating). This ensured that I never got hooked by the money-earning job and was always longing to get back to the physics. But the most important thing in my case was simply a gift of fortune: the joint problems of time and motion 'took hold of me'. I could never stop thinking about them and little by little accumulated results and insights that to me at least seem to have promise. If young researchers do not have such a burning desire within them, they probably will not succeed either inside or outside academia.

C: Finally, what advice might you offer to young theoretical physicists and philosophers of science today embarking on the dauntless task of perhaps some day helping to bring to a close the 'unfinished revolution' of twentieth-century physics?

JB: I would say that there is an urgent need for clear independent thinking. Both 'clear' and 'independent' are vital. Far too many papers that are published today by young researchers desperate to build up a long publication list that will look impressive on a CV (and ensure at least short listing in a more or less automated process) lack clarity and take important things on trust just because leaders in the field have made certain pronouncements. Several PhD students I know were given computational problems in string theory and told not to ask why they should be done. I am glad to say that two at least promptly got out of the field in protest. I am not saying that string theory is wrong, only that such practice does not advance science. I do feel very sorry for young researchers struggling with today's conditions – but then perhaps it has always been like that. Only those with deep inner conviction and application have ever made it through to great discoveries.



Shadows of Copernicanism

Conrad Shawcross and Robin Mackay

For the best part of five centuries the Copernican revolution has served as a virtually inexhaustible source of philosophical and existential disquiet. Undoubtedly, we have yet to fully adjust our spontaneous image of reality to accord with our displacement from its centre. Yet Copernicus and Kepler retained the Sun as the unique centre. If later developments showed the Sun to be only one of trillions of stars, recent observations even show that singular stars are the exception rather than the rule: The unicity of our Sun is mere cosmic happenstance, in a universe where binary star systems are more common, many capable of supporting Earth-like planets.[1] Considering the overwhelmingly heliotropic tendency of the philosophical imaginary, from Plato to Heidegger,[2] how might our image of thought be disrupted by the loss of the unicity of the Sun, of the object's shadow, of tomorrow's sunrise ...? These are some of the questions posed by Conrad Shawcross's motion sculpture *Binary Star* (2006), a faithful cosmological model whose two 'suns' rise on a world in which there is 'No Such Thing as One'.[3] As the massive, wooden beams of the mechanical contraption rotate in their simulated gravitational dance, its two light sources, in their complex paths, cast double shadows whose shifting superpositions are baffling and unfathomable to the eye.

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[1] E.V. Quintana & J.J. Lissauer, 'Terrestrial Planet Formation in Binary Star Systems', 2007, at http://arxiv.org/abs/0705.3444v1.

[2] 'Insofar as it structures the metaphorical space of philosophy, the Sun represents what is natural in philosophical language [...] There is only one Sun in the system [...] the unique, irreplaceable, natural referent, around which everything must turn, toward which everything must turn' – J. Derrida, 'White Mythology', in *Margins of Philosophy* (Evanston, IL: Northwestern University Press, 1988), 243, 251.

Philosophical tradition has often metaphorically anchored thought to apparently fixed and permanent characteristics of the physical world. Such models are inevitably burdened with an inability to absolve themselves of their metaphorical investment in the very reality they claim to conceptually underwrite. When we select features from a contemporary image of reality to stand for the task of thought, we always run the risk of becoming a hostage to the fortunes of scientific inquiry, whose progress seems eventually to disabuse us of every illusion of fixity and permanence. In Shawcross's work the physical realisation of such emblematic epistemological models exacerbates the problem of this 'bleeding' of the empirical into the philosophical. Through an intriguing lateral shift, *Binary Star* demonstrates how the epistemological trope of 'Copernicanism', in its naïve acceptation as a simple reversal of perspective between two heavenly bodies, remains tied to 'terrestrial' tropes of thought: above all, the notion that an orbiting multiplicity always pays homage to a central unity. It seems that, even confronted by a radical shift in thinking, we always risk attaching importance to the deepseated

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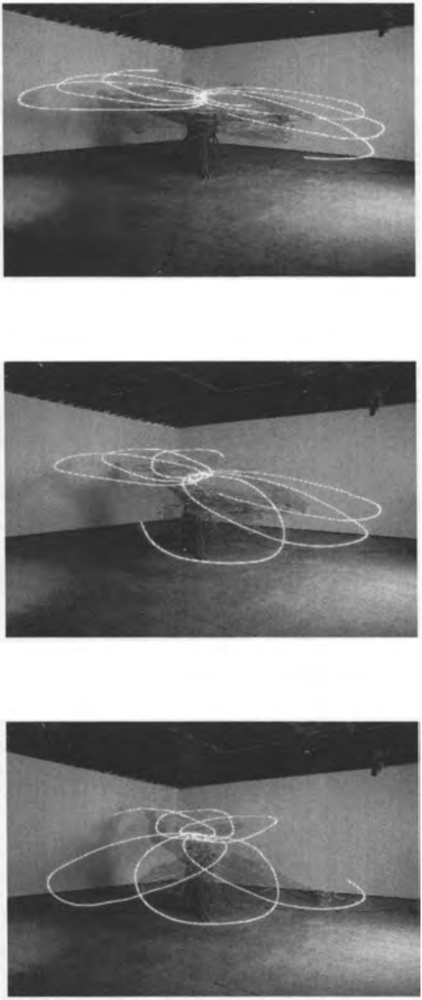
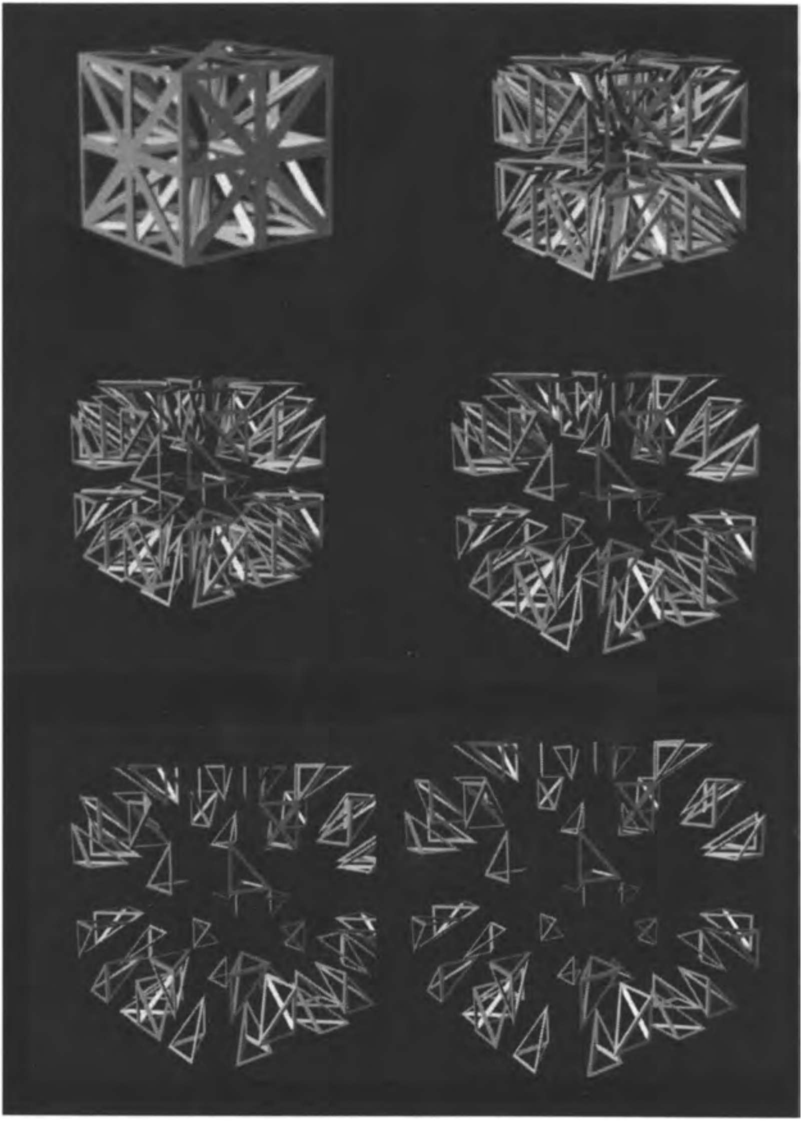
[3] The name of the show at Victoria Miro Gallery in London in which *Binary Star* was first exhibited.



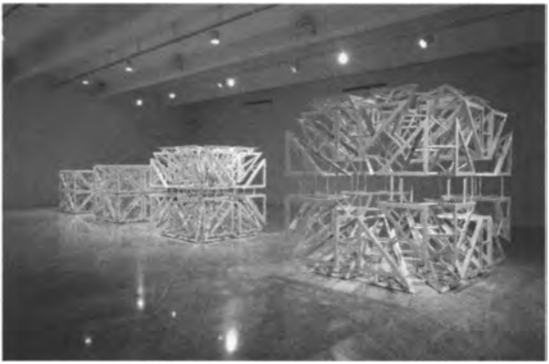
Binary Star (2006)



Schematic of *Lattice Cube Sequence* (2008) prejudices it foregrounds but leaves intact, rather than to its real consequences.

Does philosophy's thirst for such precarious models of thought indicate that a surreptitious exploitation of the all-too-human world is a veritable *condition* for philosophical discourse – at least insofar as the latter seeks to preserve its proper domain from purely mathematico-scientific accounts of reality? The more profound epistemological lesson to be drawn from Copernicanism, of course, is not that of a simple role-reversal. It is that of a gap opened up between a mathematical model freed from the contingencies of human visibility, and the efforts of intuition and imagination – conditioned by those very contingencies – to 'make sense' of such absolutes. Much of Shawcross's work seeks to locate the thinking of the artist and of the philosopher on this fractured terrain, and to inquire after the compromise involved.

In recent work, the artist confronts mathematical models of space with those of an art movement that defined itself in terms of conceptual interrogation. Artists such as Sol Lewitt and Donald Judd, pioneering a research programme into space as the fundamental element of artistic practice, selected the cube as a kind of fundamental particle of aesthetic experience; representing, apparently in the most elementary manner, the three-dimensional Cartesian grid, the plastic degree-zero which these artists would seek to organise in optimally simple and modular fashion. In Shawcross's *Lattice Cube Sequence* (2008) a 'barycentric subdivision' (the cube is sliced by planes connecting the 'barycenters' which divide each of its faces into two) allows the cube to retain maximal simplicity and symmetry, whilst breaking it down into a set of tetrahedrons. With this mathematical procedure of simplification into more basic constituent entities – the same 'simplicial approximation' used to build up from simple forms the complex computer graphics models used in movies – Shawcross questions the claim of Lewitt's 1960s cubes to be the fundamental 'simplex' of three dimensional space ('Space [...] thought of as [...] cubic area'),[4] and reconsiders the nature of a conceptual art practice that avowedly 'doesn't really have much to do with mathematics, philosophy, or any other mental discipline'.[5]



Lattice Cube Sequence (2008)

What Shawcross explodes here is the bond between aesthetic elegance and conceptual simplicity which the sixties conceptualists had tried to push to the limit. He has often tested this fundamental unity of human aesthetic perception and mathematical elegance, confirming it, for instance, in his *Loop System Quintet* (2006), a mechanised visualisation of musical harmony. But contemporary science yields substructures of 'basic elements' whose configuration cedes nothing to our spontaneous image of the world, unbinding us from the Greek heritage of mathematico-aesthetic intuitions (Pythagorean harmony, Platonic solids ...). Tracking this 'Copernican' vector, *Lattice Cube Sequence* sees the serene perpendicularity of the cube giving way to an inner structure whose complexity renders it opaque to the eye. As the simplices explode outward, the form of the cube itself evaporates, and with it the cubic grid system, as if it had never been more than an optical illusion, an anthropological artifact. The rotational 'grammar' of the cube, of which Lewitt was the virtuoso, seems in retrospect a parochial dialect.

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[4] S. Lewitt, *Sol Lewitt* (NY: Museum of Modern Art, 1978), 167.

[5] Ibid., 166.

It would be wrong to imply that Lewitt himself was unconscious of his 'failure' in this respect: Against any theoretical or illustrative relation to science, he argued forthrightly for the artist's need to be 'smart enough to be dumb'.[6] And his intention, for instance, for the very first modular cube 'to be large, but not too large',[7] clearly betrays the anthropocentric nature of his research programme. In this respect Shawcross's piece is as much homage as critique, since the very manufacturing and exhibiting of *Sequence* opens it to the vagaries of embodied perception. In inviting the emotions and associations occasioned by its physical encounter to derail the precision of the scientific model, *Sequence* seems designed as much to disturb as to evoke the self-sufficient serenity of its abstruse prototype.

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[6] S. Lewitt (quoted by L. R. Lippard) in Lewitt, op.cit.

[7] Ibid., 4.

Shawcross's work is characterised by this ambivalence towards its scientific sources. Against the violence done to the imagination by mathematical science, the deliberate, relentless arcs of *Binary Star*'s hefty oaken beams sing the glory of the creative vigour of the mad inventor, the gentleman-amateur. With scientists' models of reality increasingly inimical to any grounding in metaphors drawn from the everyday lifeworld, Shawcross's diligent physical renderings mimic the efforts that philosophy must make to incorporate them into the grain of language without ceding the latter entirely to mathematical abstraction. The artist himself has consequently qualified his machines as 'tragic' or 'misguided'; but the most profound content of the work seems to lie precisely in the vacillation between object and model that indexes its 'failure'.

From the same group of work as *Lattice Cube Sequence*, *Slow Arc Inside a Cube* (2007) redeploys the mechanism of *Binary Star* at a more abstract level. The 'slow arc' is described by a brilliant, omnidirectional halogen bulb moving inside a cube whose barred walls it projects onto the walls of the installation space, in a ceaselessly shifting mapping of object onto environment. Rather than a separate source of light illuminating worldly objects and casting shadows, the blinding core of the object brands the environment with the continuous phases of its own projected image.

Shorn of *Binary Star*'s literal reference to astronomical Copernicanism, *Slow Arc* exerts all the more profound pressure on philosophical (Kantian) Copernicanism, for which the transcendental ego has become the point-source of objectivity. Its proposed object-model scrambles the Platonic heritage of Kantianism, and releases a cloud of philosophical associations. In transforming the environment into a continuously-shifting image, *Slow Arc* already seems to move through Husserlian phenomenology towards Gabriel Catren's quantum model of objecthood. In Catren's account, the unification of multiple phenomenal aspects into a single object ('eidetic variation') is no longer the work of a synthesising subject. Instead, the object itself is 'a kind of "projector" of phases, aspects or profiles', a hallucinatory 'dream machine' with its own inner Sun.[8]

For Shawcross, *Slow Arc* bears a broader reference to the process of scientific experimentation and discovery. The piece was directly inspired by x-ray crystallographer Dorothy Hodgkin's discovery of the molecular structure of insulin, and in particular by the scientist's comparison of the exhaustive process of extrapolating the dense protein 'cloud' from reams of chromatographic grids with 'trying to work out the structure of a tree purely from looking at its shadow'. Like Plato's Sun, the blinding core of the object cannot be confronted directly, but must be speculatively inferred as the origin of the projections thrown onto the inner surface of a phenomenal *camera obscura.*

Finally, however, the source of light itself is a moving target. It is the cage – that through which the light is thrown to create the shifting projections – that is the only constant. So an alternative interpretation might take up Alberto Gualandi's post-Copernican anthropocentrism:[9]

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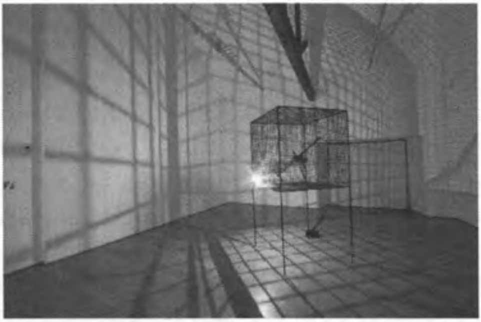
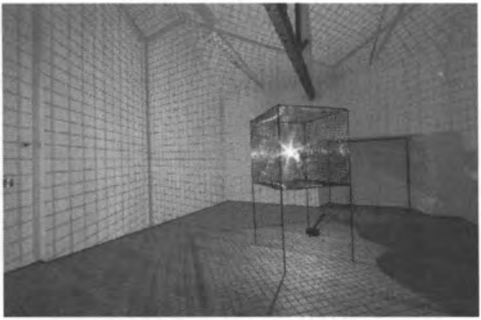
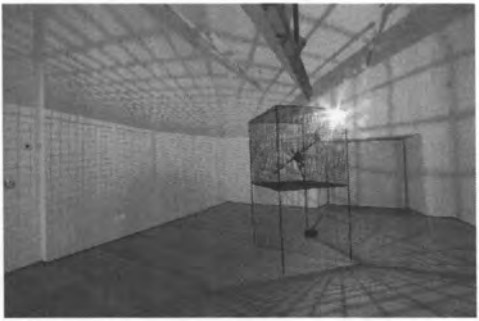
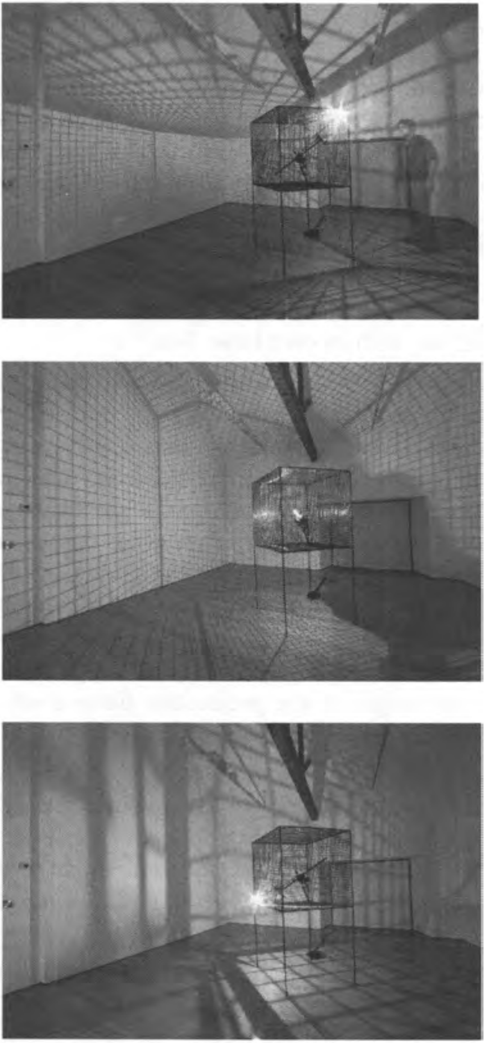
[8] See G. Catren 'A Throw of the Quantum Dice Will Never Abolish the Copernican Revolution', this volume.

[9] See A. Gualandi, 'French Philosophies of Nature and the Overturning of the Copernican Revolution', this volume.







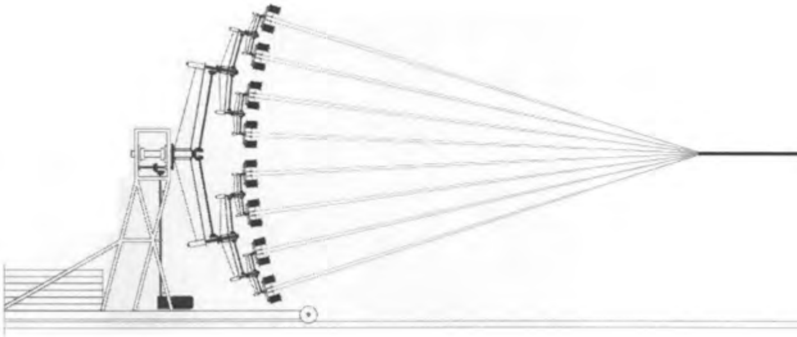


Slow Arc Inside a Cube (2007)

The structure that locks us out of the object's core, imprisoning us in the phenomenal realm, is also the only constant by which we can measure that which exceeds it.

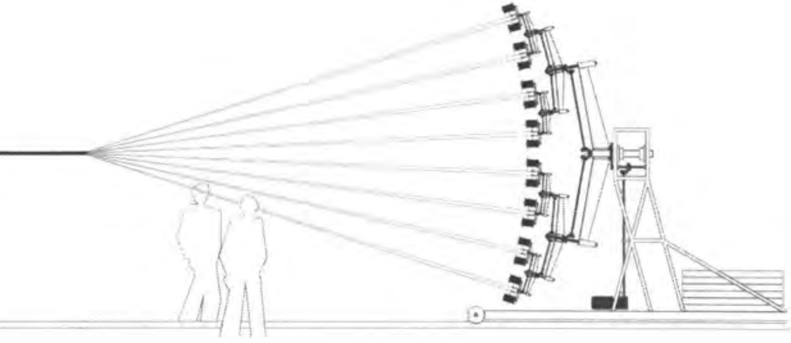
In this case, both artists and philosophers should be wary of falling victim to another superficial reading of the 'Copernican imperative', indicating a peremptory jettisoning of the evidence of the senses and of inherited language. 'Smart enough to be dumb' and 'misguided', a part of their task will consist instead in probing the discontinuities and the slippages between those blinding mathematical abstractions forever closed to intuition, the shadows they cast in experience, and the imaginary heritage with which we struggle to make sense of them.

Fittingly for what has been read here as an extended meditation on philosophical heliotropism, Shawcross's latest 'irrational machine', to be unveiled in summer 2009, returns to the depths of the Earth. But *Chord* does



Working sketch for *Chord* (2009)

not presume, like the philosopher, to drag benighted cave-dwellers up into the light; instead it excavates and brings to light a forgotten underground space. A descendent of Shawcross's (2001) spinning-machine *Yarn*, the piece will elaborate on that work's automated weaving of hundreds of coloured threads into a single rope. But in *Chord* this process will be co-ordinated by the two halves of a gigantic 'twin machine' to be installed in London's disused Kingsway tram tunnel. Laying down their own tracks as they proceed, the two machines will illuminate the expanding space between them as their multiply-articulated tri-arms fabricate a line of communication across it. According to Shawcross's latest yarn (narrative, creation myth, epistemological model?), therefore, the emergence of a linear simplicity is contemporaneous with the clearing of the space in which it is knitted together, by intricate machinations on the edge of darkness.



Who's Afraid of Scientism?

Interview with James Ladyman

In 2007 James Ladyman and Don Ross published Every Thing Must Go: Metaphysics Naturalized,[1] *an attempt to synthesize Ladyman's 'Ontic Structural Realism' and Ross's 'Rainforest Realism' into a unified metaphysics applicable to science from physics to economics. Beginning with a blistering polemic against what they call 'neo-scholastic metaphysics', Ladyman and Ross argue for an approach to metaphysics which goes far beyond the vague science-friendliness characteristic of so much of contemporary soi-disant naturalism in favour of an unabashedly 'scientistic' stance. Dispensing with the habitual ontology of 'little things and microbangings' which continues to hold sway in contemporary 'pseudo-naturalist philosophy',* Every Thing Must Go *provides the case for a radically naturalistic metaphysics capable of taking on board the most counterintuitive findings of modern physics without impugning the epistemic credentials of the special sciences. In our interview, Ladyman discusses the reasons for his exasperation with philosophers who persist in doing metaphysics as if modern science had never happened, provides a robust defence of 'the scientistic stance', and explains how the position developed in* Every Thing Must Go *provides a heuristic framework for the unification of the sciences via a dialectical synthesis of the strengths of both realism and empiricism.*

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[1] James Ladyman and Don Ross with David Spurrett and John Collier, *Every Thing Must Go: Metaphysics Naturalized* (Oxford: Oxford University Press, 2007).

Collapse: You are known within philosophy of science circles for your defence of a form of scientific realism you call 'ontic structural realism'. The list of names of philosophers and physicists who have subscribed to one or another form of structural realism is an impressive one indeed. Restricting ourselves to the twentieth century we have Henri Poincaré, Ernst Cassirer, Bertrand Russell, Arthur Eddington, Moritz Schlick, Rudolf Carnap, Grover Maxwell and, more recently, John Worrall and Elie Zahar. A landmark paper in the current debate was John Worrall's 1989 'Structural Realism: The Best of Both Worlds',[2] in which structural realism is presented as a kind of synthesis of the insights contained in both the (realist) 'no miracles' argument, on the one hand, and the (anti-realist) 'pessimistic meta-induction', on the other. For those who might not be familiar with recent debates concerning scientific realism, could you briefly describe the nature and import of these two arguments, and how they pull in opposing directions?

James Ladyman: The no-miracles argument in its crudest form is the claim that if scientific theories were not correctly describing the nature of the unobservable entities and processes that cause what is observable, then the success of science in describing the phenomena would be completely mysterious, so our best scientific theories do indeed describe the hidden workings of the universe. The argument is made more sophisticated by Richard Boyd and others who refer not just to the success of science, but the success of the highly theory-laden methods used by scientists as one generation of new hypotheses become the background theories deployed to design instruments and experiments in the development of the next generation of theories. The pessimistic meta-induction can already be found in crude form among the arguments of the ancient Greek sceptics; it says that we ought not believe in more than the approximate empirical adequacy of our best scientific theories because there have been highly successful theories in the past that by our current lights are false, and that our best contemporary theories are no different in kind and liable to befall the same fate. (In the modern literature this argument is was forwarded by Poincaré, and then its name was coined by Hilary Putnam. It is usually now associated with Larry Laudan, but he never really puts it quite like this.) Clearly, these arguments are in tension. The first would now have us believe in the quantum electrodynamic field because of the predictive success of the relevant theory, but would have had us believe in the ether because of the success of Fresnel's wave optics; and the second says that the quantum electromagnetic field will go the same way as the ether in the end, so we ought not to believe in such things.

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[2] *Dialectica* 43 (1-2), 1989: 99-124.

C: In 1998 you published 'What is Structural Realism?',[3] a paper which quickly became the focus of debate. Here you argue that structural realism 'gains no advantage over traditional scientific realism if it is understood as merely an *epistemological refinement* of it, and that instead it ought to be developed as a *metaphysical* position'.[4] As already mentioned, the version of structural realism which you subsequently elaborate you have called 'ontic structural realism' (OSR), though others have preferred the term 'eliminative structural realism'.[5] The more traditional, epistemological variety, in contrast, has come to be referred to as 'epistemic structural realism' (ESR), which you have also called 'Kantian structural realism'. Could you explain the key difference between these two positions, and which considerations led you to the conclusion that structural realism demanded to be reformulated as an ontological or metaphysical rather than a merely epistemological position?

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[3] *Studies in the History and Philosophy of Science* 29 (3), 1998: 409-28.

[4] Ibid.: 411; emphasis added.

JL: ESR is the claim that our best scientific theories should be thought of as describing the relations among unknown unobservable entities. That is why I have called it 'Kantian structural realism', since it incorporates the view that the intrinsic natures of the unobservable entities are epistemologically beyond reach, i.e., noumenal. Rae Langton's 'Kantian humility', for example, is very similar to ESR.[6] OSR is the claim that the world does not consist of a set of entities with intrinsic natures at all, but rather the world has a relational structure which is described by our best scientific theories. Fundamentally, OSR seeks to deny ontological priority to individual objects, and to upgrade the ontological status of relational structure. Exactly what form OSR should take is a matter of current debate. ESR is an ontologically conservative thesis that proposes a purely epistemological revision of scientific realism – hence the name. OSR is motivated by reflection on quantum mechanics and general relativity, as well as the problem of accommodating theory change in the history of science. I was led to OSR in part by my interest in the ontology of contemporary physics (and Steven French's work on identity and individuality in quantum mechanics),[7] and in part by the thought that the problem of theory change is an ontological one. By this latter claim I mean that the problem is to understand how there can be continuity between theories such as Newtonian mechanics and general relativity, or Maxwell's electromagnetism and quantum electrodynamics. This is an ontological problem because the natures of the entities postulated by the theories are so different. However, there is much continuity in the structure they attribute to the world via their mathematical form.

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[5] Stathis Psillos, 'Is Structural Realism Possible?' in *Philosophy of Science* 68 (Proceedings), 2001: S13-S24.

[6] Rae Langton, *Kantian Humility: Our Ignorance of Things in Themselves* (Oxford: Oxford University Press, 1998).

C: Your 1998 paper contains as an epigram a quotation from Max Planck which reads as follows: '[T]he structure of this physical world consistently moved farther and farther away from the world of sense and lost its former anthropomorphic character [...] Thus the physical world has become progressively more and more abstract; purely formal mathematical operations play a growing part.'[8] The quotation does not receive any discussion in the paper itself. Could you explain why you chose this as an epigram, and what light you think it sheds on the debate over scientific realism?

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[7] Steven French has also contributed much to the development of OSR. A comprehensive guide to the literature on both OSR and ESR can be found in the entry 'Structural Realism' by James Ladyman in *The Stanford Encyclopaedia of Philosophy*, http://plato.stanford.edu/entries/structural-realism/.

[8] Max Planck, 'The Universe in the Light of Modern Physics' in W. Shirmacher (ed.), *German Essays on Science in the 20th Century* (New York: Continuum, 1996), 38-57; cited by Ladyman, 'What is Structural Realism?', op. cit., 409.

JL: I happened to have a book called *German Essays on Science in the Twentieth Century* and read the Planck paper.[9] At that time I think I was attracted by his claim that mathematics has become more and more central to scientific representation. The quote seemed to encapsulate what I wanted to say in the paper, namely that we should stop trying to interpret physics in terms of objects of some kind and take the mathematics to be describing relational structure directly. When I look back upon it, I'm very glad I chose that epigram since I have more recently come to despair of many philosophers' inability to escape the manifest image, and their insistence on trying to do metaphysics with categories like object and intrinsic property, which I now see as anthropomorphic in the sense that they are a projection of how the everyday world of our experience is conceptualized. Scientists, especially physicists, have moved on, and it is time that metaphysicians tried at least to catch up.

C: Many philosophers will of course strongly protest your suggestion of their 'inability to escape the manifest image', not because they regard themselves as having already escaped it, but rather because they will insist that such an escape is neither possible nor desirable. For many such philosophers, the progressive deanthropomorphisation of the world exhibited by the history of the natural sciences, far from being a cause for celebration, or even for revising our commonsense ontology in accordance with it, is rather something to be fiercely guarded against or 'critically' circumscribed. So long as natural science can be 'kept in its proper place, as a rigorous inquiry internal to the disengaged stance', it does not pose too much of a threat, but to base one's ontological commitments solely on the deliverances of the natural sciences is to be 'uncritical', 'naïve', and 'scientistic'. A crucial part of the philosophers task, on this view, is that of 'stopping natural science from overstepping its proper boundaries' and thereby 'forcing due humility on it'.[10] How would you respond?

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[9] Ibid.

JL: Escape from the manifest image is clearly possible for science. The scientific image of the physical world is remote from the common sense one. Let me mention just two of many examples that could be given. Firstly, if you walk in bare feet from a carpet onto ceramic tiles, the latter feel cold. According to the manifest image the tiles are colder than the carpet. Science tells us that this is an illusion. The tiles are at the same temperature as the carpet but they are better conductors of heat and so the heat from one's feet is whisked away by them making them feel cold. Secondly, according to the manifest image motion is observable and so we ought to feel it if the Earth was in motion, but according to the Galilean principle of relativity only relative motion is observable.

The manifest image is not itself fixed or necessary but is a product of the contingencies of our evolution, and of course there is some variation in it since the acuity of the senses varies between musicians, artists, surveyors and so on. I see no reason why philosophers should find escape from the manifest image impossible if it is possible for scientists. To those who maintain that science should stay in its proper place I reply that the predictions that science makes are ultimately tested by their observable consequences for the behaviour of things in the manifest image. So it is wrong to suggest that science should not impinge on the manifest image because it just does, as a matter of fact.

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[10] Mark Sacks, *Objectivity and Insight* (Oxford: Oxford University Press, 2000), 323.

Another couple of examples: Firstly, contrary to what one would expect, when a helium balloon is held by a passenger in the cabin of an airplane as it accelerates down the runway, the balloon will spontaneously move forward in the direction of motion rather than backwards. This is predicted by Einstein's Equivalence Principle, according to which it is impossible to locally tell whether one is accelerating in one direction or subject to a uniform gravitational attraction from the opposite direction. Returning to the example above, Galilean relativity is also a feature of the manifest image since, as Galileo pointed out, insects flying around in the cabin of a steadily moving ship on a calm sea move just as if the ship was at rest and behave no differently, and one is able to sit at a desk and write oblivious to the motion of the vessel. Partial and total solar eclipses or the passage of comets are predicted by science but manifest to all.

Of course, scientific knowledge affects the manifest image profoundly in a way that we must celebrate, by extending people's lives through medical intervention. The scientific understanding of the causes and effects of cholera directly motivates the treatment of continual administration of saline solution which is estimated to have saved around three million lives to date. Philosophers may insist that science should keep out the manifest image but they doubtless write their arguments to this effect on computers, arrange to meet their colleagues to criticize science on mobile phones and so on. Does anyone with a seriously ill child really want science to keep out their manifest image?

I regard all such talk of keeping science in its proper place as the expression of either bad faith (because they can't really mean it when push comes to shove), conservatism (because they want to defend the doctrines of some old religion), or intellectual laziness (because science is vast, complicated and hard to learn). The charge that basing one's ontological commitments on science is naïve and uncritical is ironic in the extreme given that it is likely to be made by people who wish to defend the uncritical acceptance of intuition against the hugely complex and constantly evolving refinements engendered by science. The scientific image is ever subtle and never simple. In the end the epistemic authority of science is based on its astonishing novel predictive success and its role in the development of technologies or extraordinary power. Deference to science in respect of how the world is seems eminently sensible, but that science is supreme does not entail that it should be regarded as perfect or uncritically accepted. Scientific knowledge is provisional, incomplete and approximate. One might think that science is very far from ideal and hence that (to paraphrase the well-known saying) science is the worst source of metaphysical beliefs, apart from all the others.

C: While few philosophers would disagree with you regarding the various ways in which science and technology 'impinge upon' the manifest image, many would nevertheless insist that it simply doesn't follow from this that one ought to let the tail of natural science, as it were, wag the dog of our general worldview. Indeed, many philosophers who insist upon the methodological and ontological priority of the manifest image explicitly foreground the ways in which science and technology have radically transformed the 'everyday life-world' in their critiques of what they call the 'technological' or 'instrumental rationality' of late-capitalist post-industrial society. By privileging natural-scientific knowledge over all other forms of human experience and taking technical-scientific rationality as the paradigm of rationality in general, positivist and naturalist philosophers are accused by such critics of espousing a pernicious ideological conservatism which serves to perpetuate the politico-economic status quo and stifle creative thought.

Similarly, while few philosophers would deny the extraordinary success of science in making novel predictions, in improving the general quality and length of human life, and in providing explanations for the behaviour of observable events, many would insist that none of this obliges one to embrace ontological naturalism. Thus, for example, Edmund Husserl famously argued that the ontological posits of natural science comprise 'nothing more than a garb of ideas thrown over the world of immediate intuition and experience, the life-world',[11] amounting to 'the surreptitious substitution of the mathematically substructed world of idealities for the only real world, the one that is actually given through perception, that is ever experienced and experienceable – our everyday life-world'.[12] Maurice Merleau-Ponty goes even further, claiming not only that '[s]cientific points of view are always both naïve and at the same time dishonest' on account of their refusal to acknowledge the ontological anteriority of the manifest image, but that it ought to be the task of the phenomenologist 'to re-establish a direct and primitive contact with the world [...] that world which *precedes* knowledge, of which knowledge always *speaks*, and in relation to which every scientific schematization is an abstract and derivative sign-language, as is geography in relation to the countryside in which we have learnt beforehand what a forest, a prairie or a river is.'[13]

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[11] Edmund Husserl, *Experience and Judgment* (Evanston: Northwestern University Press, 1973), 44-5.

Such strongly instrumentalist views of science are by no means restricted to phenomenology, of course, and Husserl's comments have been enthusiastically endorsed by a good number of prominent philosophers in the 'analytic' tradition, including Bas van Fraassen and Hilary Putnam. Thus Putnam, for example, citing the authority of both Husserl and Wittgenstein, argues that since natural science is 'a product of the same interests that underlie our conceptual construction of our *Lebenswelt*' it should no more be considered 'a description of reality "itself" than is our everyday talk of colours or of meanings or of desires or of values or of anything else'.[14]

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[12] Edmund Husserl, *The Crisis of European Sciences and Transcendental Philosophy* (Evanston: Northwestern University Press, 1970), 48-49.

[13] Maurice Merleau-Ponty, *The Phenomenology of Perception* (London: Routledge, 1962), vii, ix.

[14] Hilary Putnam, *Words and Life* (Cambridge, Mass.: Harvard University Press, 1994), 489.

For all such philosophers, the suggestion that it is possible even for scientists to 'escape the manifest image' would thus amount to failing to take account of the way in which the 'everyday *Lebenswelt*' furnishes the quasi-transcendental 'conditions of possibility' for scientific practice, and that it is only by disavowing the reality of such necessary conditions that it is possible for the scientific realist to reify the 'mathematically substructed world of idealities' of natural science as the only 'real' world. While, as you suggest, such views may indeed often be motivated ultimately by little more than bad faith, conservatism, or what have you, they are undoubtedly widespread in contemporary philosophy, and so if we are to avoid the tiresome spectacle of philosophers slinging *ad hominem* accusations and counter-accusations of 'naïveté' and 'conservativeness' at one another, it would seem that such arguments must be squarely confronted. How, then, would you go about attempting to persuade such philosophers of the erroneousness of their reasoning, or to convince them that they ought instead to embrace what in your recent book you call a 'radically naturalistic metaphysics'?[15]

JL: I see absolutely no evidence for the claim that scientific rationality is ideologically conservative or gives any support to the politico-economic status quo. Of course Lenin was hugely enthusiastic about scientific rationality and empiricism. More recently, note that the enemies of science in the USA are the members of the Christian right, who deny that humans evolved and have highly conservative views about the role of women and the civil rights of homosexual people. Moreover, of course, the existence of human-caused global warming has been advocated for years by independent scientists who have struggled to overcome the opposition of vested interests among the politico-economic elite. Those who are most enamoured of science are often also those who are most critical of prejudices of class, race and gender. On the other hand, cultures that antedate modern science have been capable of slavery and horrendous barbarism.

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[15] *Every Thing Must Go*, op. cit., 1.

More generally, I am not even sure that there is such a thing as 'the status quo' in the contemporary world, since it seems to be changing rapidly and quite unstable; but technology is ultimately essential to all human life, given that we have been unable to survive without tools for all of our recent evolutionary history. Most people who live outside of industrialized societies are fairly keen to have their life-worlds transformed by science and technology. (For example, while the medicalization of child-birth may have been overdone in some societies, it should not be forgotten that infant and maternal mortality without modern medicine is extremely high.) Of course, lamentably, what usually goes with that transformation is a degree of exploitation, pollution and so on, but the selfish disregard for the wellbeing of others and of the environment is not a product of the Enlightenment.

I once reviewed a book by Mary Midgley in which she claimed that deforestation was in part caused by Cartesian dualism, as if vast reaches of Western Europe had not been deforested by our ancient ancestors. Frankly, I find the easy association that many intellectuals make between bad things about industrial and post-industrial capitalism and scientism in metaphysics completely naïve. The tragedy of the commons, which may well lead to the extinction of many species of fish due to over-fishing, is just a familiar feature of social life writ-large, and if it is prevented it will be because science has identified the problem and because we rationally decide to collectively deal with it. Science and technology certainly amplify the effects of human greed and our tendency to discount the future in favour of making a fast buck today, but the latter traits are perennial features of our species.

I am completely at a loss about who advocates privileging scientific knowledge 'over all other forms of human experience'. This would be like arguing that listening to music is better than walking in the countryside. I don't know of anyone who argues that scientific reasoning is better than the aesthetic appreciation of music or making love. However, if what is being claimed is that scientific knowledge is superior to folk wisdom or whatever, then I think that this is largely true. Science is the best source of knowledge about disease and how to treat it for example, and exorcism simply doesn't do the trick. If we are to respect people's feelings about the nature and causes of disease then presumably we must respect the feelings of religious fundamentalists who believe that homosexuality is a disease. Similarly, should the views of people whose intuitions tell them that people of a particular race are unlike them and not to be trusted be respected because to not do so is to deny the reality of their experience? While the academic critics of scientific rationality may be expecting it to be replaced by some kind of new age spirituality that will re-enchant nature, de-alienate us and inaugurate some kind of postmodern arcadia, the actual alternatives to science are the ideologies of bigotry and superstition.

As for stifling creative thought, again I see no evidence that taking science to be our best source of knowledge about how things are does this. Nobody is suggesting that artists and musicians must learn scientific theories and use them as sources of inspiration. Lived human experience and the study of great art fuels the imagination and creativity, and will do so regardless of the source from which the individual acquires their metaphysical beliefs. Science is continually renewed by human creativity and in no way conflicts with it. You mention the engaged stance, and here I agree that scientific rationality cannot tell us upon what values to base our lives. However, I am not suggesting it should, just that it be our guide with respect to our metaphysics. Furthermore, let me repeat that as a guide it should be considered to be fallible and liable to revision.

The quote from Husserl is very interesting and makes a very different point from the one about ideological conservativism. In a sense I agree with him that the mathematical idealities are all we have to substitute in metaphysics for the manifest image, since the scientific picture of the world is painted with mathematics. However, I do not think the everyday world is fixed and independent of theory. Note also that it is susceptible to appearances that must be challenged independently of science, for example, mirages and other illusions. Even in the manifest image, a rainbow will be seen to be an illusion since it looks to be in different places to different people. So from my perspective, we have either the manifest image, which we have good reason to believe is full of illusion and not our best picture of the nature of reality, or we have the scientific image. I have plenty of time for philosophers like van Fraassen who say we must embrace agnosticism about all matters metaphysical. However, it is important to note that van Fraassen does not advocate some kind of non-scientific metaphysics but rather recommends not doing metaphysics at all. Again, there is no connection between van Fraassen's and Husserl's claims on the one hand, and the ideological critique of scientific rationality on the other.

I do not think what Merleau-Ponty says about dishonesty is correct, since it is perfectly possible to acknowledge that our experience of the world is the ultimate source of all scientific knowledge while retaining a scientific outlook. Furthermore, to say that our experience is *epistemologically* prior is not to say that it is *ontologically* prior. If by the latter he means to deny that there was lots of stuff going on in the world prior to humans arriving on the scene then I see no reason to believe that. On the contrary, it is the idea that we might restore some mythical purely 'direct and primitive contact with the world' that is naïve. Babies perhaps have it, but they spend their time using their contact with the world to make their subsequent contact with it less direct and primitive, and for good reason since the world unconceptualized is much less forgiving to those seeking to survive in it. Of course, there is always an element of direct and primitive contact with the world in our experience, particularly noticeable through intense sensation perhaps. But then it can hardly be the job of the philosopher to restore this in us since it is always present. Anyone who feels a deficit of direct contact with the world is best advised to go for a good walk, as their ailment is not liable to be cured by reading phenomenology.

Against Putnam I argue that the whole point about the scientific image is that it is what you get when you collectively refine the *Lebenswelt* in the light of theoretical reasoning and vast ranges and quantities of empirical data, so of course it is a better description than that with which we started. On the other hand, it would be a fool who argued that the manifest image is not part of the real world. The fact of our experience is itself an empirical phenomenon and, whether or not science can explain it, it would be absurd to deny its reality.

C: You have recently published *Every Thing Must Go: Metaphysics Naturalized*, co-authored with Don Ross and containing contributions from David Spurrett and John Collier.[16] While the first part of the book's title expresses your eliminativism with regard to individual objects – that is, your ontic structural realism (OSR), mentioned above – the second announces a project for a metaphysics that would, as you put it, 'escape from the manifest image'. Such a 'radically naturalistic metaphysics' is 'motivated exclusively by attempts to unify hypotheses and theories that are taken seriously by contemporary science', and you argue that 'no alternative kind of metaphysics can be regarded as a legitimate part of our collective attempt to model the structure of objective reality'.[17]

Given all this, one might be somewhat surprised to hear you say that you 'have plenty of time for philosophers like van Fraassen who say we must embrace agnosticism about all matters metaphysical'. As far as we understand it, van Fraassen's advocacy of agnosticism regarding metaphysics is to a significant extent motivated by his concern to delimit the scope of what he calls the 'Copernican spirit' or 'objectifying inquiry' characteristic of science in order to make the world safe for the cognitive aspirations of 'non-objectifying' modes of discourse, those of religion in particular.[18] Like many philosophers over the past few centuries, one of van Fraassen's driving concerns is that if we take the scientific world picture to be 'our entire world picture' then 'we ourselves don't seem to fit into our own world picture'[19] – in other words, that there seems to be little room to accommodate our conception of ourselves as *persons* (this being of special concern for van Fraassen 'because that topic covers the, for religion, all-important subject of personal encounter with the divine').[20]

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[16] *Every Thing Must Go*, op. cit.

[17] Ibid., 2.

But whether or not the motivating concern is the explicitly fideistic one of safeguarding religion from the supposed perils of a 'materialist worldview', the idea that it is either possible or desirable to base one's entire *Weltanschauung* on the deliverances of the sciences is one which has always been strongly resisted by the vast majority of philosophers, and is nowadays often blithely dismissed with little more than an invocation of the (pejoratively-intended) term 'scientism'. However, while you are happy to assume the latter epithet, you argue that the explicitly 'scientistic stance' you advocate does not 'impugn the everyday status of objects like tables and baseballs',[21] nor does it entail a narrowly physicalist world-picture suited only for those who share a Quinean 'taste for desert landscapes' (what van Fraassen disparagingly calls 'the spiritually anemic tastes of scientism').[22] While what you call 'fundamental physics' retains an irreducible position of ontological priority inasmuch it is taken to impose definite asymmetrical constraints upon the permissible ontological commitments of the special sciences, your project of unification, guided as it is by the idea of consilience rather than reduction, results in an ontology 'of lush and leafy spaces rather than deserts' for which Don Ross coined the term 'Rainforest Realism'.[23]

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[18] See Bas van Fraassen, *The Empirical Stance* (Yale University Press, 2002), esp. 153ff.

[19] Ibid., 189.

[20] Ibid., 190.

Obviously, this is not a simple thing to explain in a few words, but could you say something about how you reconcile your physics-motivated eliminativism with regard to individual objects with an ontology which neither impugns the everyday status of objects nor has recourse to any notion of 'emergence'?

JL: The reason why I have time for van Fraassen's agnosticism about the metaphysical content of scientific theories is because it is an expression of empiricism that is itself scientific. As we discussed earlier, the history of science itself motivates a degree of scepticism about science and especially about any claim to finality or completeness made on behalf of particular parts of contemporary science.

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[21] Ibid., 5.

[22] *The Empirical Stance*, op cit.: 3.

[23] *Every Thing Must Go*, op cit., 234.

Van Fraassen's constructive empiricism is defensible on such grounds, and on the grounds that, in the end, what matters in science is making empirical predictions and that hence empirical adequacy is the aim of science. It is true that he has recently advocated his empiricism as a way of placing a limit on the claims of objectifying inquiry and a way of making the world safe for religion, but I am not sympathetic to constructive empiricism for that reason. Indeed, in so far as religions centrally involve doctrines concerning the nature of gods, messiahs and the special place of certain ethical and cultural groups in the history of the world, then they just *are* attempts at metaphysical theorizing. Presumably, furthermore, claims about, say, the unique corporeal manifestation of the divine a couple of millennia ago, are supposed to be objectively true, and so I don't understand the equation of 'the Copernican spirit' with the idea of objectification. Religion seems to me to be replete with objectifying discourse.

As for 'non-objectifying' modes of discourse, we say in the book, and I have implied as much in what I've said, that we do not see our attempts at naturalized metaphysics as rivalling or threatening the articulation of human subjectivity in art, literature, music or even in philosophical anthropology. Of course, the scientific worldview does incorporate us and it tells us about ourselves. Fundamentally, according to science, we are continuous in anatomy and physiology and to an extent in psychology with other animals. We find out many unpleasant things about ourselves from experimental psychology concerning our propensity to identify and persecute those not of our 'group', where the latter may be completely arbitrarily circumscribed. I think it is important that in our attempts to promote social justice and peaceful social living we be informed by the evidence concerning what we are actually like, not by idealized conceptions of personhood derived from our self-image which, like the manifest image, is replete with illusions. Of course, there is something to the claim that the first-person perspective per se cannot be objectively described; however, this does nothing to undermine the importance of using the most realistic models we can when deploying the third-person perspective. Again, as I have said above, naturalized metaphysics and science cannot tell us what to value, indeed the valuing of reason in itself is an extrinsic commitment to science, but that is no argument for adopting an anthropocentric or religious worldview.

Our repudiation of individual objects makes sense only in the context of how many philosophers think about them – it is the individuals of analytic metaphysics that we eliminate from our ontology, not the individuals of everyday life. Furthermore, once we have abandoned the false ideals of a privileged set of fundamental individuals, there is no reason to claim that macroscopic objects are less real or not real – hence our denial of physicalism. As for 'the spiritually anemic tastes of scientism', I think this phrase refers again to objectification, and again I say that naturalists are as capable of appreciating the value of life as anyone else.

You ask that I explain our positive ontology and so I will try to do so. In essence it amounts to seeing what follows once one accepts the idea that there is nothing more to the existence of an object than the necessity of incorporating it into any adequate and efficient predictive and explanatory theory of the world. Such theories are always applied to the world at certain scales of time and space, and often only in special locations, so we advocate what we call 'the scale relativity of ontology'. Tables, for example, are indispensable components of everyday ontology but would deliver no predictive or explanatory power to a theory designed to describe the world over scales of light years and eons, or over scales of nanoseconds and nanometers. The basic idea here is that of Daniel Dennett's 'real patterns'.[24] Don Ross developed Dennett's paper, which was about the philosophy of mind, into a defence of a kind of realism about all the special sciences.[25] We then developed the idea of synthesizing this with OSR. Our claim is that the view that things are scale-dependent patterns best accommodates both the repudiation of self-standing individuals in quantum and relativistic physics, and the ontological variety of the sciences as a whole.

C: In the first chapter of *Every Thing Must Go*, fittingly entitled 'In Defence of Scientism', you mount a strongly polemical attack upon contemporary analytic metaphysics, which you charge with 'sowing systematic confusion about the nature of the world, and how to find out about it'.[26] Analytic or 'neo-scholastic' metaphysics, you suggest, 'contributes nothing to human knowledge and, where it has any impact at all, systematically misrepresents the relative significance of what we do know on the basis of science'.[27] While often paying lip-service to science (and, for obvious reasons, to physics in particular), or else rhetorically emulating it, such philosophers typically rely upon commonsensical notions of classical physics according to which the physical world is essentially 'made of' myriad 'little things' and 'micro-bangings' – a conception of the physical world which, you argue, has long-since been rendered obsolete within physics itself. Essentially, what contemporary 'neo-scholastic metaphysics' and 'pseudo-naturalist philosophy' thereby do is attempt to 'domesticate' physics on the basis of an illegitimate extension of the manifest image of the world bequeathed to us by our natural history.

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[24] Daniel Dennett, 'Real Patterns', *The Journal of Philosophy* 88, 1991: 27-51.

[25] Don Ross, 'Rainforest realism: a Dennettian theory of existence' in D. Ross, A. Brook, and D. Thompson (eds), *Dennett's Philosophy: A Comprehensive Assessment* (Cambridge, Mass.: MIT Press, 2000), 147-168.

[26] *Every Thing Must Go*, op. cit., vii.

Earlier on you spoke of your despair with regard to many philosophers' insistence on 'trying to do metaphysics with categories like object and intrinsic property', which are 'anthropomorphic in the sense that they are a projection of how the everyday world of our experience is conceptualized'. Similarly, in *Every Thing Must Go*, quoting Ernan McMullin's remark that 'imaginability must not be made the basis for ontology',[28] you criticize the demand for an ontology based on individuals on the grounds that it is tantamount to demanding 'that the mind-independent world be imaginable in terms of the categories of the macroworld'.[29] However, you have also just said that your position does not entail the elimination of the individual objects of everyday life or the macroscopic objects of the manifest image from one's ontology. How, then, do you go about squaring these assertions? If the mind-independent world is *not* to be thought of as 'imaginable in terms of the categories of the macroworld', how can the individual objects of the macroworld nonetheless be regarding as 'no less real' than the 'real patterns' uncovered by fundamental physics? Are you really suggesting that it is only the way in which certain philosophers think about objects which is 'anthropomorphic', whereas our everyday or commonsensical notion of individual objects picks out something which really exists 'out there' in the mind-independent world?

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[27] Ibid.

[28] The passage deserves quoting at length: 'The denizens of the microworld with their "strangeness" and "charm" can hardly be said to be imaginable in the ordinary sense. At that level, we have lost many of the familiar bearings [...] that allow us to anchor the reference of existence-claims in such macrotheories as geology or astrophysics. But imaginability must not be made the test for ontology. The realist claim is that the scientist is discovering the structures of the world; it is not required in addition that these structures be imaginable in the categories of the macroworld. [...] If the success of the argument at the macrolevel is to be explained by postulating that something like the entities of the theory exist, the same ought to be true of arguments at the microlevel. Are there electrons? Yes, there are, just as there are stars and slowly moving geological plates bearing the continents of earth. What are electrons? Just what the theory of electrons says they are, no more, no less, always

JL: Our polemic against analytic metaphysics will doubtless not persuade those already committed to it, but we hope at least to provide some solidarity to those who have their doubts about the direction the subject has taken. There is a debate that epitomizes the problem, as I see it, and that is central to the recent literature in analytic metaphysics, and it concerns the question of the conditions under which objects form composite objects. The options range from nihilism

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allowing for the likelihood that the theory is open to further refinement. If we cannot quite imagine what they are, this is due to the distance of the microworld from the world in which our imaginations were formed, not the existential shortcomings of electrons [...].' Ernan McMullin, 'The Case for Scientific Realism', in J. Leplin (ed.), *Scientific Realism* (Berkeley: University of California Press, 1984), 14-15.

[29] *Every Thing Must Go*, op. cit., 132.

– there are only simple objects and no composites – to unrestricted composition – all mereological sums of simple objects form composite objects. Restricted composition – the natural position that only some collections of objects form composite objects – is considered difficult to defend because finding a non-arbitrary criterion for distinguishing genuine composites is apparently problematic. The analytic metaphysicians really are trying to decide whether or not tables are real – not because they doubt there is an external world, but because they worry that only table parts are real. At no point in these debates do any of the participants refer to the complex and fascinating science of, say, how molecules form liquids, or how atomic lattices form solids. Rather, the debates are conducted a priori and in exactly the same terms as they would be if modern science had never happened. In particular, they persist in operating as if the world can be visualized as composed of little objects, much as the Greek atomists thought, and they pay scant attention to the utterly bizarre nature of matter revealed by physics. This is especially frustrating because there are fascinating issues about individuation, both in physics and the rest of science, that are being neglected by philosophers. For example, in evolutionary biology there are rich puzzles about how and why individual organisms subsume themselves within cells, colonies, multi-cellular organisms, and social colonies. Metaphysicians have realized that people are beginning to wonder about their subject, so the fashionable issue now is called 'metametaphysics'. Apparently they are worrying about whether or not there is a special metaphysical sense of 'exists'. This all strikes me as evidence that the bandwagon is about to crash and burn – but I may be being optimistic.

According to us, then, those interested in metaphysics must look to science, liberate themselves from the strictures of what can be visualized, and avoid trying to 'domesticate' the theories they find by rendering them in terms of the manifest image. We also think that the notion of an 'object' is fundamentally tied to the practical purposes of prediction and explanation to which theories are put, starting with folk physics and folk biology. Whether or not the species concept will feature in a fully scientific evolutionary biology, human beings have an innate disposition to categorize animals into species – and with very good reason, because over the time scales and to the degrees of accuracy that are relevant to us, there are indeed stable kinds with stable properties, and getting them right mattered a lot to our survival. Similarly, while fundamental physics will never recognize the existence of tables at our time and length scales, tables are an essential part of any adequate and efficient ontology of our world. Real patterns are scale relative, and this is why tables are as real as atoms. Life is short and time is precious, so in general people have learned only to focus successfully on salient features of the world. Ones that stick around for a while are objects. The mistake philosophers make is to start asking questions like 'Is the table the same table if some parts are replaced?', or 'Is a neutrino passing through the table part of it or not?' If one is selling an antique table with a provenance then there may be a genuine need to ask whether it really is the same table that was made by a famous craftsman or whether it is a new table with old legs or whatever. However, there are many questions about tables to which we should expect no answer, because real patterns are necessarily approximate and scale dependent, unlike the hypostasized objects of philosophers.

Finally, note that the table as pattern is no less mind-independent for that. It is precisely because it does what it does independently of our beliefs, intentions and desires that it is a real pattern and not a fictitious one.

C: One of the principal reasons that many people regard 'scientism' as inherently objectionable is that they believe that it necessitates a drastic narrowing-down of the range of permissible ontological commitments such that only that which is quantified over by fundamental physics (on some construal thereof) may be regarded as fully real, everything else being a candidate for either (microphysicalist) reduction or straightforward ontological elimination. The charge, in short, is that a strictly physicalist ontology is a necessarily impoverished one inasmuch as it is by its very nature incapable of doing justice to the manifest image of the world – that world 'which spontaneously appears around me when I open my eyes' invoked by Eddington in his famous discussion of the problem of the relationship between the 'two tables' (i.e. the 'scientific' table of microphysics and the 'manifest' table of commonsense). While Eddington concluded that the scientific table 'is the only one which is really there – whatever "there" may be' and that the manifest table is thus a kind of anthropomorphic illusion (a 'strange compound of external nature, mental imagery and inherited prejudice'),[30] you argue that the everyday table is 'undoubtedly a real pattern', whereas '[s]trictly speaking there is no scientific table at all'.[31]

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[30] Arthur Eddington, *The Nature of the Physical World*, (Cambridge, Cambridge University Press, 1928), xii.

[31] *Every Thing Must Go*, op. cit., 253.

While, on the face of it, this latter conclusion might sound like an endorsement of an instrumentalist stance vis-à-vis the 'theoretical posits' of physics, it is in fact motivated rather by a kind of instrumentalism about individual objects (both those of everyday life and the special sciences). Given your rejection of ontological physicalism (due to its incompatibility with naturalism more broadly construed),[32] and the fact that the special sciences (including non-fundamental physics) 'are richly populated with individual objects',[33] it is one of the principal objectives of your project of unification to explain the relationship between fundamental physics and the special sciences, and to do so in consilient rather than reductionist terms. As you have already mentioned, two of the key theoretical innovations which you have introduced for this purpose are the 'scale relativity of ontology', on the one hand, and a certain instrumentalist stance vis-à-vis individual objects, on the other. While, as you have said, it is the former (scale relativity) which is supposed to guarantee the reality of individual objects like tables or organisms or persons, one might nevertheless wonder whether this is not somewhat in tension with the latter instrumentalism regarding individual objects. If the objects of the special sciences are to be regarded as 'pragmatic devices used by agents to orient themselves in regions of spacetime, and to construct approximate representations of the world',[34] 'only epistemological book-keeping devices',[35] 'constructs built for second-order tracking of real patterns', or 'community representations',[36] how can they at the same time be regarded as fully (i.e. mind-independently) real? Moreover, if 'to be is to be a real pattern', how can real patterns, as you have just put it, be 'necessarily approximate'? Is there not perhaps a certain equivocation between *representatum* and *representandum* here; that is, between real patterns as representations, on the one hand, and as that which is represented, on the other? Perhaps the distinction you draw in *Every Thing Must Go* between second-order ('representational') real patterns and first-order ('extra-representational') real patterns might shed some light on this?[37]

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[32] Ibid., 40-1.

[33] Ibid., 130.

[34] Ibid.

[35] Ibid., 240.

JL: 'Instrumentalism' is a term subject to many interpretations. Normally it connotes the view that the theoretical posits of science are cognitive tools for predicting the phenomena rather that real entities. However, our instrumentalism is universal and admits of no contrast between real objects and mere posits. According to our view, individuation is always a cognitive tool that is used to predict and explain the world at some scale of resolution. The objects of the special sciences and everyday discourse are 'fully real' just because there is nothing more to being a real object than being a real pattern. When it comes to mind-independence the point is that any observer wanting to track the world at a particular scale with respect to particular features will fail to do so most efficiently if they do not quantify over the real patterns. However, reality only coalesces into real patterns at all if one is restricted to a particular level of accuracy. Consider what happens in quantum field theory where all the known theories can only be applied when length-scale cut-offs are imposed to prevent infinities appearing in the equations. Of course, it is hoped that a more fundamental theory will be found that does not have such limitations, but whatever the details of it are I think it is a fairly safe bet that it will not describe the world as being composed of some set of individuals, but rather will describe some sort of structure. In the book we are agnostic about whether there will ever be a final theory in fundamental physics. Either way, we argue that our everyday and special scientific conceptions of objects are cognitive tools for getting a grip on the structure of the world. The scale relativity of ontology and the idea that to be is to be a real pattern are hence not in tension but are rather two-sides of the same metaphysical coin.

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[36] Ibid., 242.

[37] Ibid., 243.

The distinction we make between first-order and second-order real patterns is not intended to be a metaphysical one, but to draw attention to the fact that the patterns we find in the world – tables for example – are patterns in phenomena that themselves are already cognitively picked out as real patterns – such as properties like macroscopic shapes, colours and textures. Many of these latter real patterns are discerned and packaged for our cognition by our basic perceptual systems. According to us all individuals are second-order real patterns in this sense. We seem to confuse representations with what is represented for our aim is to undermine the distinction when it comes to individuals. However, since it is possible to bump into tables they cannot be mere representations, so our view seems nonsensical.

I hope not, but it must be very carefully stated. When one describes the phenomena as someone bumping into a table one is representing the world at a certain scale and to a certain degree of accuracy. Fundamental physics could have no use nor attach any meaning to such a description and so in this sense the table is merely a representation; but all objects are like this, and so the table is as real as anything could be. Some real patterns are more representational than others though, insofar as they only exist because of the contingencies of our actual representations and their historical development. Hence, while any observer interested in certain scales of resolution would have to quantify over stars and planets, only someone in our particular cultural milieu needs to quantify over Sherlock Holmes. Fictional characters are real patterns but not universal ones.

C: When you say that a table is a representation inasmuch as fundamental physics does not quantify over such things, and yet that, since this is the case for all objects, 'the table is as real as anything could be', is the implication that while a table is as real as any *thing* could be, *things* as such are nevertheless not ontologically fundamental, but must rather cede their traditional place of metaphysical priority to *structures*? This much, at least, would seem to be required by your OSR, according to which there is nothing but 'structure all the way down'. Yet what exactly is it which OSR affirms to be ontologically fundamental when it insists that 'structure' is all that there is? Is it mathematical structure itself, or is it those 'extra representational real patterns' which mathematical structures are taken to represent? If it is the former, you would of course be committed to a radical form of

Platonism or Pythagoreanism akin to Max Tegmark's 'Mathematical Universe Hypothesis';[38] if it is the latter, how are we to understand the relationship between the mathematical theories and the metaphysically-real structures which they supposedly track?

JL: This question gets to the heart of the matter and I must confess that I am not sure what the answer to it is. The idea of structure that I have in mind is that of modal structure – nomological structure – rather than mathematical structure. However, it might be that the necessity of mathematics and the physical necessity of laws coincide, and the history of physics has progressively undermined the distinction between mathematical and physical necessity. We do not advocate Pythagoreanism or Platonism, because they contrast mathematical or formal existence with material being. Our metaphysics is directly motivated, just as we say all metaphysics should be, by the actual content of physics, and our review of the latter significantly undermines the distinction between mathematical and physical-nomological structure. However, if mathematical structure does not coincide with physical structure then the relationship between them is surely that of isomorphism (or something similar but weaker such as homomorphism). As to what makes the difference between concretely instantiated mathematical structure (physical structure) and purely mathematical structure, I think that any attempt to say so would amount to empty words that would in the end add nothing to our understanding of the difference. I have no idea what conceptual resources one could deploy to say more about a distinction that, if it obtains, is so fundamental.

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[38] Max Tegmark, 'The Mathematical Universe', *Foundations of Physics* 38, 2008: 101-150.

C: According to OSR 'structure is all there is', yet doesn't the very concept of structure require as its complement something which is *not* structure? In this regard, Bas van Fraassen has argued that the very distinction between 'content' and 'structure' is 'painfully context-dependent',[39] and that the continuity of structure upon which structural realism's proposed solution to the history of science induction hinges is identifiable only *retrospectively*, rendering the solution both circular and ad hoc: 'The atoms are still there at some level, so that was structure. The ether is no longer there, at any level, so that was a mistake about content'.[40] Thus, van Fraassen asks: 'Is it not a little embarrassing to start with the thesis that what is preserved through scientific revolutions is the structure attributed to nature, and then to have to identify structure by noticing what has been preserved? Must this philosophy of science [not] ultimately rest on a metaphysics to distinguish intrinsic and extrinsic properties (essences and accidents, substantial form and prime matter, relation and pure quality)?'[41] How do you respond?

JL: I respond by saying that some of the structure of the ether is retained and what is retained is more than the pure empirical content of the ether theory. In every revolution in physics much of the mathematical structure of the old theory is recoverable from the new theory. It is not just a matter of the predictions coinciding. The Galilean transformations and the inverse square law of classical mechanics are reached as approximations from relativity theory. Of course we can only say retrospectively exactly which aspects of current science will be retained in its future form, but we can say prospectively that all the well-confirmed laws, and not just the empirical content of the theories, will be recoverable from the next generation of theories. According to OSR the theoretical content of theories tracks the nomological structure of the world and not just the empirical regularities.

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[39] Bas van Fraassen, 'Structure: Its Shadow and Substance', *British Journal of the Philosophy of Science* 57, 2006: 303.

[40] Ibid., 290.

[41] Ibid., 303.

C: Isn't it the case that what, at one stage of the history of science, is taken to be 'extra-representational' is at a later stage found to be 'representational'; in other words, that what is at one time taken to be describe the fundamental structure of physical reality is at a later time shown to be at best only an approximate limiting case of a more comprehensive theory, holding relative to a certain set of special conditions or domain of application? But if that is the case, how can it be legitimate to suggest that we are now in possession of knowledge of 'extra-representational real patterns' at all? Might it not rather suggest that the very distinction between 'representational' and 'extra-representational' real patterns is an epistemologically suspect one, and that we might be better-off talking instead (in the manner of Ernst Cassirer and, more recently, Michael Friedman)[42] about a continuously converging series of mathematical structures in which the extra-representational real (the 'thing in itself', if you like) is at best a regulative ideal which science only asymptotically approximates?

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[42] See, e.g., Ernst Cassirer, *Substance and Function and Einstein's Theory of Relativity* (London: Dover, 1923); Michael Friedman, *Dynamics of Reason* (Stanford: CSLI,

JL: I agree that the most serious challenge to OSR comes from empiricism and not from scientific realism or analytic metaphysics. Van Fraassen and Friedman present this challenge in different ways because Friedman's view cedes no ontological priority to the manifest image. The thing that makes me disagree with Friedman is that I am confident that the causal and nomological structure of reality as revealed by our best science (and as approximated to a fairly good degree by common sense ontology) amounts to knowledge of real patterns that will be retained in the future. However, the idea of a real pattern is not the idea of a thing in itself, which I agree is at best a regulative ideal.

C: Perhaps the most widespread and persistent objection to OSR is that it makes no sense to talk about *relations* without *relata*; or, in other words, that the very notion of a relation presupposes *objects* which *stand in* the relations. It is on the basis of this assumption that many philosophers, while admitting that physics only tells us about the 'relational properties' of things, nevertheless insist that there must also be 'intrinsic properties' upon which the former supervene, thus motivating only an 'epistemic' or 'Kantian' structural realism (ESR) rather than the strong metaphysical or 'ontic'

2001); and Michael Friedman, 'Ernst Cassirer and Contemporary Philosophy of Science' in D. Veal (ed.) *Continental Philosophy and the Sciences: The German Tradition*, Special Issue of *Angelaki* 10 (1), 2005: 119-28.

variant (OSR) which you endorse. What is your response to this criticism? Is it only an especially stubborn metaphysical article of faith that there must be unknowable intrinsic properties (analogous to Kant's 'thing in themselves') upon which the relational properties revealed by fundamental physics must supervene? Why is it that you insist upon adopting an eliminativist rather than an agnostic stance with regard to the existence of 'intrinsic properties'?

JL: The notion of an intrinsic property is usually defined as a property which an individual possesses or not regardless of what else exists. In the philosophy of physics it has become extremely dubious to suppose that individuals exist independently of other individuals. Once the idea of classical atoms as paradigmatic of individuals is abandoned, although one can make sense of saying that all properties are intrinsic properties of the universe, the pragmatic point of saying that is obscure, to put it mildly. Note, however, that the question of whether everything supervenes on intrinsic properties is different from whether there are any intrinsic properties at all. Many philosophers would concede that there may be some relational properties that do not supervene on the intrinsic properties but insist that the latter must also exist.

C: If OSR was proposed solely as a solution to the pessimistic meta-induction, it would be open to the charge that it is ad hoc, but as you have already said, it is also motivated by reflection on quantum mechanics and general relativity. In particular, you argue that the ubiquity of quantum entanglement provides us with an empirically underdetermined choice between either individuating each particle with respect to some transcendent metaphysical haecceity or else jettisoning the notion of individuality altogether in favour of a structuralist ontology, and that the latter option is preferable on grounds of ontological parsimony. Yet as Paul Dicken has argued in his review of your book, all of this is a debate over the *interpretation* of quantum mechanics, and it is therefore hard to see how a naturalistic injunction to reject any hypothesis that 'conflicts with fundamental physics' (as your 'Primacy of Physics Constraint' demands) could decide the matter either way.[43] After all, as Dicken points out, '[i]f primitive this-ness *conflicted* with fundamental physics, it would never have been a potential *interpretation* of fundamental physics in the first place'.[44] You say in your book that 'we can cite instances of leading physicists who motivate our metaphysical approach from strictly physical considerations';[45] yet, given the problem of metaphysical underdetermination, is it not the case that one could equally cite other physicists, with very different interpretations, and thus come up with a list of constraints that would be incompatible with those which you have picked out? In other words, isn't the criterion according to which something might be taken to conflict or not to conflict with fundamental physics itself somewhat hopelessly underdetermined?

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[43] *Studies in History and Philosophy of Science* 39 (2), 2008: 290-3, at 292.

[44] Ibid.

[45] *Every Thing Must Go*, op. cit., 61.

JL: The Primacy of Physics Constraint is not meant to decide the matter. Rather it is supposed to capture the correct insights of the physicalism and reductionism that we otherwise reject. Our argument for eliminativism about self-subsistent individuals is based in part on the ad hoc manoeuvres that have to be made to make fundamental physics compatible with them, and in part on the consilience of our overall metaphysics which does not include them, but we do not take conflict to mean outright inconsistency. I think everyone will agree that there is at least a prima facie conflict between the metaphysical commitment to a world made of some set of fundamental individuals, and quantum mechanics and general relativity. Whether that conflict is there on further consideration is a matter for people's judgement and not a matter of logic. However, we claim to have given reasons to think that the right judgement, in the round, is to break the underdetermination of metaphysics by physics and the rest of science in favour of structuralism. The point about OSR and our overall metaphysics is that our naturalism requires us to abandon it if it does not express a unifying picture of the world that is both compatible with and motivates successful science.

C: The central component of your scientism is your verificationism. While the latter term is nowadays still habitually associated with the failures of the logical positivist demarcationist programme – a failure which, you suggest, paved the way for the subsequent recrudescence of neo-scholastic metaphysics – your own verificationism is not based upon any a priori philosophical criteria of meaning-satisfaction but rather upon the institutionally-selected epistemic reliability of science itself. To cite a relevant passage:

> We admire science to the point of frank scientism [...] what most impresses us about science is not its results – marvellous though these have been – but the way in which its institutional organization selects for rationality and collective epistemic progress in the activities of a species that seems, in its more natural institutional settings, strongly disposed to superstition and fearful conservatism. Our verificationism, like all versions of that, is promoted as a bar against seeking explanation where we have good reasons to doubt that it promises anything but temporary psychological satisfaction at the expense of truth. In particular, we deny that there is value to be had in philosophers postulating explanantia, without empirical constraint, on the grounds that these would make various putative explananda feel less mysterious if they prevailed.[46]

That the institutional error filters of science indeed rigorously select for optimal rationality in a way that few other institutions may claim to even approximate seems incontrovertible. However, isn't there a risk here that making theoretical research entirely subordinate to internal institutional mechanisms of selection might result in a certain counterproductive conservatism or conformism, even a severe diminution in the range and diversity of active research programmes? After all, when talking about such institutional filters here we are not only talking about an ongoing intersubjective process of rational and self-correcting inquiry but also about the power-politics of hiring committees, funding agencies and government institutions. In this regard Lee Smolin has argued in his recent book

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[46] *Every Thing Must Go*, op. cit., 61-2.

The Trouble With Physics that comparatively little progress has been made in fundamental physics over the past three decades precisely because of the way in which certain firmly entrenched institutional filters have served to perpetuate not only a particularly narrow approach to scientific problem-solving but also a particular research programme – namely, string theory – at the expense of its rivals.[47] According to Smolin, string theory 'now has such a dominant position in the academy that it is practically career suicide for young theoretical physicists not to join the field', since 'theorists who pursue approaches to fundamental physics other than string theory have almost no career opportunities'.[48]

It is well known that string theory hardly even qualifies as a candidate physical theory at all, given that nobody seems to have the slightest idea of how to test it. But given that you tie your verificationism so firmly to the processes of institutional selection rather than empirical confirmation or falsification per se, oughtn't the aforementioned institutional hegemony of string theory commit you to embrace the latter as the currently most promising approach to physical unification, despite the fact that your structuralist metaphysics would seem to be more in line with 'relational' interpretations of quantum mechanics such as those proposed by Rovelli and Smolin? Moreover, isn't it the case that it is not only philosophers but also scientists themselves who postulate explanantia 'on the grounds that these would make various putative explananda feel less mysterious if they prevailed'? One thinks, for example, of the popular idea of the postulation of some kind of multiverse in order to 'explain' the putative 'fine-tuning' of the cosmological constants or else to 'explain' the fact that string theory comes in more versions than all the atoms in the known universe. Thus, isn't it the case that a good deal of (institutionally heavily-funded) research in contemporary quantum gravity and cosmology is in this respect at least as 'empirically unconstrained' as anything which one might find in analytic metaphysics?

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[47] Lee Smolin, *The Trouble With Physics: The Rise of String Theory, The Fall of Science, and What Comes Next* (Boston and New York: Houghton Mifflin, 2006); see also Peter Woit, *Not Even Wrong: The Failure of String Theory and the Search for Unity in Physical Law* (New York: Basic Books, 2006).

[48] Smolin, *The Trouble With Physics*, op. cit., xx, xxii.

JL: String theory became popular largely because the existence of spin-2 massless bosons (gravitons ought to be exactly this kind of particle) dropped out of its formalism without being put in by hand. However, Smolin is right that string theory cannot claim any novel predictive success, and, while it is certainly well-funded, I do not think the majority of experts in fundamental physics would say that string theory has the same claim to truth as quantum mechanics or general relativity or even the standard model. It may well be that the institutional processes of science have not functioned particularly well in this case, and it may also be the case that they are not in general that great. Our book contains no arguments against the claim that there is a pressing need to improve and reform science. However, we do think that there is no other epistemic game in town.

Of course scientists also make explanatory posits, but in the end empirical consequences and predictions are what make or break theories in science. There is a big difference between the established theories in physics and the far-out speculations of contemporary theorists that attract the attention of the layperson. I am extremely sceptical about multiverses, and certainly theories associated with them would have to acquire more empirical success before they would be counted as scientific knowledge. Indeed, the 'fine-tuning' problem may be bogus since its formulation relies upon a modal distinction between laws and boundary conditions that might be spurious.

However, the general point that scientists sometimes engage in metaphysics is well-taken and sometimes they too allow themselves to get carried away. I also think that philosophers can and do carry out work that is continuous with scientific theorizing and of scientific value (for example, within the philosophy of physics or the philosophy of biology), but in recent years the field known as analytic metaphysics has been largely characterized by inquiry that ignores science altogether, or by work which addresses a domesticated and distorted scientific image (we call this the philosophy of A-level chemistry). My view is that metaphysical theorizing should always be based on or at least inspired by scientific knowledge rather than intuitions and conceptual analysis (although the latter obviously has a role to play in promoting clarity of thought generally); and also that, whether metaphysics is being carried out by philosophers or scientists, contact with experience must be considered the supreme court. In this sense I have a view of metaphysics very like that of van Fraassen – namely, that it is of epistemic value only in so far as it contributes to the progress of science.

C: Perhaps you could qualify more precisely what you mean by 'experience' and the relevant sense of 'contact' here, since the idea that 'contact with experience must be considered the supreme court' is of course one which would be endorsed by philosophers representing a wide variety of different approaches, yet you surely do not mean by 'experience' here either the 'sense perception' of traditional positivism, the 'lived experience' of the phenomenologists, nor – in spite of your expression of kinship with van Fraassen – anything which depends upon an anthropocentric distinction between what is and what is not humanly observable. Indeed, as we were saying earlier, many philosophers continue to reject the ontological import of modern physics precisely on the grounds that it seems to make *too little* 'contact with experience' in their preferred sense of the term, substituting a 'mathematically substructed world of idealities for the only real world, the one that is actually given through perception', etc. In this regard, it seems important to point out that your verificationism substitutes for the traditional empiricist criterion of *observability* the broader notion of *informational connectedness.*[49] Could you say a little about what this means, and why you deem this substitution to be necessary?

JL: The idea of 'contact with experience' I have in mind includes the traditional empiricist idea of sense perception but also includes the way we have extended our empirical contact with the world using instruments and measuring devices. All such systems have in common that they have degrees of freedom that become correlated with (contain information) about states of the world. By 'informational connectedness' we refer to a kind of contact between states of the world and subsystems of it that is very general and so does not commit us to doctrinal empiricism. When we talk about 'information' in the book we always have formal information theory in mind. There is an informational connection wherever there's a system with particular detecting capacities, a set of properties that are transduced, and a channel that explains the covariance between aspects of the transduced properties and some states of the transducer. A person, as one kind of transducer, is informationally connected from spacetime coordinates *s* to any part of the world *w* when there exists a channel such that records of properties measurable at *w* are transmitted to *s* in a way that a person, equipped with physically possible technology, could recover, and it's physically possible that the person could position themselves at *s*. This isn't supposed to be an analysis of anything, but a description of an important distinction, namely that between states of affairs one *could* set out to empirically investigate if one had a big enough budget, and states of affairs one could not. If the Big Bang was truly a singularity – and of course it might not be – then no one is informationally connected to the other side of it and our verificationism is then the claim that it's silly to speculate about that because anything one can imagine is as probable (in the Bayesian sense) as all the members of an infinite set of descriptions that no person *would* imagine. As always, the scale relativity of ontology applies here. So, to cite an example we use in the book, we're all informationally connected to the approximate amount of hair

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[49] *Every Thing Must Go*, op. cit., 303-10.

Napoleon had on his head at Waterloo because we have paintings, plus records from his contemporaries that don't say he was bald but some of which would have if he had been. But we living today are informationally unconnected with the precise number of hairs Napoleon had that day and it would be foolish to speculate about whether he had x or $x+1$ or $x-1$. Our verificationism doesn't involve any deep thesis but is a form of being practical that scientists themselves observe.

C: In his classic essay 'Empiricism and the Philosophy of Mind',[50] Wilfred Sellars makes the interesting point that whereas before there was any such subject as 'the philosophy of science' all students of philosophy felt obligated to keep 'at least one eye' on the methods and findings of the sciences, once philosophy of science came to have 'nominal as well as real existence' there arose a temptation 'to leave it to the specialists, and to confuse the sound idea that philosophy is not science with the mistaken idea that philosophy is independent of science'. What this gave rise to, suggests Sellars, was the view according to which 'philosophers of science deal with a mode of discourse which is, so to speak, a peninsular offshoot from the mainland of ordinary discourse. The study of scientific discourse is conceived to be a worthy employment for those who have the background and motivation to keep track of it, but an employment which is fundamentally a hobby divorced from the perplexities of the mainland'. Aided and abetted by an instrumentalist conception of science according to which the categories of the manifest image have an 'unchallengeable authenticity' and the theoretical apparatus of the sciences is a mere 'auxiliary framework', this in turn ultimately paved the way for a resurgence of the kind of neo-scholastic metaphysics which you rail against in your book. Could this be one of the reasons that you call what you do 'metaphysics' rather than 'philosophy of science'? Given that, as Sellars says, 'nominal causes [...] have real effects', is it time that philosophers of science wrestled the banner of 'metaphysics' from the neo-scholastics and, as it were, reoccupied the mainland of philosophical discourse?

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[50] All of the quotations which follow are taken from section IX, 'Science and Ordinary Usage', in Wilfred Sellars, *Science, Perception and Reality* (Atascadero, California: Ridgeview, 1963), 170-74.

JL: It is certainly true that much work has been done by philosophers of science, on for example, causation, laws of nature, natural kinds and so on, that definitely counts as metaphysics. Perhaps I should explain how we came to write the polemic against analytic metaphysics in the first place. We did not set out to write a book that began by attacking other philosophers, but rather to synthesize ontic structural realism and rainforest realism into a unified metaphysics applicable to science from physics to economics. We then realized that we were writing a book about metaphysics but that we were neither reading nor discussing the work of the most prominent metaphysicians of our time, but were engaging only with the literature in general philosophy of science and the philosophy of the various special sciences. At the same time we were encountering the resurgence of analytic metaphysics within philosophy and finding ourselves frustrated by its insularity and lack of engagement with the sciences. Hence, we decided to write a methodological introduction that explained why a book about metaphysics was ignoring the metaphysical literature. Once we started doing that we warmed to our theme and became convinced that what we were saying needed to be said quite independently of the rest of our project. What we say is deliberately polemical and less nuanced than it might be. Of course, there is no sharp distinction between good naturalized metaphysics and bad analytic metaphysics, or between the people who do these things. However, it is undeniable that one of the most significant developments in analytic philosophy in recent years has been the growth in power, prominence and status of metaphysics, and we stand by the claim that this is generally a bad thing for philosophy since it has led to a concentration on internally-generated philosophical problems and a failure to look outwards. By adopting the subtitle 'Metaphysics Naturalized' for the book we hoped in part to stake a claim for the mainland; however, so far I have seen no evidence that we have been successful.

C: The role which your book assigns to the philosopher vis-à-vis the sciences is very much that of an 'underlabourer' in which philosophers help to build bridges (that is, to trace networks of consilience) between already-established domains of scientific knowledge. However, one might wonder if the history of science, and that of physics in particular, does not suggest the need for an even more intimate relationship between science and philosophy than this. The historical divorce between science and philosophy is, after all, a very recent one, hard as it often is for us to remember that fact. In this regard, not only philosophers and historians of science such as Lawrence Sklar, Michael Friedman and Thomas Ryckman[51] but also physicists such as Lee Smolin and Carlo Rovelli[52] have emphasized the crucial role of an ongoing dialogue between philosophy and physics, especially in times of revolutionary transition in the latter. What is needed at the time of the present 'unfinished revolution' in physics, they suggest, is radical reflection on the very conceptual foundations of physics, and they urge philosophers to take a more active and constructive role in these discussions; thus Rovelli writes:

> if a new synthesis is to be reached, I believe that philosophical thinking will be once more be one of its ingredients. Due to the conceptual vastness of the problematic involved, the generality and accuracy of philosophical thinking and its capacity to clarify conceptual premises are probably necessary to help physics out of a situation in which we have learned so much about the world, but no longer know what matter, time, space and causality are. As a physicist involved in this effort, I wish that philosophers who are interested in the scientific conception of the world would not confine themselves to commenting [on] and polishing the present fragmentary physical theories, but would take the risk of trying to look *ahead*.[53]

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[51] See, e.g., Lawrence Sklar, *Space, Time, and Spacetime* (Berkeley: University of California Press, 1974); Thomas Ryckman, *The Reign of Relativity: Philosophy in Physics 1915-1925* (Oxford: Oxford University Press, 2005) ; and the references to Friedman in note 40 above.

[52] See, e.g. Lee Smolin, *The Life of the Cosmos* (Oxford: Oxford University Press, 1997); Lee Smolin, *The Trouble with Physics*, op. cit.; Carlo Rovelli, *Quantum Gravity* (Oxford: Clarendon Press, 2003); Dean Rickles, 'Interpreting Quantum Gravity', *Studies in History and Philosophy of Science* 36 (4), 2005: 691-715; and the papers in C. Callender and N. Huggett (eds), *Physics Meets Philosophy at the Planck Scale* (Cambridge: Cambridge University Press, 2001).

[53] Carlo Rovelli, 'Halfway Through the Woods: Contemporary Research on Space

Given your own underlabourer conception of the role of the philosopher, is this an invitation which you think philosophers of science ought to turn down?

JL: Some philosophers have the capacity to work at the cutting edge of physics or theoretical biology, and have done so and of course should continue to do so. I see no reason why philosophers should not try and look ahead, but then since so many of them insist on looking backwards, even getting them to catch up with the present seems hard enough. However, let me emphasize that within the subfield I know best, namely the philosophy of physics, there are a great many superb intellects engaged in subtle and deep explorations of the conceptual foundations of the most advanced theories and these people are often engaged in looking ahead to some extent (I am not including myself among their number since my knowledge of quantum field theory and general relativity is not nearly good enough for me to look beyond them).

C: Finally, what advice might you have for those who may be convinced by your arguments for the need for a philosophical naturalism which goes beyond a vague sort of 'science-friendliness', yet who are nevertheless daunted by the prospect of doing metaphysics in the way that you recommend; in other words, those who may be not so much afraid of 'scientism' as intimidated by the kind of interdisciplinary omnicompetence that a project such as

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and Time' in J. Earman & J. Norton (eds), *The Cosmos of Science* (Pittsburgh: University of Pittsburgh Press, 1997), 182.

yours would seem to demand? Since you argue that a priori metaphysics 'should be discontinued'[54] and exhort contemporary philosophers to 'come back and rejoin the great epistemic enterprise of modern civilization',[55] what exactly would you advise them to do? Should they simply put aside their philosophy books and start reading up on physics, chemistry, biology, cosmology, neuroscience, economics, linguistics, anthropology ...? You said yourself earlier in the interview that science is 'vast, complicated and hard to learn'. Is there really any hope of scientifically- and mathematically-untrained philosophers being able to contribute to the kind of bridge-building which you claim is the only viable form of metaphysics? Isn't there the risk that such philosophers will only end up perpetuating yet more 'pseudo-naturalist' metaphysics due to their superficial acquaintance with the methods and findings of the sciences?

JL: The worry you raise here is a genuine one and it often concerns me given my own avowed feelings of inferiority with respect to theoretical physics. In short I think the answer is not to put away philosophy books but to make sure that one reads the relevant other subjects too. For example, many of my colleagues at Bristol work in the philosophy of mathematics and logic. They continually educate themselves in set theory, category theory, various logical systems and so on. Similarly, I do think that philosophers of mind ought to be reading about the science of the mind, political philosophers ought to be reading about history, politics and economics, and so on (as indeed plenty of them do). The fact that there is a vast amount of learning to be had is no excuse for turning aside from the world and looking inwards. Philosophers in my experience are on the whole incredibly intelligent and astute. When they turn their minds to something they quickly spot ambiguities, conflations, incipient contradictions and so on. There is plenty of confusion and poor reasoning in science which they could help to sort out. Furthermore, there is another obvious solution to the problem you raise, namely: collaboration. Papers in particle physics are often written by a hundred or more people. Science in general is now so vast and highly developed that more and more work is done by teams of people. I see no reason why philosophers and scientific specialists cannot work together to integrate philosophy and science.

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[54] *Every Thing Must Go*, op. cit., vii.

[55] Ibid., 310.

Enlightenment 2.0

Interview with Thomas Metzinger

Thomas Metzinger's work is at the forefront of interdisciplinary research between the philosophy of mind and cognitive neuroscience. Marrying an encyclopedic grasp of the philosophical literature on consciousness with a superlative mastery of the latest neurobiological research, his Being No One *is a groundbreaking work that recasts the terms in which the problem of consciousness is formulated. Although advances in cognitive neuroscience over the past twenty years have sparked a notable resurgence of interest in this problem among philosophers, many have argued that consciousness cannot be reductively explained by cognitive neuroscience, while others have gone so far as to insist that consciousness is a mystery that cannot be explained tout court, and that cognitive neuroscience lacks the resources to tackle 'the hard problem' of explaining how first-person subjective consciousness could ever arise from un-conscious neurophysiological processes. In our interview, Metzinger discusses not only how he confronts this philosophical challenge head-on by forging new conceptual resources capable of bridging this allegedly irreducible 'explanatory gap', but also how innovations such as the concept at the heart of his new theoretical framework – the 'phenomenal self-model' – might impact upon the personal and social experience of being human.*

COLLAPSE: At the beginning of *Being No One*[1] you criticize the tendency towards 'arrogant armchair theorizing' in what you call 'analytical scholasticism' in the philosophy of mind, a tradition which you charge with 'ignoring first-person phenomenological as well as third-person empirical constraints in the formation of one's basic conceptual tools'. Rather than taking into account empirical constraints on concept formation, such neo-scholastic 'armchair philosophers' will often explicitly stipulate that it is our commonsense or 'pre-philosophical' intuitions which must 'serve as the benchmark for a satisfactory account'.[2] But while you agree that such intuitions 'have to be taken seriously', you are scornful of the idea that they should serve as the *explanans* rather than the *explanandum* in the philosophy of mind, pointing out that it may well be the case that 'our best theories about our own minds will turn out to be radically counterintuitive', presenting us with 'a new kind of self-knowledge that most of us just cannot believe'. Though you suggest that 'nobody ever said that a fundamental expansion of our knowledge of ourselves has to be *intuitively* plausible', it is unfortunately the case that many philosophers of mind continue to act as if that were precisely the case. As Daniel Dennett has recently characterised the situation, philosophers of mind have typically proceeded 'as if the deliverances of their brute intuitions were not just *axiomatic-for-the-sake-of-the-project* but *true*, and, moreover, somehow inviolable'. Whereas in most sciences

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[1] Thomas Metzinger, *Being No One: The Self-Model Theory of Subjectivity* (Cambridge, Mass.: MIT Press, 2004). The quotations in this paragraph are taken from pages 1-3 of the book.

[2] Tim Thornton, *Wittgenstein on Language and Thought* (Edinburgh: Edinburgh University Press, 1998), 1.

‘few things are more prized than a counterintuitive result’, given that it ‘shows us something surprising and forces us to reconsider our often tacit assumptions’, in philosophy of mind a counterintuitive result is ‘typically taken as tantamount to a refutation’.[3]

In your own work, you are not content with simply reversing this order of priorities by taking the commonsensical intuitions and concepts of the folk and the philosophers as the *explanandum* rather than the *explanans*; you also aim to provide an account of precisely how such deeply ingrained intuitions, and the philosophical conservatism which follows from them, are ‘ultimately rooted in the deeper representational structure of conscious minds’. So for you, explaining consciousness and subjectivity is not simply a matter of ‘changing the way we talk’, but of forging conceptually convincing links between sub-personal and personal levels of description which are *empirically* rather than *intuitively* plausible. Can you say more about what this project of ‘interdisciplinary philosophy’ involves, and the kinds of ‘empirical constraints’ which have guided the formation of your own conceptual tool-kit?

THOMAS METZINGER: Daniel Dennett is of course right – there is a certain deflationary Gestus in a lot of good, professional analytical philosophy of mind, and it sometimes blocks progress by simply being conservative without independent argument. There may be deeper evolutionary reasons for this attitude (quite obviously, our brains are 'coherence engines', maximizing the coherence of our internal model of reality at any point, often sacrificing veridicality for short-term functional adequacy, with the 'goodness of fit' then being what determines the degree of intuitiveness of a given thought), as well as reasons based in the history and culture of analytical philosophy – which was itself a revolutionary enterprise in the past, a beautiful rebellion against academic pretentiousness and narcissistic obscurantism. I do not want to speculate about these reasons any further, but obviously, to talk in an unnecessarily 'revolutionary' tone and to cultivate counterintuitive interpretations of empirical results in order to achieve media attention (a strategy sometimes found in neuroscience) is not the solution either. It could be just another kind of corniness.

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[3] Daniel Dennett, *Sweet Dreams: Philosophical Obstacles to a Science of Consciousness* (Cambridge, Mass.: MIT Press, 2006), 34.

Our resources are limited. My intuition (!) is that, in these exciting times, we should not waste *too* much time and energy investigating what *exactly* the relationship between philosophy of mind and, say, neuroscience, cognitive science or AI ideally should be. Rather, in this particular historical epoch, I think further epistemic progress can be generated by philosophy becoming partly embedded into interdisciplinary research programs, following a strategy which one of my best critics, Josh Weisberg, has called the 'method of interdisciplinary constraint satisfaction' (MICS).[4] Part of the idea is to first confine ourselves to homing in on the target phenomenon in the actual world, using all sources of information available from every single discipline researching the human mind, in order to compress the space of possible solutions dramatically. Then we can see whether, in the course of this historical phase, empirical results have actually changed some of our deeper, theoretical intuitions. Maybe then we might have a better idea of how intuitions evolved in the first place; what concepts actually are; why exactly certain forms of self-deception were adaptive and became superbly robust, spilling over into the enterprise of philosophy and science itself – or perhaps even what actually rendered unargued conservatism and corniness successful strategies in primate societies and the world of our ancestors. Let's say we are interested in consciousness, or in a specific issue like non-conceptual self-consciousness: instead of kicking the problem upstairs into formal semantics and modal logic (i.e., by making *modal* intuitions explicit; intuitions which themselves have an evolutionary history), and instead of analyzing the sociohistorical accident of how we happen to talk about our own minds today, we should perhaps strive to invent a new form of philosophizing, which would be partly data-driven and conducted by philosophers who do not just *talk* about 'first-person methods', but actually *are* phenomenologically well-travelled.

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[4] See J. Weisberg, 'Consciousness Constrained: A Commentary on *Being No One*', *Psyche* 11 (5), 2005, and Metzinger's 'Reply to Weisberg: No Direction Home – Searching for Neutral Ground' in *Psyche* 12 (4), 2006. These papers, as well as a Symposium on *Being No One* can be found online at http://psyche.cs.monash.edu.au/.

C: Cultivating counterintuitive interpretations of the results of the empirical sciences in order to grab media attention would be 'corny' indeed. Yet the fact remains that much of modern natural science is really in no *need* of any such deliberate 'cultivation' in order to bring out its 'counterintuitive' nature, quite simply because it explores aspects of reality to which our evolutionary ancestors simply had no access, and in regard to which it would therefore not have been reproductively advantageous for them to develop any 'intuitions'. This is a point, of course, which you develop at length in *Being No One* with regard to the likely evolutionary provenance of what you call our 'naive-realistic self-misunderstanding'. Indeed, the 'self-model theory of subjectivity' which you formulate is not only something which is 'radically counterintuitive' *for the time being*, as it were – the kind of theory which is deeply unsettling at first but is destined ultimately to be absorbed into the culture at large – but is something which you insist will necessarily *always* remain counterintuitive. 'Even if you are intellectually convinced by the current theory', you write, 'it will never be something *you* can believe in'.[5] Thus, you insist that we can never come to intuitively believe, properly digest or internalize the fact that the 'selves' which we take ourselves to be *do not in fact exist*.

But in this regard you have sometimes been accused of having cultivated an unnecessarily 'radical' or 'counterintuitive' interpretation of empirical results yourself. Of course, science frequently discovers that our commonsensical or folk conceptions of things are inadequate and so radically revises them. Our folk conceptions of space and time, for example, have undergone extremely profound revolutions, yet it is rarely claimed that space and time *do not exist* (even if there are certain avant-garde physicists willing to make precisely such a claim).[6] Rather, the claim is more often that they are not what we, and previous science, took them to be. Thus a predictable and somewhat inevitable objection to your thesis would be that, in claiming that 'no such things as selves exist in the world: Nobody ever *was* or *had* a self',[7] you are overstating your case, since your arguments only motivate a much weaker, *revisionist* position regarding the self, rather than the strong *eliminativist* one indicated by the title of your book.

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[5] *Being No One*, op. cit., 567.

[6] See 'The View from Nowhen: An Interview with Julian Barbour', this volume.

Why, then, do you feel it is necessary to insist that selves *do not exist* rather than that they are *not what we thought they were*? Why can't we think of the project as one of revision and redefinition; of replacing our folk-psychological intuitions with the richer conceptual vocabulary provided by cognitive neuroscience; or of developing new and better-informed intuitions which are grounded in science? Can you say more about the ontological constraints that necessitate eliminating rather than revising the idea of 'the self' and replacing it with the theoretical entity you call the 'phenomenal self-model'?

TM: A lot of very good questions, for many of which I do not have a ready-made, official answer. First, if it makes you feel better (it will), to be a revisionist and come up with some weaker notion of selfhood, fine. The title of the book *Being No One* attempted to allude to many different things at the same time, and certainly wasn't about the rather trivial and unoriginal point that the self is not a substance – Hume said that, Kant said that, Buddhist philosophy of mind had made the point long before, and few people uphold this ontological claim today. Yet, for the purposes of scientific psychology and neuroscience we can certainly do without the ontological commitment to 'a' self.

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[7] *Being No One*, op. cit., 1.

I do claim that everything we want to understand can be understood at the representational, functional, and dynamicist levels of description – and this really is not too breathtaking a point either, at least in my own view. The concept of ‘a’ self just is not a necessary ingredient of explanatory theories. We can predict what we want to predict and achieve the growth of knowledge we want to achieve with a more parsimonious conceptual framework. For example, relative to our interests and a given context, ‘self’ can be substituted by simpler notions like ‘PSM’ (phenomenal self-model), ‘SMT-system’ (self-model theory), or ‘MPS’ (minimal phenomenal selfhood).[8] In other contexts, such as literature, art, or everyday communication, we may continue to use the notion of ‘self’ in order to drive and shape each other’s mental models of reality in a way that we find attractive.

But since selfhood ultimately is a form of phenomenal content, we must take the phenomenology seriously – and the phenomenology *is* Cartesian; it is expressed by what I have called the ‘substantiality intuition’: We actually *do* experience ourselves as ontologically autonomous, indivisible entities, as something that can ‘hold itself in existence’ all by itself, and as something that *knows* about its own existence, with certainty, because in some hard to understand way it is ‘infinitely close to itself’. If we simply take the deflationary attitude again, or try to be good citizens and not exaggerate things too much by saying that, for example, this is just a straw man fallacy and then proposing some weaker notion of the phenomenal self, then we overlook the fact that the *phenomenology* itself is deeply substantialist. Of course, the phenomenology of substantial selfhood is not an epistemically justified claim, it is just a naturally evolved form of phenomenal content. But it must be taken seriously, as I have tried to do. Deflationary accounts cannot do that: Phenomenal selves are not particulars, simples, or individual entities, but dynamical processes, creating locally supervening forms of conscious content.

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[8] See O. Blanke and T. Metzinger, ‘Full-Body Illusions and Minimal Phenomenal Selfhood’, forthcoming in the January 2009 issue of *Trends in Cognitive Sciences.*

C: Clearly, you are not simply reiterating the now familiar claim that the self is not a substance: as you point out, Hume, Kant, Nietzsche, and even Buddhism had already taught us that. Many philosophers, including critics of your views like Dan Zahavi,[9] are perfectly willing to concede this, but only in order to conclude that the self is a *process* rather than a substance. And it precisely by redefining the self as a process that one avoids the stronger (and rather more interesting) thesis that there are no such things as selves. Yet it seems clear that you cannot be content with such a redefinition. Were *Being No One* merely proposing to redefine phenomenal selves as dynamical processes, this would be just a redescription, not grounds for elimination. Rather, your argument would seem to be that the self experienced at the level of phenomenal content is an *effect* generated by non-phenomenal, sub-personal representational processes. Consequently, the self cannot be identified with these processes themselves, since that would be to conflate content at the level of the *representandum* with its *representatum*. This would be why it is no more legitimate to redefine the self as a 'process' than it was to call it a 'substance'. Would you agree that this is what distinguishes your thesis from the more familiar 'self-as-process' thesis favored by many?

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[9] See D. Zahavi, 'Being Someone', in *Psyche* 11 (5), 2005.

TM: My perception is that some who now jump onto the 'self-as-process' reading (which I offered myself in the very first paragraph of *Being No One*) perhaps only do so because this wording has a trendy 'narrative' ring to it – and this, in turn, would set the stage for more of what my excellent British PhD student (who is a bit chaotic, but from whom I learn a lot) has recently termed 'Continental Jazz'. (I now use this new technical term all the time!) But there is no narrator, just selfless dynamical self-organization, and if the self *is* a process, then the least we must admit is that it is a very intermittent, patchy one – it comes to an end every night, in dreamless deep sleep. And waking up is obviously not performed by some transcendental technician of subjectivity pushing a magical reboot button in our brain – there is no subpersonal 'narrator' or 'author' piloting the conscious self. But it is also true that we do need good, modern neurophenomenology providing us with new conceptual instruments; a phenomenology that is not driven solely by ideological anti-reductionist resentment, but one that is at once historically and empirically well-informed. This is an extremely demanding challenge.

But I am guilty of having indulged in 'process' talk as well. A process is a chain of events, and, roughly, events are property instantiations in some given domain, at a specific location in space and time. As long as we stay with the representational level of description, we may differentiate between the representational content of such a process (an abstract property), its carrier (concrete neural dynamics), and the phenomenal properties co-instantiated along with it (Shoemaker and others would say phenomenal 'character' here, I mostly say 'phenomenal content' in order to distinguish it from intentional content per se). 'Selfhood' is precisely such a phenomenal property. But please note that even the vehicle/content distinction is not a necessary one, because it depends on your chosen theory of mental representation. More empirically-plausible ones, like the connectionist model of representation, demonstrate how the content can be *directly* realized in the physics of the carrier – for example in the sheer synaptic connection strength between individual units. It is the connectivity itself that does the job, and we have a host of formal tools to pick out the abstract properties we are interested in – partitions of activation vector space, points in weight space, trajectories, and so on. My own position is that introspectively available phenomenal content is just a very small subset of the overall intentional or representational content systems like ourselves generate and use, namely that portion which is locally determined, because it depends on microfunctional properties realized by the NCC (neural correlate of consciousness). Consciousness is in the brain, but a lot of cognition certainly isn't – and if you don't believe that, you should read Andy Clark's new book *Supersizing the Mind*.[10]

In the new TICS paper, Olaf Blanke and myself,[11] based on our own experimental work attempting to create out-of-body experiences in healthy individuals, have presented a framework for the *simplest* form of conscious selfhood. Self-consciousness is in the brain, a lot of self-related cognition certainly isn't. In particular, agency is not a necessary condition for conscious selfhood, but self-location in time (presence), self-location in space (embodiment), and identification (with the transparent content of a body-image) seem to be the three decisive dimensions. So if I speak of a 'process' I envision an intermittent neural dynamics that can sometimes instantiate and functionally integrate phenomenal properties of this kind. The existence of content does not, of course, imply that there is *reference* as well. The subjective aspect of substantiality in this representational process could be entirely misrepresentational, a form whose *character* is entirely phenomenal.

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[10] A. Clark, *Supersizing the Mind: Embodiment, Action and Cognitive Extension* (Oxford: Oxford University Press, 2008).

[11] See note 8 above.

C: The Cartesian 'substantiality intuition' regarding selfhood which you have mentioned – rooted as it is, as you say, deep in the evolutionary past of our species, and forming the very content of our understanding of who we are and our place in the world – is certainly not one which is likely to be abandoned any time soon. Indeed, as we've already mentioned, it is extremely difficult to imagine how the idea that what people pre-reflectively take to be their innermost 'self' is in fact nothing other than a kind of ongoing phenomenal hallucination generated by their brains could ever take root at an intuitive level. Broadly similar ideas which were afloat in the psychophysiology and philosophy of the mid-to-late nineteenth century were compared by Friedrich Albert Lange to the impact of the Copernican revolution in astronomy: Just as it was once amazingly difficult for people to think of this fixed earth on which we stand, 'the prototype of rest and stability', as moving, so it would be all the more difficult for them to recognise their own phenomenal selves, 'the prototype of all reality for them', as 'a mere scheme of representation' generated by what Lange called their 'psycho-physiological organisation'.[12] In this regard, you have written that neuroscience may instigate a revolution in our self-conception more radical than any previous scientific revolution, a revolution which might have 'greater social and cultural ramifications than any previous theoretical upheaval'.[13] Could you explain what kind of upheaval you have in mind here? How do you envisage such a cultural and social upheaval given that, as you also insist, your self-model theory of subjectivity is constitutively indigestible for us at any intuitive level of lived experience, and so necessarily confined to the level of the philosopher's conceptual understanding? What conditions would need to be in place for this 'cultural integration'[14] of your thesis to take place?

TM: Again, a lot of very important questions, and I have tried to address some of them in a forthcoming non-academic book, *The Ego-Tunnel: The Science of the Mind and the Myth of the Self*.[15] To cut a *very* long story short, neuroscience turns into neurotechnology, neurotechnology turns into phenotechnology, and in the course of the next fifty to two hundred years such phenotechnologies will gradually invade our *Lebenswelt*, or 'life-world'. Even given a culture of denial this may then actually have a lot of psychosocial consequences – which, however, are very hard to foresee today. We see the very first, early developments in neurotechnology today – cognitive enhancers such as modafinil,[16] forensic neurotechnologies like brain-fingerprinting, and new types of lie detectors, or the development of new brain-machine interfaces, as in the case of the monkeys at Duke University controlling humanoid robots in Japan via the internet,[17] and so on. A small subset of these new technologies is already used to directly control information flow within the NCC itself, for example by alleviating severe, treatment-resistant depression through direct deep brain stimulation with electrodes and so on.[18] My point is that a small fraction of neurotechnology will slowly turn into consciousness technology and that *this* may have cultural consequences, even if we haven't got the proper, comprehensive theory of the human mind yet. The ethically relevant class of actions could be defined as all those forms of practical intentionality in which the content-specifier consists of satisfaction conditions centrally involving phenomenal contents. Now, more and more actions become technologically available, which directly influence information flow in the NCC and directly determine phenomenal content. I'm sure many people will have heard about the full-body illusion experiments carried out in Lausanne by Bigna Lenggenhager, Tej Tadi, Olaf Blanke and myself,[19] and perhaps some have heard about Henrik Ehrsson's brand-new variation of his own earlier studies in which you actually have the conscious experience of shaking your own hand in cyberspace.[20] What if it actually became feasible to directly control an artificial body-model in VR with your brain *and* to fully identify with the avatar on the phenomenological level (a possibility the self-model theory predicts)? Many might spontaneously say this would be terribly 'cool' or 'awesome' – but for my part, I am not so sure. If one really tries to think through, in a more sober and critical fashion, some of the consciousness technologies that are now on the horizon, one finds that the challenges they present are not only ethical, but perhaps also challenges to our mental health.

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[12] F. A. Lange, *The History of Materialism* (London: Routledge & Kegan Paul, 1925), Book 2, Section 3, Chapter 4, 206.

[13] T. Metzinger (ed.), *Conscious Experience* (Paderborn: Ferdinand Schöningh, 1995), 13.

[14] See *Being No One*, op. cit., 2.

[15] T. Metzinger, *The Ego Tunnel: The Science of the Mind and the Myth of the Self* (New York: Basic Books, forthcoming 2009).

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[16] See Henry Greely et al., 'Towards responsible use of cognitive-enhancing drugs by the healthy', published online in *Nature*, 7 Dec. 2008: 702-5.

[17] See http://www.sciam.com/article.cfm?id=monkey-think-robot-do.

[18] See Helen Mayberg et al., 'Deep Brain Stimulation for Treatment-Resistant Depression' in *Neuron*, Vol. 45, 2005: 651–660.

C: It is tempting to say that once such 'consciousness technologies' become possible, it will be very difficult for any ethical agency to prevent or control their deployment. But perhaps part of the motivation for your publishing a book aimed at a wider audience is precisely to pre-emptively open up a public discussion of these possibilities before they become reality. What did prompt you to write a non-academic work like *The Ego Tunnel*, and could you summarize its contents for us?

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[19] O. Blanke, B. Lenggenhager, T. Metzinger and T. Tadi, 'Video Ergo Sum: Manipulating Bodily Self-Consciousness', *Science,* Vol. 317, no. 5841, 2007: 1096-9.

[20] See V. Petkova & H. H. Ehrsson, 'If I Were You: Perceptual Illusion of Body Swapping' in *PLoS ONE*, Vol. 3, Issue 12, 2008, 1-9. See http://www.plosone.org/article/info:doi/10.1371/journal.pone.0003832.

TM: I just wanted to try something new. *Being No One* was my third monograph. I had also done service for the scientific community by editing two or three anthologies focused on consciousness and by helping to construct an academic society (the Association for the Scientific Study of Consciousness),[21] setting up an infrastructure for consciousness research. So I thought it could perhaps be interesting to move on from research to teaching and the public understanding of science, at least on the level of books. So I began working on a three-volume text-book called *Grundkurs Philosophie des Geistes* (a basic course in philosophy of mind covering mostly the second half of the twentieth century, which will eventually appear in an English version as well). I am now working on Volume 3, which is on intentionality and mental representation and scheduled for publication in summer 2009. Volume One, on phenomenal consciousness, and Volume Two, on the mind-body problem, already appeared in 2006 and 2007 respectively. *The Ego Tunnel* has the subtitle 'The Science of the Mind and the Myth of the Self'. It is a popular book which will appear in March 2009. It addresses a wider audience, has a playful and experimental character to it, and attempts to explain an entirely idiosyncratic selection of those issues I personally judge to be most important in what I call the ongoing 'consciousness revolution', to the educated layperson. Of course, there is a quite a bit on self-models in there, with many concrete examples, and three interviews with prominent neuroscientists as well. The two final chapters address some of the consequences of these new scientific insights into the nature of the conscious mind-brain: the ethical challenges they pose and the social and cultural changes they may produce, given the naturalistic turn in the image of humankind. I close by arguing that ultimately we will need a new 'ethics of consciousness'. If we arrive at a comprehensive theory of consciousness, and if we develop ever more sophisticated tools to alter the contents of subjective experience, we will have to think hard about what a *good* state of consciousness is. So yes, as you say, one of the functions of this project could be to draw the attention of a wider public to the relevance of neuroethics and *normative* issues that have been neglected. (Another ethical question with which I am deeply concerned these days is whether or not I should stop writing books now!)

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[21] See http://assc.caltech.edu.

C: In his 'Empiricism and the Philosophy of Mind' Wilfrid Sellars suggests that eliminativist claims such as the claim that 'physical objects are not coloured' ought to be construed not as statements *within* the framework of common sense or the manifest image, but rather as *challenges to the framework itself*.[22] Accordingly, is your claim that selves do not exist meant to be construed as part and parcel of a broader challenge to the manifest image, and if so, what else might need to be eliminated from it? After all, it would seem strange to say that it is only our folk conception of human beings as persons that is false; that beliefs and desires and selves do not exist but that the things about which we say we have beliefs and desires are adequately captured by common sense. So if we envision a future in which we employ the language of cognitive neuroscience rather than folk psychology, wouldn't this have to be part and parcel of a much broader overhauling of all our other folk conceptions such as our intuitive or commonsensical folk physics, folk biology, etc.?

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[22] Wilfred Sellars, *Science, Perception and Reality* (Atascadero, California: Ridgeview, 1963), 172-73.

TM: Let me first give a 'Continental Jazz' type of answer to this question: Folk psychology is not only a theory, but also a practice. A lot of things will happen in science and philosophy, but the question of course is how this will actually change the practice, what it will do to everyday social interactions for example. As I pointed out above, although the way we speak about ourselves may only change slowly and gradually, the more likely prediction is that new *technologies* will invade our life-world and have an impact on the way we look at ourselves – because they directly change social interactions. The 'manifest image' is anchored in the phenomenal model of reality that evolved in our brains over millions of years, and it will certainly prove to be quite robust, at least in its transparent sensory and motor partitions. Social emotions and the opaque cognitive layers in our self-model, however, may prove to be more sensitive to a new cultural context. Actually folk psychology – understood as a pre-theoretical set of conceptual assumptions about reality – has already been completely demolished, just like folk physics. What will prove to be more robust is the pre-linguistic phenomenal model of reality anchored in our brains. And, functionally speaking, this is predominantly what drives our behaviour.

There is a deeper aspect to your question, however: it pertains to the 'self-as-epistemic-subject'. What many do not see is that there is also a sort of 'folk epistemology' – a deeply engrained, naturally evolved set of assumptions about what it means to know, what certainty is, how we mentally represent the world. If cognitive neuroscience also dissolves our traditional ideas about what a knowing self – an 'epistemic agent' – is, then this might also eventually have interesting consequences for the theory of science and philosophical epistemology.

C: Do you foresee an increasing resistance to your attempt to integrate philosophy and neuroscience, given philosophy's institutional complicity with servicing socio-cultural interests (morality, religion, liberal-democratic consensus, etc.)? What scope might there be for the kind of radically revisionary philosophical naturalism to which you are committed given how energetically some professional philosophers insist on providing alibis for folk superstition? Is the human race doomed to eternal resistance to such difficult and uncomfortable scientific truths? Or is such 'difficulty' simply based upon a misconception as to what theses like yours entail? What sort of cultural effects might we expect were they to be integrated into our everyday understanding of the world?

TM: A sincere sensitivity to ethical issues, a commitment to liberalism and democracy – if taken seriously – are very radical affairs, not something old-fashioned, and if philosophical conservatism (you may be disappointed to hear) means keeping such sociocultural interest alive then we certainly need good, professional, analytical philosophy to do this. The overall situation on our planet reminds me of one big ocean of irrationality, suffering and confusion – if more conservative philosophy's 'complicity' with certain social institutions can help at least a little bit to improve our situation, then this is a good thing.

I think, taken as a whole, humankind will prove to be absolutely robust in its resistance against the growth of knowledge, against what I sometimes like to call the 'Enlightenment 2.0' introduced by modern philosophy of mind and cognitive neuroscience, AI and AL, etc. There may be some rare individuals or even groups who find an interesting new synthesis of intellectual honesty and spirituality. But on a larger scale I believe two types of reactions are most likely to spread: A primitive form of hedonism, based on vulgar forms of materialism and a cynical, simplistic version of normative neuroanthropology; and the rise of irrationalism and fundamentalism, even in secular societies, supported by all those who desperately seek emotional security and espouse closed worldviews, simply because they cannot bear the naturalistic turn in the image of humankind. Both types of reaction are deeply human, and obviously, both are a danger to the very few stable, open societies we have established on this planet so far.

C: We certainly don't intend to denigrate the value of hard-won civil liberties or the democratic ethos: a sincere sensitivity to ethical issues and a commitment to democracy are indeed very grave and important matters, and certainly in no way 'old-fashioned'. But the question remains whether social institutions shaped by a conception of human beings as maximally rational, self-determining agents –

a conception with deep ties to a philosophical tradition that construes ‘selfhood’ as the defining feature of properly human being or ‘personhood’ – will prove adequate to the challenge of improving a human condition characterized by the undeniable surfeit of what you yourself describe as ‘irrationality, suffering, and confusion’. Might there not be a fundamental difficulty in reconciling the naturalistic understanding of selfhood as an inevitable ‘user-illusion’ generated by the human organism with a commitment to the irreducible worth of persons understood as the ultimate loci for the freedom and dignity attributed to the individual? Does the notion of ‘selfhood’, given its close ties to the concept of ‘personhood’, not serve to anchor the ethical, political, and juridical norms upheld by those who espouse liberalism and democracy? Can one really retain these norms while denying the existence of the ‘selves’ that were supposed to feature among the necessary conditions for human personhood and serve as the bearers of freedom and dignity? Can there be persons without selves?

TM: Persons are not something we find out there, in objective reality. Persons are *constituted* in societies – through mutual acts of, say, acknowledging each other as rational and morally sensitive individuals. There can be selfless persons. Selfless individuals could certainly acknowledge each other as rational, and agree on a basic political and moral consensus. The problem is rather that we may turn out to be less rational than we thought, and less self-determining (whatever this might mean exactly) than our own previous anthropological self-idealizations have encouraged us to believe. My point is that (if this unargued empirical speculation turns out to be true) it would be irrational as well as unethical in itself if we didn't take such new empirical insights into account. But will we be rational and ethical enough to let new data about the evolutionary history and the neural underpinnings of rational thought and moral cognition themselves influence decision-making, say, in pedagogy or politics?

I think you make a very good, and relevant, observation in describing why many of our best political theorists assume they *must* resist a naturalization of selfhood: They see the danger of bulldozing the normative dimension of personhood, of losing the 'critical subject'; the dangers associated with an erosion of precisely what you call the 'anchor' of our ethical, political, and juridical norms. You cannot imagine how well I know these worries and anti-reductionist resentments! When I studied philosophy at Frankfurt in the late 1970s, it was not only trendy, but a frequently repeated and politically-correct commonplace move among we students to call the kind of stuff I and others do today 'proto-fascist'. I was part of the more radical wings of the alternative movement of the late 70s, and when I sat in the seminars of Jürgen Habermas and so on all of this was certainly too superficial and not radical enough for me – at that time I thought that if you were really *serious* about getting in touch with political reality then you could do this by smelling some tear-gas, or by *actually* walking through shanty-towns in India. I certainly do respect Habermas and old-school political philosophy, but I have always thought that one has to dig *much* deeper in order to understand not only how the German catastrophe could happen, but why we seem unable to end all this violence and oppression, the constant turmoil on our planet that we call our 'history'. I think it is a kind of intellectual tragedy that most of the best political philosophy is systematically shielding itself off from neuroscience, evolutionary psychology, and so on. It does damage to our discipline.

C: This obdurate refusal on the part of most political philosophers to acknowledge any possible connection between the normative and the neurophysiological is indeed a kind of intellectual tragedy. But tragedy also veers into farce, as when the veritable phobia towards 'scientism' and 'reductionism' exhibited by Frankfurt School Critical Theory leads its adherents to issue moralistic denunciations of science and technology which are virtually indistinguishable from those of institutions like the Catholic Church. But critical theorists are certainly not alone in this regard. Returning to your earlier comments about analytic philosophy: We share your admiration for the analytic tradition's commitment to intellectual sobriety, responsibility, and rigour. However, despite these virtues, it cannot be wholly absolved from responsibility for the kind of neo-scholastic 'intuition-mongering' critically invoked at the beginning of this interview. Thus we are less convinced that this tradition is entirely innocent when it comes to promulgating the kind of 'closed worldviews' which actively obstruct the growth of natural-scientific knowledge. While twentieth-century analytic philosophy may have started out in part, as you put it, as 'a beautiful rebellion against academic pretentiousness and narcissist obscurantism', once should not forget that it was also in many cases an avowedly *anti-naturalist* rebellion bent on preserving the autonomy and 'purity' of philosophy by actively preventing its hybridization with empirical disciplines such as experimental psychology (a story minutely documented in Martin Kusch's *Psychologism: A Case Study in the Sociology of Philosophical Knowledge*).[23] Indeed, one might argue that the active resistance on the part of many academic philosophers to any miscegenation of philosophy with the empirical sciences ultimately has the unfortunate effect of helping to make the world safe for the irrationalism and fundamentalism of those who, as you put it, 'cannot bear the naturalistic turn in the image of humankind'. In this regard, your use of the expression 'Enlightenment 2.0' is particularly suggestive: could you elaborate? Are you referring to the way in which the techniques and methods of the natural sciences are now being used to explore those phenomena which we take to constitute the core of our humanity, i.e. mind and consciousness? The emergence of a 'science of cognition' would seem to represent science's attempt to understand itself by investigating the structure of the mind engaged in investigating reality. Is this the ultimate twist in the trajectory of Enlightenment: the twist whereby the explanatory strategies hitherto used to disenchant 'outer nature' are now being deployed to disenchant our own 'inner nature'?

TM: Well, first, anti-naturalism could be true. We have to take one philosopher and one argument at a time. I certainly do understand your point – academic disciplines are self-modeling entities too, and they tend to preserve their boundaries. There will always be individuals who profit from isolationism, from keeping the boundaries hard and the methods 'pure'. There is this conservative social movement within analytical philosophy, yes. But let us not commit a psychologistic fallacy or indulge in paranoia – I do not know any anti-naturalists who *intend* to make the world safe for the irrationalism and fundamentalism. The question is simply who is right here.

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[23] New York and London: Routledge, 1995.

Enlightenment 2.0 will tell us more about what the conditions of possibility for knowledge are. We will use our intelligence not only in order to understand its own evolution, but also to begin to optimize it. We will use scientific rationality to gradually understand the fine-grained, microfunctional properties realized by our brains that *enabled* scientific rationality in the first place. If one takes a closer look, it is unclear what 'Enlightenment 1.0' actually was, but at least there were certain general *attitudes* increasingly shared and cultivated in Western society – a critical questioning of traditional institutions, customs, morals, and so on. I think that in the decades to come we may be able to elevate this old philosophical project to a new level of precision and generate a sustainable growth of knowledge by connecting it to our new partner disciplines like cognitive neuroscience. In particular, we could free the Enlightenment project of the accusatory, moralizing tone it has tended to exhibit in the past – we may obtain a better understanding of the ways in which in-group behaviour, tribalism, traditionalism, unargued conservativism, higher-order forms of self-deception and cultures of denial actually evolved, what their neural underpinnings are, why they proved to be adaptive in the world of our ancestors and how they now spill over into the process of doing science.

We may also come to understand how this effect could be minimized. In the course of this process we will also see that actual scientific practice is not at all something carried out by philosophical saints pursuing the ideal of self-knowledge, but is often driven by jealousy, ill-will, ostentatious behavior and brute career interest. This could indirectly bring about a great improvement in the process itself; it could serve to foster intellectual honesty. But Enlightenment 2.0 may also have a sobering quality about it, extending Max Weber's 'disenchantment of the world' to the conscious self. We will have to pay an emotional price for it – and what I am interested in is what this may do to the forces of social cohesion, to what Habermas would have called *soziale Bindekräfte*.

C: In *Being No One*, you describe the object which I consciously experience as holding in my hand as 'a dynamic, low-dimensional shadow of the actual physical object in your hand, a dancing shadow in your nervous system'.[24] Does this not also imply that the hands which are holding the book, and indeed, the entire manifest image of the world, turns out to be 'a dancing shadow in my nervous system'? There are several other places in your book where you say that the content of our phenomenal image of the world is 'solely' and 'exclusively' due to our neurophysiology. For example, you write: 'Our conscious model of reality is subterranean in that it is *determined exclusively by the internal properties of our nervous system* [...] phenomenal experience as such unfolds in an *internal* space, in a space quite distinct from the world described by ordinary physics [...] [and] evolves within an individual model of reality, in an individual organism's brain, and its experiential properties are *determined exclusively by properties within this brain*'.[25] Similarly, the cognitive scientist Donald Hoffman has argued that our perceptions of the world no more resemble the world itself than a computer icon resembles the inside of a computer.[26] Would it be fair to say that, for you, representation is more akin to simulation, understood as the process whereby the mind-brain *generates* its own virtual phenomenal reality, than to replication, understood as the process whereby a mirror *reflects* a pre-existing reality? But then what is the ontological status of the reality that is being perceived or simulated? Moreover, how do we get to know about the non-phenomenal objects to which the phenomenal 'shadow-objects' of our experience supposedly correspond in some way, and what is the nature of this correspondence? Does your conception of representation allow for the possibility that our perceptions might resemble aspects of the unperceived world in some sense, at least at a structural level? Or does the world generated by representational processes, the world of commonsense phenomenal experience, screen us from the world in itself? We might be tempted to insist that the only real objects are those quantified over by fundamental physics, but the problem with this is that fundamental physics nowadays doesn't quantify over *any* objects (a point made by James

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[24] *Being No One*, op. cit., 549

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[25] Ibid., 547-8; emphasis added.

[26] Donald Hoffman, *Visual Intelligence: How We Create What We See* (New York: W. W. Norton and Co., 1998); cf. 'Conscious Realism and the Mind-Body Problem' in *Mind & Matter*, 6:1, 2008: 87-121.

Ladyman in another interview for this volume),[27] and certainly doesn't provide us with anything like the 'actual physical objects' experienced in phenomenal consciousness. How, then, is science, which would seem to be rooted in the domain of phenomenal experience at some level, able to access reality? Can science dispense with appeals to perceptual consciousness altogether? Where do you stand on these basic epistemological issues?

TM: Well, we should never conflate intentional and phenomenal content. Conscious experience *per se* is how the world *appears* to you – that is all. Epistemology only comes in with intentionality, with semantic properties of representations, such as reference or truth. Unfortunately I don't know Ladyman's work yet, but it seems obvious to me that he has a very good point – we have to assume those entities as existing that our best current theories with the highest predictive success etc. *need* to postulate, and classical objects will not be among them. I like to look at our phenomenal model of reality – including objects, properties, relations, naïve physics and all – as a multimodal interface to navigate our behavioural space, a tool enabling the organism to successfully close certain sensorimotor causal loops on a very coarse-grained level, shielding it from the underlying causal complexity. Consciousness is autoregulation in a system that has become much too complex to understand itself. The phenomenal model of reality is a naturally evolved virtual organ, and segmented scenes, sets of properties bound into robust objects, and so on, were functionally adequate fictions – just as selves were. But the majority of these fictions *must* have picked out at least some of the relevant causal regularities governing 'middle-sized' physical phenomena in our space of interaction, or else they would not have helped us to copy genes more efficiently. Other virtual models may have been adaptive precisely *because* they created functionally adequate forms of self-deception. But given the evolutionary history of nervous systems as a background assumption, it is hard to see how the majority of relational/structural assumptions about our ecological niche could have been outright false – our ancestors would not have survived.

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[27] See 'Who's Afraid of Scientism? Interview with James Ladyman' (this volume), and James Ladyman and Don Ross with David Spurrett and John Collier, *Every Thing Must Go: Metaphysics Naturalized* (Oxford: Oxford University Press, 2007).

You may remember that in *Being No One* I explicitly and deliberately decided not to develop a theory of mental representation, and to ignore epistemological issues in favor of fine-grained neurophenomenology. But I did – very vaguely and perhaps inconsistently – endorse connectionism, embodied dynamicist cognitive science and Johnson-Laird's theory of mental models as working background assumptions. For a mental model, the key phrase you are looking for could be 'partial relational homomorphy' – perhaps it is like a child's colouring-book: an extremely selective set of outlines is given, but all the colours are self-made. The extremely small and selective set of spatiotemporal relations and causal regularities faithfully carried over into our perceptual model of reality might then be something that is strongly relative to our bodies and the actions beings like us can perform in the world – a world without objects or selves, but one that can be known through the right combination of science and philosophy.

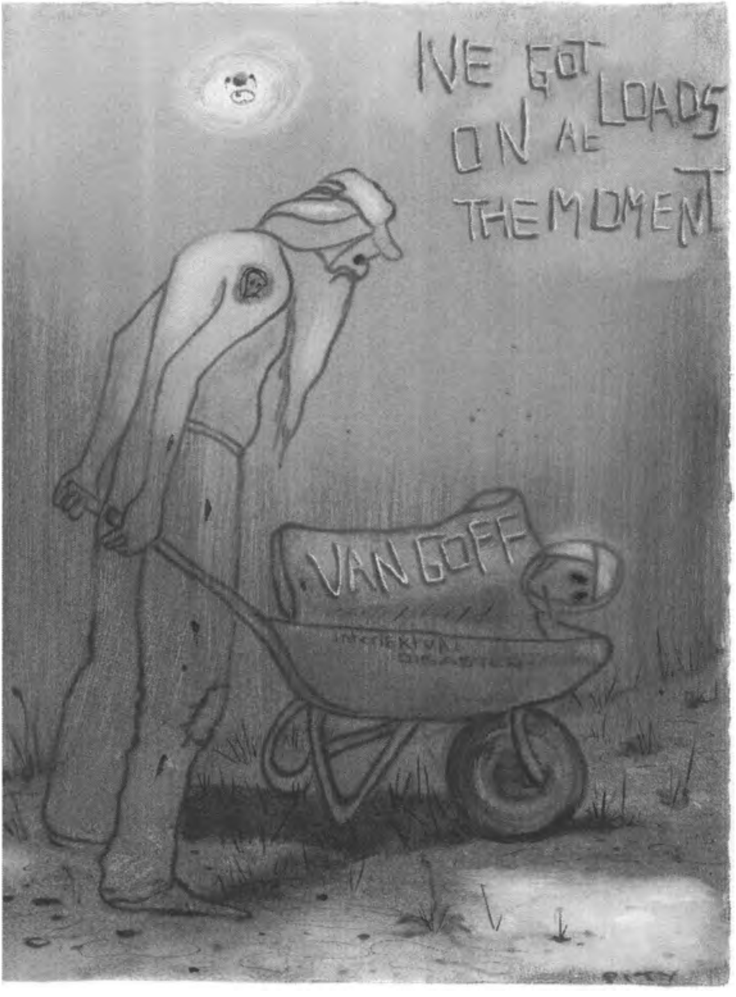
Thinker Dejecta

Nigel Cooke

p218. *Thinker Dejecta Labour*
p219. *Thinker Dejecta Research*
p220. *Thinker Dejecta Action*
p221. *Thinker Dejecta Leisure*
p222. *Thinker Dejecta Toxin*
p223. *Thinker Dejecta Reflection*

All works oil on paper, 76 x 57.5cm, 2008.

Courtesy of Stuart Shave/Modern Art, London, and Andrea Rosen Gallery, New York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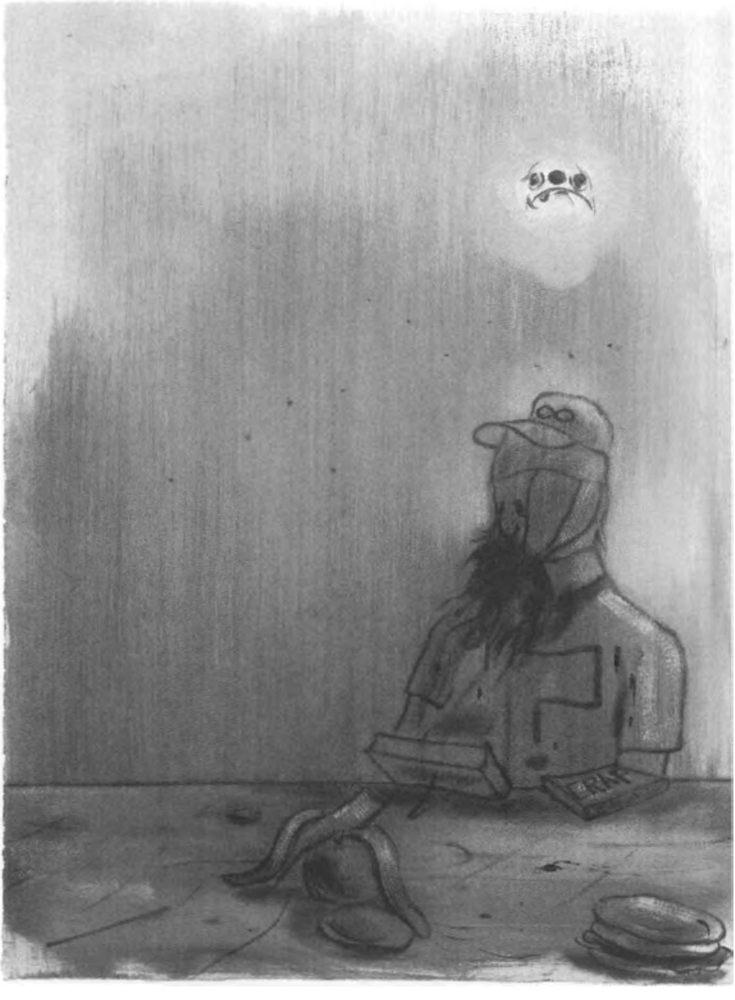

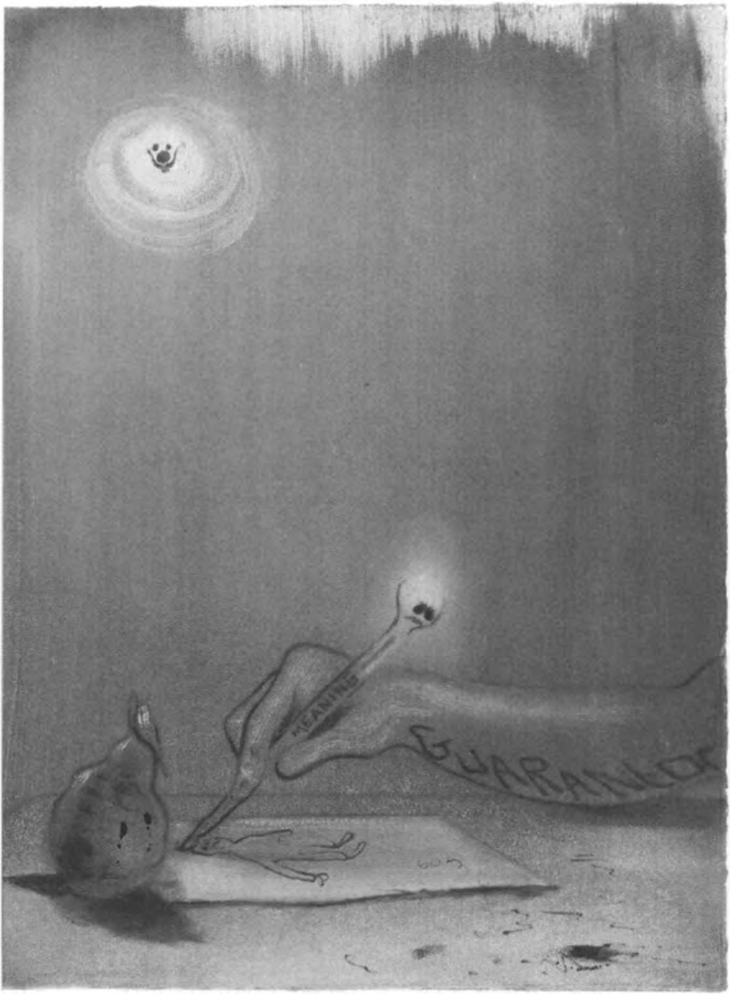
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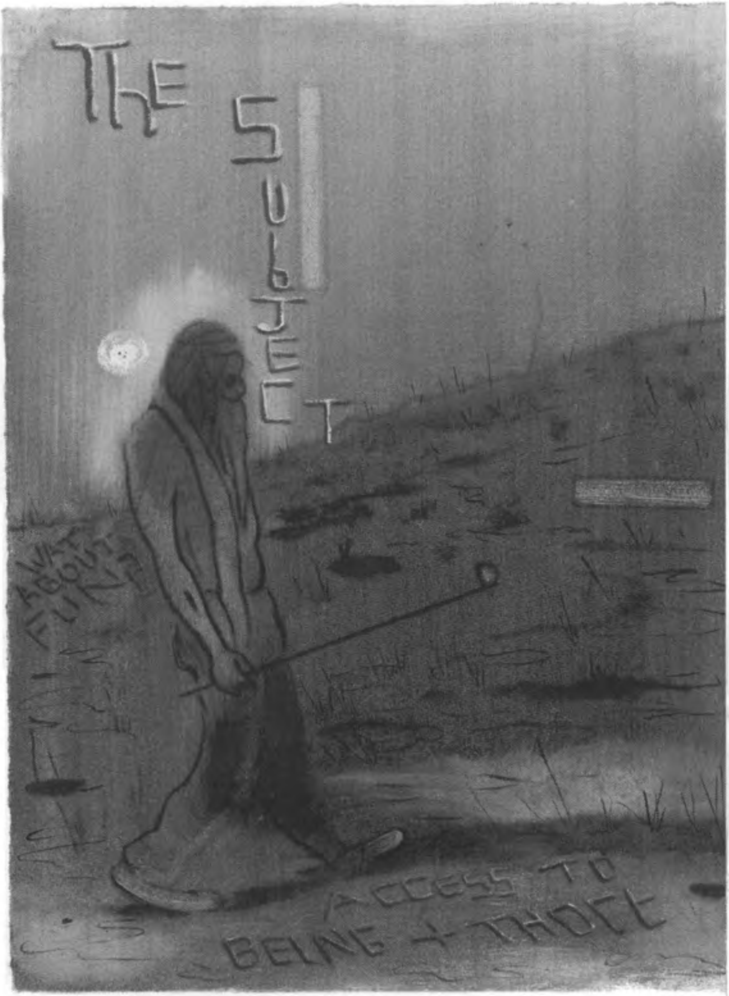
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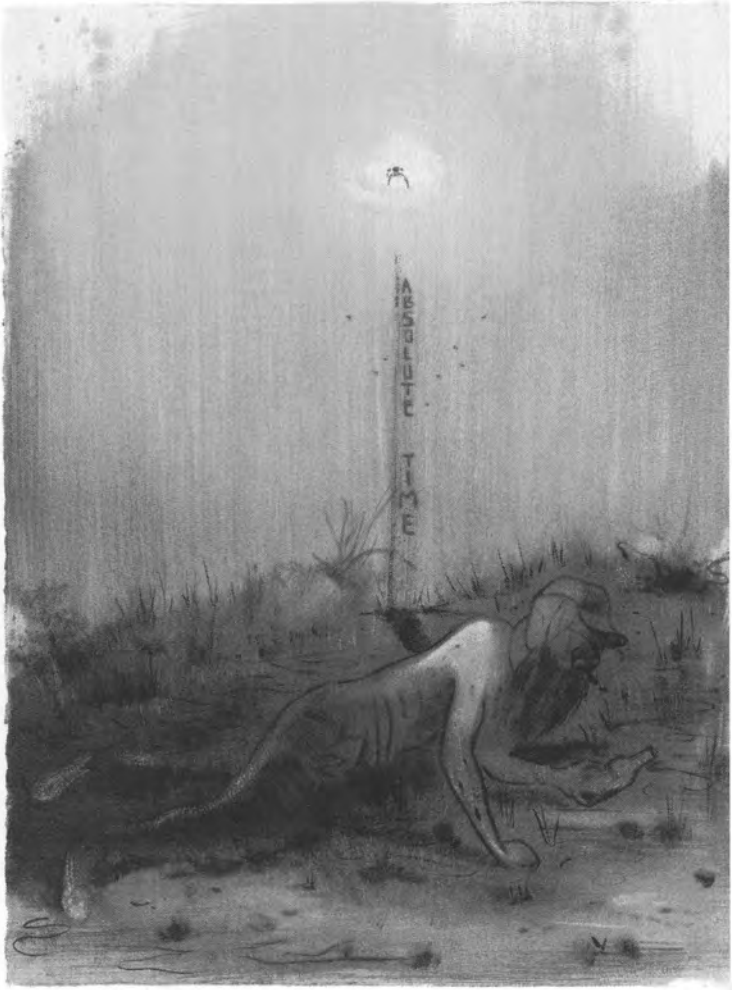
ABSOLUTE TIME

Alien Science

Interview with Jack Cohen and Ian Stewart

One of the most fertile collaborations in contemporary popular science writing began with a biologist and a mathematician meeting for lunch at a Coventry pub in 1990. Combining their prodigious knowledge of contemporary science, the unique partnership between Jack Cohen and Ian Stewart has spawned a series of popular science books remarkable in their scope, epistemological subtlety and conceptual innovativeness. To read 'Jack&Ian' is to embark upon an exhilarating and intellectually enriching ride through the thickets of contemporary scientific thinking and emerge with a profound sense of how it all interconnects. Their combined critical perspective brings much-needed clarity to popular science memes such as 'emergence', 'chaos' and 'complex systems', and they can be relied upon never to neglect the 'big picture'. In our interview, Cohen and Stewart recount the history of their 'complicit' collaboration, discuss the significance of the novel ideas proposed in their co-authored works, explain their criticisms of reductionism, anthropic reasoning and astrobiology, and tell us about the aliens who helped them to write their books.

Collapse: Perhaps a good place to begin would be with one of the key conceptual innovations of your work together, namely 'complicity', which you define in the opening pages of your first major co-authored work, *The Collapse of Chaos*,[1] as 'the tendency of interacting systems to co-evolve in a manner that changes both, leading to a growth of complexity from simple beginnings – complexity that is unpredictable in detail, but whose general course is comprehensible and foreseeable'. The same concept is introduced more succinctly in *What Does a Martian Look Like?*[2] as referring to 'any process by which two different systems recursively complicate each other by repeated interaction'. Perhaps you could say a few words about the simple beginnings and co-evolution of what you have described as 'the collective entity [...] Jack&Ian'?[3] When and how did this unique collaboration come about, and what are some of the ways you have 'recursively complicated' each other over the years of your repeated interaction?

Ian Stewart: Jack and I met in 1990. He had read my book *Does God Play Dice?*,[4] and some of my SF stories, and sensed a fellow spirit. He phoned me, we met in a pub for lunch, and we were still there at about half past five, discussing various areas of science. We continued to meet about once a week for several years, and out of those discussions emerged the plan for a book: *The Collapse of Chaos*. One of the first questions Jack asked was 'what's a good word for two processes interacting but modifying each other recursively, so that they end up being completely different from anything you'd expect just by putting them together?'. At the time, I had no idea.

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[1] Jack Cohen & Ian Stewart, *The Collapse of Chaos: Discovering Simplicity in a Complex World* (London: Penguin Books, 1994).

[2] Jack Cohen & Ian Stewart, *What Does a Martian Look Like? The Science of Extraterrestrial Life* (London: Ebury Press, 2002).

[3] *What Does a Martian look Like?*, op. cit., xii.

[4] Ian Stewart, *Does God Play Dice? The Mathematics of Chaos* (Oxford: Blackwell, 1989).

JACK COHEN: I'd been very caught-up in this issue, looking for a vocabulary for interaction with change in both sides, having in mind nature/nurture etc., specifically for embryology (a book on reproduction was in preparation); asking actors (e.g. Ken Campbell – recently deceased alas) what words they used for audience relations: when actor comes on stage, audience changes; seeing that change, actor reacts. 'Well, yes', they said, 'that's so of course – but we don't have words for it ... !'. I was also doing the 'Cell Biology' chapter for a great tome in *Obstetrics & Gynaecology* and, having done a drawing of a lot of the reactions in 'the cell', had come to the conclusion that it would all knot up, there was no way that these reactions could 'proceed'. There was something in *Does God Play Dice?*, which I'd just read, that suggested that Ian could be of help, so I rang him. We arranged to have lunch in the Coventry Cross pub the next day.

IS: During the writing of *The Collapse of Chaos*, I was playing word-games with 'simplicity' and 'complexity', as part of an attempt to characterise how simple large-scale structures and behaviours can emerge from the interaction of large numbers of simple components, and the words 'simplexity' and 'complicity' presented themselves. Of course 'complicity' is a standard word, but what it means has strong echoes of Jack's question about recursive interactions between two systems. So we decided to give it a more technical meaning, in the context of complex systems.

By the time we wrote *What Does a Martian Look Like?* we had become used to employing the word, so we explained it in the simplest terms we could think of to avoid importing too much baggage from complex systems.

Jack&Ian is itself an example of complicity. We have similar attitudes in many ways, but very different backgrounds. In particular Jack is a biologist and I'm a mathematician, and in those days the two subjects tended to see eyeball to eyeball rather than eye to eye. But we discovered that most of the generic questions (such as 'how do you stop PhD students spending their time on tedious routine work and get them to start thinking about the problems?') were common to both subjects. As we explored the common issues, we found that the combination of viewpoints often led us in directions that neither of us would have thought of on our own. The concept of 'complicity' was one example. It very much felt as though there was a combined entity which somehow knew more than both of us did put together. To distinguish our individual ideas from the joint ones, we referred to 'Jack&Ian'.

JC: The Jack&Ian viewpoint(s) was a curious mix: Ian was very divergent (consistent with the chaotic viewpoint: the space between the piano-keys increases, and you get more keys etc.) and I was very convergent (the egg splits, but you don't get two half-embryos – each 'heals' and becomes a complete embryo!). The first paper we did together, which was called 'Chaos, Contingency and Convergence',[5] exposed this difference amusingly, and laid the foundation for *The Collapse of Chaos*, in many ways.

C: One of the most striking aspects of your collaborative works is the impression one receives of a genuinely creative symbiosis of ideas originating from widely disparate fields of inquiry. While one can of course at times identify certain concepts and themes as bearing the signature of either 'JC' or 'IS', the way in which they then come together and re-emerge, reciprocally transformed as it were, in your co-authored writings, is something remarkable indeed. Would you care to comment upon the collaborative process which goes into writing your books?

IS: We even make such identifications ourselves, on occasions when one of us has a particular viewpoint and the other isn't sure. So we kind of sense when we are in JC and IS mode, and when it's Jack&Ian.

How we work depends on the book. *The Collapse of Chaos* and *Figments of Reality*[6] were both written the same way. We talked a lot, about whatever came to mind. We took rather scrappy notes. As the ideas came together, Jack would put together a plan.

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[5] *Nonlinear Science Today*, 1991: 9-13.

[6] Jack Cohen & Ian Stewart, *Figments of Reality: The Evolution of the Curious Mind* (Cambridge: Cambridge University Press, 1997).

JC: Only about a sentence or two for each chapter ...

IS: After I'd commented on the plan, he fleshed each chapter heading out into about four pages of notes. Then I expanded them to chapter length, usually rewriting heavily, putting in anything related that seemed to fit, marking gaps for later repair ('Jack: tell me more about ampulla of Lorenzini'), making suggestions ('Would it be worth referring to Schrödinger's cat here?'). Jack would return the manuscript covered in pencilled responses and comments, and we'd go round the same procedure several times. On the whole we did this chapter by chapter, so I might be polishing one while Jack was tearing another to bits. As it began to converge, we took a broader view, did an editorial job on each other's contributions, chucked stuff out, replaced it with something we thought was better.

JC: A lot of this involved quite deep argument. I think there were times when the question 'How could I ever have thought that we could work together?' occurred to both of us. But then we just had to get Jack&Ian to sort out the problem, or – occasionally – we'd just leave both views in.

IS: Some stuff was self-indulgent – notably the Zarathustrans, a race of aliens with a group mind – but they were there for a reason. Their role was to jog us, and our readers, out of the safe, familiar, parochial way of thinking. Sometimes the Zarathustrans illuminated things for us, too. I'd write a sentence, look at it, and ask myself 'now what would the Zarathustrans say about that?' And sometimes they'd say it was rubbish, and I'd work out what their viewpoint would lead to, and occasionally that made more sense than what I'd written. I think many authors find that their characters sometimes take over the book – not in reality, they're inventions, but in imposing a kind of consistency. 'Would my character do/say that?' And sometimes the answer changes your mind.

Our science fiction novels *Wheelers*[7] and *Heaven*[8] followed a very different pattern. We plotted *Wheelers* on a boring car journey from Coventry to Plymouth, and then I scrambled to write it all down on hotel stationery. Then Jack's agent sold it. Then we wrote it. Jack invented most of the characters, ideas, background, and plot. I wrote virtually every word. We did much the same for *Heaven* (not our choice of title and possibly a mistake) except for the original plot, which we assembled over several weeks. We plotted out a prequel, *Oracle*, during a very uneventful book-signing (the shop hadn't advertised it until the morning of the event). We're still looking for a publisher, though.

The *Science of Discworld*[9] series with Terry Pratchett was written differently again, as befits a three-person collaboration, but I won't go into details.

C: *The Collapse of Chaos: Discovering Simplicity in a Complex World* was published in 1994, and was followed in 1997 by

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[7] Ian Stewart & Jack Cohen, *Wheelers* (New York: Warner Aspect, 2000).

[8] Ian Stewart & Jack Cohen, *Heaven* (New York: Warner Aspect, 2004).

[9] Terry Pratchett, Ian Stewart & Jack Cohen, *The Science of Discworld* (London: Ebury Press, 1999); *The Science of Discworld II: The Globe* (London: Ebury, 2003); *The Science of Discworld III: Darwin's Watch* (London: Ebury Press, 2005).

Figments of Reality: The Evolution of the Curious Mind. For those of our readers who may not be familiar with your work, could you briefly explain a little more about what you set out to do in these books?

IS: *The Collapse of Chaos* was an attempt to tackle one of the big questions Jack asked as a result of reading *Does God Play Dice?*, which is about the mathematics of 'chaos' – which, by the way, isn't just another word for 'random'. The full term is 'deterministic chaos', and it reflects what I would argue is one of the most fundamental discoveries of the late twentieth century. Namely: rigid mathematical rules, in which the entire future of a system is determined by its present state, still permit behaviour so complex that it can be unpredictable, and certain features are genuinely random – that is, they can be modelled with complete rigour as stochastic processes.

Anyway, Jack wanted to know how a complicated system like a biological organism could exist as a coherent working structure when 'everything is chaotic'. Part of the answer is that the mathematics tells us chaos is possible, indeed common, but that it is not ubiquitous. Non-chaotic deterministic systems also exist. But the deeper issue is how chaotic systems can have robust features, as if the chaos somehow 'collapses' – hence our title. In retrospect it may not have been a good choice: people sometimes think the book is an argument against 'chaos theory', which it absolutely is not.

What we concluded – and I'm not claiming this is either correct or the last word – is that robust patterns not only can, but typically do, emerge from complex interacting systems. Down on the level of fine detail, nothing makes sense.

JC: This was my stuff with cell processes again. 'Nothing makes sense', says Ian, but it works, so far as we can tell, totally reliably. So, at the level of the cell, we're not in a 'soup' of chemicals dissolved in water; we have proteins all hooked up to each other, systems of membranes all interleaved, an immensely complicated network of causality that simply isn't a watery solution. I've done a lot of EM (electron microscopy) of cells, and quite a lot of time-lapse photography. The two views – EM revealing a series of 'rigid' membranes, time-lapse photography showing fluid movement – don't make any sense with each other. The pictures you get are incommensurate, 'wave' and 'particle' – so the cell 'is' something else again, with Ian's view and mine wrapped up in it. But this is quite common – think of nerves and 'mind'!

IS: Observe a local region of neurons firing in a brain, and you won't be able to tell what it's thinking – or even *that* it's thinking. But on a higher level, there may well be coherent structure. And (I'm basically a determinist) it is a *consequence* of the underlying small-scale structures and rules; it doesn't transcend them in any causal way. However, there is no mathematical scheme that can derive the large-scale structure from the small-scale rules, except by simulating the entire system step by step. There are no short cuts to the patterns. Basically, this is how I like to define 'emergence' as a mathematical concept.

So *The Collapse of Chaos* was mainly about physical science and evolutionary and developmental biology. *Figments of Reality* was a kind of sequel, concentrating on the mind/brain problem. From our point of view it seemed plausible that mind is an emergent property of a brain – under suitable conditions. Separating the two and making them essentially independent, as Descartes did, misses the crucial feature of emergence: that it is *caused* by the fine-scale structure and rules, but is not something that can be *derived* from them (by an argument short enough for humans to follow). So mind is a consequence of brain structure, but it cannot be *reduced* to brain structure by any rigorous logical scheme. Our chapter on free will is an attempt to reconcile the small-scale determinism of neurons with the apparent lack of determinism in the brain's decisions. We ignored quantum indeterminacy for two reasons: it may not be as random as physicists think – it might well be deterministic chaos – and if it is genuinely random, then it doesn't explain free will anyway, because that is a directed choice, not a coin-toss. What we ended up with is very close to (and anticipated) what Daniel Dennett argues in *Freedom Evolves*.[10]

C: This is the chapter in *Figments* amusingly entitled 'We Wanted to Have a Chapter on Free Will, but We Decided not to, so Here It Is'. The conclusion you reach on the problem of free will, as pithily summarised in the final sentence of the chapter, is that while freedom is indeed an illusion of sorts, it's 'not "just" an illusion: it is a *figment*

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[10] Daniel Dennett, *Freedom Evolves* (London: Penguin, 2004).

rendered real by the evolutionary complicity of mind and culture'.[11] Could you say a little about what this means, and how it anticipates Dennett's conclusions?

IS: We think that the brain makes *decisions* rather than *choices*. That is, when faced with various courses of action, the brain decides on one of them by some process which depends on our past history, personality, and so on. We feel as though we could make either choice, but that feeling may be just the 'quale' of deciding – just as the vivid impression of red is the quale of whatever in the physical world makes us perceive the colour red. This resolves the apparent conflict between physical laws that are either deterministic (Newtonian) or random (quantum). Neither fits the simple 'free will' model in which under identical circumstances the human brain is free to behave in several different ways. It *feels* as though it could do that, but what it actually does is constrained by the physics. However, because the brain is a complex system, it may in practice be unpredictable even if it behaves deterministically.

We don't really think others have free will. When they do unexpected things, we always wonder 'Why did they do that?' and seek excuses. Once we realise 'Oh, she's had a row with her boyfriend' we feel we understand the reason for the choice. With true free will, there doesn't *have* to be a reason.

Dennett argues his way to a very similar view, with 'free will' as the *quale* of decision-making.

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[11] *Figments of Reality*, op. cit., 241.

JC: Dennett takes the first three chapters to show that we can't 'decide' if the universe is determinate because, essentially, of levels with causality between them – which is essentially what in *Figments* we called 'Ant Country'.

C: For those unfamiliar with your writings, what do you mean by 'Ant Country'?

JC: The Ant Country side of things refers to all the turmoil of micro-causality that underlies history, while the 'figments' level is not just aggregates but rather 'things' with emergent properties, that (seem to) react to each other on the higher level; this separates the causality into different provenances, so that 'determinism' can't be determined! Dennett, finding this essential a-causality, leaves the question of freedom of will aside; he goes on to say that the only use of this notional 'freedom' is to make the inevitable evitable. From the same indeterminacy we go for the joke in our chapter title.

IS: Ant Country is our term for the way that many localised parts of complex systems tend to be indistinguishable from each other as far as significant differences go. Rather like being somewhere randomly chosen in a big UK city: There will be a main road with shops, an Indian restaurant, a pub, a Chinese takeaway, a betting shop, a church, some side streets, ordinary houses ... a bus stop, a set of traffic lights ... the locality will have much the same stuff as any other 'non-special' locality.

The prevalence of Ant Country means that it is virtually impossible to understand what a complex system is doing by looking at the details. A computer program, for instance, will always look like 0011011011100101 ... no matter whether it is a word processor, a spreadsheet, or the computer's own operating system. So Ant Country represents a particular kind of barrier to reductionism, when considering complex systems.

JC: We called it 'Ant Country' for essentially three reasons: Firstly, Aunt Hillary in *Gödel, Escher, Bach*,[12] the anthill whose recognition of her friend the anteater works by the ants panicking; secondly, Langton's Ant game, which demonstrates that even knowing all the rules you can't predict what'll happen; and thirdly, by envisioning a kind of suburbia, an Ant Country in which all paths are equal, some leading up and some down but without any scheme. Like suburbia, the location of the odd pub and post office doesn't imply a general geography. When trying to argue across this Ant Country to explain chemistry by physics one can use the odd by-way, but there are no general rules! This is what Ian means when he says that mind is a consequence of brain, but can't be reduced to brain. Ant Country doesn't have any general rules.

C: Apart from anticipating Dennett on freedom, what you say in *Figments* about the illusory nature of selfhood and the evolutionary provenance of that illusion also strongly gestures towards ideas subsequently worked out at considerable length by Thomas Metzinger in his recent tome

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[12] Douglas R. Hofstadter, *Gödel, Escher, Bach: An Eternal Golden Braid* (London & New York: Penguin, 1979), 311-336.

Being No One.[13] For example, you write about the difficulty of trying to explain how the brain creates the illusion of an internal observer 'to a person who has the strongest feeling that they *are* an internal observer, sitting inside their own head, *experiencing* that self-same illusion.'[14] In this respect, Metzinger describes us as self-modelling systems permanently ensconced within an evolutionarily bestowed 'naïve-realistic self-misunderstanding', a naïve realism in terms of which we constantly *confuse ourselves* with the content of our own self-models. Pushing this idea to what would seem to be its logical conclusion, Metzinger even goes on to insist that inasmuch as there is an illusion in operation here, it is quite literally *no-one's* illusion, since there is no-one there to be the *subject* of the illusion. As with the case of free will, however, I suspect that you would want to insist that the illusion of selfhood is not 'just' an illusion.

IS: I think 'illusion' is a loaded and overworked term. For example, physicists often say that the solidity of matter is an illusion because matter is mostly empty space. I'd prefer to say that the space, far from being empty, is full of inter-atomic forces, and it is this that creates the impression of solidity. Far from being an illusion, that's what 'solid' means on the atomic level.

So our *feeling* of 'self' is not illusory – we really do feel that way. But this of course doesn't imply that our naïve interpretation of what we feel is the literal truth. 'Self' is whatever causes us to feel that we *have* a self. And it must be real (whatever that means) or it wouldn't happen.

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[13] Thomas Metzinger, *Being No One: The Self-Model Theory of Subjectivity*. MIT Press: Cambridge, Massachusetts, 2003. See also 'Enlightenment 2.0. Interview with Thomas Metzinger', this volume.

[14] *Figments of Reality*, op. cit., 205.

JC: Metzinger clearly has gone further than we did; we're clear about 'self-hood', but only in the context of the Zarathustrans, as a model for our multibrains.

C: Metzinger describes *Being No One* as 'an experiment in *interdisciplinary* philosophy',[15] and it seems to us that this could equally well serve as a description of your work together. In the Preface to *The Collapse of Chaos* you forewarn the reader that while, for the first, more orthodox and conventional half of the book, you are able to 'provide plenty of roadmaps to tell you in advance just where we want to take you', you are unable to do this for the second, more experimental and speculative part of the book, since 'where we wish to travel, there are not only no road maps, but no roads'.[16] It is perhaps in part this sense of embarking on a real intellectual adventure, a genuine experiment in thinking, which makes your work so attractive to a growing philosophical readership who find themselves becoming increasingly disillusioned with the self-enclosed and narrowly specialised nature of much of contemporary academic philosophy. Your books tackle ontological and epistemological issues by directly drawing upon the full extent of contemporary science rather than from the point of view of a priori conceptual analysis or textual hermeneutics. To those of us who have relinquished the conceit that one ought to be able to do epistemology and metaphysics without actually *knowing* anything – that is, without drawing upon the immense labours of the empirical sciences – and yet who remain dissatisfied for one reason or another with most versions of contemporary philosophical naturalism, your work thus provides a real breath of fresh air. Would you care to comment on this? How do you see your work in relation to traditional and contemporary philosophy? While your books are in no sense works of philosophy in the traditional sense, and although you rarely cite or discuss any of the great philosophers, you do speak of 'invading their spaces and reinventing their wheels'.[17] What precisely did you have in mind here?

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[15] *Being No One*, op. cit., 2.

[16] *The Collapse of Chaos*, op. cit., 2.

IS: I think Jack and I both realised we were impinging on philosophical territory, and that we were very much amateurs (though Jack was quite widely read in philosophy – another of his roles in the collaboration). So we tried to tread a fine line in which we put forward our own ideas without explicitly relating them to mainstream philosophy, yet also without claiming that everything we said was new. We've been gratified by the way the philosophical community has responded.

The 'road-map' remark was motivated by Terry Pratchett, who read the book in manuscript form, and commented that in the first half he felt he was being pushed to the top of a roller-coaster, and was awaiting a wild ride – but the rails disappeared. We did our best to fix this problem, but we didn't want to do the usual academic trick of giving the main point away before we got to it. Sometimes suspense is better than foreknowledge.

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[17] Ibid., 5.

I think that what we're doing is tossing out various ideas, mostly with a sound scientific pedigree, that might stimulate a few philosophers and set them thinking along fresh lines.

Contemporary philosophy is pretty much a mystery to me, except that some of it seems to embrace a rather extreme form of social relativism – that science is whatever scientists agree on, for example. Now, there is a sense in which that is true, but there is a definite mechanism involved in coming to agreement, and it involves cross-checking with the external world. Even if every scientist in the world decided that gravity pushes things up, they still wouldn't want to stand underneath a piano when someone pushed it out of a window. Someone once said that when postmodernists come into a room they always use the door. Isn't it strange that they don't just get together and agree they can walk through the walls? A lot of this stuff strikes me as pretentious and silly. It certainly misrepresents science.

I also think that there is an ever-present danger, when thinking about 'philosophy of science', to put forward rather simplistic models of how scientists work – simplistic in the sense of being too rigid and broad – and then when it turns out scientists don't do that, to argue that they are doing it wrong because they're not doing what the model says they should. (I'm pleased to see that philosophers are generally avoiding this pitfall nowadays).

Now, I'm prepared to be put right on some of this, and I'm risking letting my hair down because I think I'm among friends. And I get the impression – in part from talking to colleagues in the Philosophy Department at Warwick – that many of today's philosophers have the same misgivings.

Though I'm sure they would phrase them differently.

As for the comment about invading the spaces of the philosophers, that was partly a get-out clause, acknowledging that our ideas have all sorts of relations to things that philosophers have been saying for ages, while sidestepping the obligation to give chapter and verse. Because I, for one, wouldn't be able to give chapter and verse. Jack might do better, and maybe he can come up with a good example. Within science, a similar problem arises. Some of what we say can be seen as 'systems theory', so we ought to pay homage to Ludwig von Bertalanffy. But the books cover a huge amount of ground, and the whole area has been so widely trampled that picking our way through the undergrowth would probably create more injustices than it removed – and it would make the book pretty much unreadable. In an academic work, we'd have to sort out sources like that, but this is popular science, and the most important thing is to tell a story. However, we did say when we consciously got ideas from some specific source.

JC: I'm as annoyed by philosophical relativism as Ian is, but this is complicated by my philosophical allegiances. I started off to be a rabbi, but read Spinoza's *Ethics* at the age of sixteen or seventeen, so became a biologist instead. But I still have Jewish associations (my rabbi says I'm the best atheist in her congregation ...) and read Spinoza, very conscious of how much has been done to build on the original – and to edit lots of it out. The quasi-religious bits of *Collapse* and *Figments* – not to say anything about *Heaven* – are very naïve (though not so naïve as other scientists 'looking into the Mind of God': ouch!); but I do read *Nature* every week – all of it. Ian reads *Science* and *New Scientist*, too. So we have a very useful body of knowledge from which to extract ideas, and against which to ring our own new thoughts.

So as you say, I think this is the main difference between our work and that of most philosophers: we do have much of modern science available to us; we do actually know quite a lot! But what we know isn't (just …) the fashionable stuff, mostly quantum physics, that 'real' philosophers of science play with; we discuss between ourselves all kinds of stuff, from geology/palaeontology and embryology/*in-vitro* fertilization to quantum experiments (the philosophers don't 'get' the experiments, just the thinking!). For example, in my own field, there has been almost no 'professional' notice taken of the Waddington symposia which, from the mid-fifties up to the nineties, began to sort out the real (philosophical) problems of development-and-evolution – what's in general being ducked now under the heading of 'evo-devo'. Professional philosophers took no real notice of those symposia, or of the (admittedly rather difficult) philosophies expounded therein – even though these symposia dealt with such issues as the thalidomide disaster, and began to deal with issues like what the genome was and what it did. This stuff is coming in now under the heading of 'epigenetics', and philosophers (with the notable exception of Evelyn Fox-Keller) are still bemused by it. It's desperately important stuff, but it's not physics, so isn't dragged into discussion!

C: Well, you're certainly right when you say that many philosophers share your misgivings about relativism, and in fact I think you'll find that the few prominent philosophers who espouse something like the kinds of views you mention tend to enjoy far more popularity outside philosophy than in it. The idea that science is 'just another narrative', for example, has an air of superficial plausibility about it when not examined too closely, and it's undoubtedly a comforting thing for many people in the humanities to be told by a sophisticated philosopher like Richard Rorty; but then Rorty's pragmatism has always received a far more severe critical treatment within philosophy than in, e.g., literary criticism or cultural studies departments.

But getting back to your comment about 'infringing upon philosophical territory', one area in which your work strongly overlaps with contemporary debates in philosophy concerns something you've already touched upon, namely: emergence. You mentioned that you endorse a kind of 'emergent monism' rather than any variety of Cartesian dualism – and this perhaps relates to the impact of Spinoza's *Ethics* on the teenage Jack – but unlike many contemporary philosophers, you do not restrict your interest in emergence to specifically human or mental features such as consciousness. Rather, you argue that emergent phenomena are ubiquitous in nature: 'emergence', as you put it in *Collapse*, 'is the rule rather than the exception'.[18] The many examples of apparently emergent phenomena which you provide in both *Collapse* and *Figments* indeed make a compelling case for this thesis, but you also do not shy away from the properly philosophical task of clarifying precisely in what sense your claim that many natural systems are 'emergent' is to be understood. Given the plethora of widely divergent notions of 'emergence' one can find in the literature – and we're talking about a truly vast literature here, stretching across fields as diverse as complexity theory, artificial life, biology, physics, psychology, cognitive science, sociology, philosophy, etc. – this is of course a crucially important task. Ian has already mentioned a couple of times that which just about everyone agrees constitutes the distinguishing feature of emergent phenomena: namely, that they are 'macro' phenomena (properties, entities, systems, laws ...) which are both *causally dependent on* and yet in some sense *irreducible to* or *autonomous with regard to* their 'micro' causal bases. The real philosophical difficulties arise, of course, as soon as one attempts to clarify the precise sense in which such phenomena are said to be thus 'irreducible' or 'autonomous'; and in this regard philosophers typically distinguish between *metaphysical* or *ontological* notions of emergence, on the one hand, and *epistemological* ones on the other. To quote Paul Humphreys, whereas advocates of ontological emergence 'consider emergent phenomena to be objective features of the world, their emergent status being independent of our own existence and knowledge', advocates of epistemological emergence 'consider emergent properties to be a result of our limited abilities to predict, to calculate, to observe, and to explain'.[19] However, as with any such broad distinctions, there is of course plenty of room for manoeuvre, and one can indeed find a whole spectrum of views stretching between the 'metaphysical' and 'epistemological' poles on this issue.

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[18] *The Collapse of Chaos*, op cit., 436.

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[19] Paul Humphreys, 'Emergence' in Donald Borchert (ed.), *The Encyclopedia of Philosophy*, Second Edition (New York: MacMillan, 2006), x. In this article Humphreys also mentions 'conceptual emergence' as a sub-category of epistemological emergence, advocates of which 'consider emergent features to be a product of our theoretical and linguistic representations of the world' (ibid.).

So the question is, where does your own notion of emergence sit along this spectrum? From what Ian has already said, it seems that your conception is one which combines explanatory autonomy (irreducibility) with ontological and causal dependence (reducibility). Would that be a fair way to characterise it?

JC: Yes, that's more or less fair. Bear in mind that I have an easy time by saying that emergence is simply the difference between the sum of the parts and the whole, thus eliding the question of whether it's an idea or an objective natural phenomenon – perhaps the word can serve either interpretation! Emergence is, indeed, a very difficult issue. If one establishes a set of levels of understanding in the old familiar way, with God at the top and a Theory of Everything at the bottom, one can read upwards through physics, chemistry, biology, sociology and psychology, politics or whatever ... There is clearly a sense in which chemistry is dependent upon the working out of physical principles, in which biology is dependent upon chemistry (and much else …), and so on. But there is no way in which we can argue from physics to chemistry, and not only because we don't know 'all of' physics. Take any chemical item, and its explanation rests upon many physical principles; there are many explanatory roads – 'Ant Country' again.

IS: My approach to emergence views all emergent phenomena as causal consequences of underlying rules.

Emergent phenomena often *appear* to 'transcend' the underlying causality of the system, by being very different from anything we expect the rules to lead to. But this may be just our lack of imagination. It's amazing what complex things very simple rules can generate.

If the detailed deduction of the phenomenon from the rules is too long and detailed for the human mind to grasp, I consider the phenomenon to be emergent. If there is some shortcut, some structure that allows a logical deduction, I call it a theorem.

For example, from the simple 'bouncing ball' model of the gas laws, mathematicians can now prove certain technical properties ('ergodicity') which imply that, say, the system almost always distributes the pressure evenly everywhere. So this feature is *not* emergent – there is a deduction short enough to be understood. Where every atom in the room will be in ten seconds' time is emergent – but not significant. The significant emergent properties are ones that really do inform us about the capabilities and behaviour of the system. The fact that the Lorentz equations have a strange attractor is now a theorem, but it relies on a gigantic computer calculation so I'm inclined to view it as effectively being emergent. So here chaos is pretty much an emergent property according to my definition of emergence.

C: It sounds very much as though, then, for Ian at least, emergence is to be regarded as an epistemological rather than an ontological or metaphysical notion. In his recent book *What's Wrong With Microphysicalism*, Andreas Hüttemann has argued that if we take emergence to be an ontological notion, candidates for emergence that depend on the epistemological inaccessibility of explanations to human beings (as opposed to, say, a Laplacian supercalculator or what the early twentieth-century theorist of emergence C. D. Broad called a 'mathematical archangel') cannot be accepted as genuine examples of systems exhibiting emergent behaviour.[20] In this respect, if we were to adhere to an ontological concept of emergence, deterministic chaos would *not* count as a genuine example of emergent behaviour.

Yet I wonder whether things are quite so simple. Earlier on you characterised the crucial feature of emergent phenomena as being that while they are caused by the fine-scale structure and rules, they are not something that can be derived from them 'by an argument short enough for humans to follow'. Similarly, you have just said that a phenomenon ought to be regarded as emergent if the deduction of the phenomenon from the rules is 'too long and detailed for the human mind to grasp'. But I wonder if this emphasis upon the cognitive limitations of finite observers such as human beings might not be somewhat misleading, inasmuch as it would seem to suggest that all apparently emergent phenomena are merely 'in the eye of the beholder', as if the simple large-scale patterns we discern in nature are somehow illusory ('*mere* appearance'), being merely an artefact of the way in which human beings are constrained to represent the world rather than something belonging to the objective structure of reality itself. But were that the case, your conception of emergence as being 'the rule rather than the exception' for natural systems would seem to open you to the charge of anthropomorphism with regard to your conception of nature itself.

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[20] Andrea Hüttemann, *What's Wrong with Microphysicalism?* (London: Routledge, 2004), 56; for Broad's 'mathematical archangel' see C. D. Broad, *The Mind and Its Place in Nature* (London: Routledge and Kegan Paul, 1925), 70.

However, I take it that when you say above that 'there is no mathematical scheme that can derive the large-scale structures from the small scale rules' and that 'there are no shortcuts to the patterns', you are not making a point about the *de facto* limitations upon the computational power which happens to be available to human beings, but rather about the formal limitations upon any possible mathematical derivation in principle. In other words, the underivability which you are talking about is the kind which would prove computationally intractable for even a Laplacean supercalculator, short of a step by step simulation of the entire system. But if that is the case, does this not imply that your notion of emergence is, after all, an ontological one, and that emergence as you understand it applies directly to natural systems as objective patterns in nature, regardless of whether anyone constructs a model or simulation of them or not? In other words, emergent phenomena are not simply the product of what you have aptly described as the 'quick-and-dirty feature-recognition-systems'[21] that the human brain has evolved in order to perceptually filter the underlying complexity of nature and so survive in a hostile world; rather, the latter is just one example of the way in which the emergent patterns and structures of nature itself 'collapse' the underlying sea of chaos via the complicit interaction of the phase spaces of complex rule-based systems. As you put it in *Collapse*, it is not only the human mind which sees the word in terms of simple high-level features; rather, 'the universe itself often functions by operating upon a high-level structure *as* a high-level structure'.[22]

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[21] *The Collapse of Chaos*, op. cit., 433.

Would it be right to say, then, that your critique of microphysicalist reductionism and your attempt to develop a 'contextualist' approach to science is not a matter of bestowing some kind of ontological privilege upon those high-level, macroscopic patterns and structures of the world which happen to be perceptually available to human beings – in which case you would be open to the charge of anthropomorphism or anthropocentrism just mentioned – but rather of complementing and completing the reductionist picture of nature by developing a scientific approach which would be able to do justice to those objective high-level features of nature by treating them, as it were, 'in their own terms' or 'on their own level'?

IS: I don't think we can ever apply a mathematical concept directly to reality. If I say that some real-world feature is emergent, what I mean is that, relative to a specific mathematical model, it satisfies (or at least I think it satisfies) my definition of emergence. The real world just *does* whatever it does. The main issues are about how our attempts to understand it relate to what it does.

I would say that your summary above – your last paragraph – is a very good statement of what I think is going on. There do exist mathematical theories in which the 'higher level' structures get manipulated in their own right, as concepts on their own level. For logical rigour they must be derived from the underlying mathematical rules. An example is the idea of a strange attractor in chaotic dynamics. Mathematicians had actually proved a lot of interesting things about how attractors behave before anyone could prove they existed in a specific differential equation with any link to models of real physics. So there was a 'calculus of attractors'. Now we have effective methods to prove that some systems (such as the Lorentz equations) do have strange attractors. This completes the picture.

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[22] Ibid., 430.

Our understanding here, however, is much better informed by the 'attractor' concept than by the vast calculations needed to prove that one exists.

JC: Treating them on their own level resonates with me. Think of a goat and some grass. The goat is emergent, in all kinds of ways, from goat embryo (*ex* goat egg, etc …). The grass has photosynthetic cells making up most of its leaves (under the silica cuticle), and it has stolons running over the ground, etc. The reductionist's goat is a physiology in lots of detail, a genome, a pelt, a grass-eater (they're really browsers, but reductionists don't care about such details); now, I'm tempted to say that the goat is emergent from the physiology, from the embryo, even from the pelt … all the ways in which the goat is a 'whole' where they are 'parts', so that the emergent properties are those that 'fill in the space' between the parts and the whole. But when the goat 'sees' the grass, it sees the high-level grass, not the cells, not the stolons. Even when it grinds it up, it doesn't relate to the cells but to the leaves – it's important that they have a silica coat, so the goats teeth get more *worn* than if it were browsing (on softer leaves-and-twigs). There's no way that the goat embryo is causally connected to this eating: It's 'goats' and 'grass', no substructure interpolated (the goat embryo just *isn't* fundamental to the goat that's eating!). The silica erodes the teeth. The goat's eyes 'see' the leaves of the grass. We see the goat; when we handle it, it's the whole goat we relate to. That's what I mean by 'at the same level'. Yes, I can take out some goat blood and get antibodies from it, investigating the way that the goat interacts with potential bacterial parasites. But there's a strong sense in which the antibodies are part of the goat: its 'defense' against bacteria (not some lower-level, 'more fundamental' structure). The cellular level seems subservient to 'goatiness' too, in a kind of top-down way – some of the emergent properties can turn around on themselves and organize the suite of emergents into goat! (There is room here for a whole argument about the recursiveness of emergents; as in, for example, Jaegwon Kim's essay, 'Making Sense of Emergence', in Bedau and Humphreys' nice book, *Emergence*.)[23]

So I don't think that this is just a matter of the way *we think about* goats and grass; I think that goats and grass interact directly, at the level of 'goats' and 'grass' – and, moreover, *that they did so before there were people!* So for dinosaurs, too, and for seaweeds and fishes – not interacting at more basic (or fundamental) levels but *as* seaweeds and fishes, with all their (emergent and other) properties intact. The fishes 'see' the seaweed. As the rock rolls down the hill, bouncing and splashing a bit here and there, I don't think it's doing very clever mathematics; I think its emergent properties (and possibly others) are interacting directly and simply – at the level of 'bounce' and the properties of mud(s), to result in the path taken. The cryptic structure of the rock doesn't affect the trajectory, just as my appendix doesn't affect the goat. That's what we mean when we say that we find emergence in the chemical and physical world as well as in the world of people.

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[23] Mark Bedau and Paul Humphreys (eds), *Emergence: Contemporary Readings in Philosophy and Science* (Cambridge, Mass.: MIT Press, 2007).

C: You've already mentioned 'the Zarathustrans' a couple of times – a fictional race of aliens with a 'group mind' who make numerous guest appearances in both *Collapse* and *Figments* in the form of necessarily imperfect (because anthropomorphic) 'translations' of their dialogues. As you've said, this was not just a matter of self indulgence on your part: they were there not simply to add an extra populist SF edge to your work, but rather 'to jog us, and our readers, out of the safe, familiar, parochial way of thinking' and 'to push our minds in new directions, to stimulate lateral thinking'.[24] In your most recent co-authored book, *What Does a Martian Look Like?*, you mount a strongly polemical attack upon what you regard as the lamentable lack of such 'lateral thinking' in contemporary astrobiology. Indeed, you argue that the very name 'astrobiology' is an unfortunate one, betraying 'an unimaginative approach to a subject that absolutely cries out for imagination'. Instead of 'opening up new worlds, new habitats, new types of lifelike organisation', you charge that astrobiology 'narrows everything down to two existing areas of science [...]

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[24] *The Collapse of Chaos*, op. cit., 51.

[o]ne of which has its feet firmly set on Mother Earth, while the other is mostly looking for duplicates of Mother Earth'.[25] While most current work on the science of extraterrestrials is carried out by astrophysicists relying upon out-dated folk biology, you argue for the need for 'a much wider form of thinking', a properly interdisciplinary approach to alien life which you call 'xenoscience'.[26] Could you say more about this?

IS: *What Does a Martian Look Like?* has a lot of Jack&Ian. The topic of alien life is one of Jack's long-term interests, and he has a lot of expertise, having advised major science fiction writers, and lectured hundreds of times to schools. My interest was more casual: as an SF fan, I'd often thought about the topic. We both felt that 'astrobiology' was too unimaginative – good, solid science for the most part, but much too happy to close down possibilities on spurious grounds. One symptom of this lack of imagination is the tired concept of 'habitable zone', which still tends to be trotted out on every possible occasion as if it tells us anything useful. A star's habitable zone is usually defined as the region around it in which liquid water can exist, and this is identified with the range of distances at which a planet supporting life can orbit.

Unfortunately this is such a simplistic concept that it obscures rather than illuminates. It is often stated that Venus, Earth, and Mars are within the Sun's habitable zone, and this is not too far wrong in terms of incident radiation from the Sun. But Venus is far too hot for liquid water to exist, and Mars is too cold. Why? Sure, Venus is closer than Earth, Mars further out, but that's not the whole story. An important reason is that Venus has huge amounts of carbon dioxide in its atmosphere, and Mars lost most of its atmosphere long ago, possibly when its core solidified, its magnetic field vanished, and the solar wind blew the atmosphere away – or perhaps not, it's controversial.

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[25] *What Does a Martian Look Like?*, op. cit., 6.

[26] Ibid.

The point here is that what counts for having liquid water is not how far the planet is from the star, and how hot the star is, but how the planet's atmosphere modifies the amount of radiation that the planet receives. If Mars had Venus's atmosphere and Venus had Mars's, they'd both be a lot closer to being able to support liquid water. The Earth, in fact, is probably outside the Sun's habitable zone, strictly interpreted. That's why we have ice at the poles. It's our atmosphere that keeps us warm enough for water. Agreed, if you get *too* close to the star, or *too* far away, no amount of atmospheric tinkering can keep water liquid. But that leaves a much bigger region for water than the traditional 'habitable zone'.

But that's just the first reason why 'habitable zone' is such lamentably silly thing to bang on about. At the same time the astrobiologists were promoting the concept, NASA (and its astrobiologists) were getting excited about the possibility of life on Europa, one of Jupiter's moons. Europa is *way* outside the 'habitable zone', even interpreted more generously. But it almost certainly has liquid water. There is very strong evidence of an ocean under Europa's ice. So the imaginative question is not 'what's the most simple-minded way to rule out liquid water?', but 'what other conditions would allow liquid water to exist?' And there are lots. A planet very close to the Sun, but tidally locked, would be enormously hot on one side, very cold on the other, with a ring of moderate temperatures in between. And so on.

Up to this point, I've been accepting the view that water is essential for life. But that's not clear either. In fact there was a high-level conference on that topic at the Royal Society, and the conclusion was that waterless life is very likely to be feasible.

Now, a common response to such criticisms is to ask for evidence of the existence of tidally locked planets with a ring of water, and evidence of life that does not involve water. And of course we don't have any such evidence. But that's not as strong a rebuttal as a lot of people think, because what's under discussion here, at this stage, is the *logic* of the arguments. Is it logically correct to claim that life cannot *possibly* exist except inside the 'habitable zone'? And the answer is 'no, the logic is full of holes you could drive a truck through'. It is not necessary to find actual examples to show that the logic is faulty. As a mathematician I am constantly surprised by how poorly people appreciate this point. When exposing a logical error, it is not necessary to demonstrate which alternative argument is right. Here's a simple example. Suppose someone argues that 2+2 = 22 = 2x2 = 4. Is the logic correct? Of course not: the intermediate step 2+2 = 22 is wrong, and so is 22 = 2x2. I don't need to know what 2x2 *is* to spot these errors. As it happens the argument even gets the right answer, but that doesn't mean it is logically correct!

Astrobiologists of the 'habitable zone' variety claim to rule out water-based life except on planets that are within specific limits. That argument is wrong. It may well be true most of the time, but we don't *know* that. I think there's a bit more justification for the assumption that water-based life may be more common than other kinds – but nothing *rules out* other kinds, not yet. And basing our concept of 'life' on just one sample – one planet – is hopelessly parochial. It would be like an Inuit arguing that the only habitable part of the Earth must be the polar regions, because there's no ice anywhere else, so you can't hunt seals or make igloos to live in.

Surely the most interesting thing about alien life is that it may, just possibly, *be* alien. By all means let's put most effort into locating life like our own, because we know that definitely works and maybe the same trick has worked elsewhere. But we shouldn't rule out alternatives just because they wouldn't work here.

JC: Ian has taken quite a lot of space to sort out a major way in which our *Evolving the Alien* (a more stylish title than *What does a Martian look Like?*, for the same book) differs from standard astrobiology, and from the 'habitable zone' idea – which turns out to be mistaken. In the book we introduce each chapter with an anecdote about two (very different) aliens that are cooperating on a popular 'Visits to Earth' enterprise (from a three-bedroom house in St Albans). This was intended primarily to introduce the reader to a variety of the Earth's ecosystems, but it also exposes many Terran-centred assumptions, like the Zarathustrans in our other books. But all of the ideas that postulate aliens like Terran life forms are mistaken too; so much so that I don't know whether Terran universal/parochial ideas can work off Earth; we try to establish rules by setting out the Europa story, but we genuinely *don't know*! There are many super ideas in that book, but all of them are highly relative, not quite applicable to 'real' science. As a work of the (disciplined) imagination, it's great – and was great fun to write. But I'm not sure that you should use it as an exemplar of 'serious' science! Certainly it's scientific, in that Ian and I took the arguments very seriously (but not too solemnly), but nearly all of the arguments are relative to the possibilities that we'll find aliens some time, to test them (except, perhaps, for the bits about Ray's Tierra, computer viruses, Conway's Game of Life, and possibly sun-spots, that certainly look as if they're based in some kind of life!). It's a useful exercise for throwing out anthropic arguments, but the latter are themselves only rather silly justifications of physical constants, varied in not nearly enough dimensions. The contrast we set up in *Figments*, between the way that we introduced the Big Bang origin at the beginning of the book, and the way that a Zarathustran sees it at the end of the book (as a series of semi-realised potentialities), says a lot about anthropics: different creatures abstract different rules; which are the anthropic ones? And it also says that there isn't one way of interpreting the universe: different creatures, different interpretations; but we could so easily be simply wrong about that: many very clever people think we are – and not only Catholics!

C: Regarding so-called 'anthropic reasoning', there's no doubt that there have indeed been a plethora of very silly arguments put forward under that rubric, especially in popular pseudo-science literature. But as I understand it, your argument is not so much against anthropic reasoning per se – at least, if we understand that in its originally intended sense as merely a type of observation selection effect – but rather with the problem to which it has been typically evoked to explain: namely, that of the supposed 'fine-tuning' of the physical constants of the universe. After all, if there were ultimately a way of proving that the physical constants were indeed exquisitely 'fine-tuned', it would seem that the multiverse scenario would indeed be just about our only reasonable option, and an anthropic selection effect would then have to be invoked in order to explain why we observe the kind of universe we do. But your argument attempts to nip the whole problem in the bud from the get-go, as it were, by showing that the kind of thinking involved in the very idea that our universe is fine-tuned is not only 'misleading' and 'wrong', but even 'downright silly', being based on nothing more than 'bad logic'. One might be surprised to learn that so many eminent scientists – including the likes of Steven Weinberg, Stephen Hawking, Martin Rees, Roger Penrose, Andrei Linde, Alexander Vilenkin, Lee Smolin, Leonard Susskind, Richard Dawkins, Max Tegmark, John Gribbin, et al. – have all been guilty of such flagrant 'bad logic'. Could you explain what this charge amounts to?

JC: The business of anthropic reasoning comes under three heads, for me: Firstly, there is the 'fine-tuning' issue, which physicists resolve either by invoking a Designer who does the fine-tuning of the laws and constants, or by postulating that this one universe out of quintillions is the one which has the tuning 'just right'; it is assumed that the 'crystalline' properties of, especially, that carbon chemistry that makes physicists possible, has no flexibility whatsoever (or that it can only be moved one dimension at a time). There is no choice – it's *our* physicists or none!

Secondly, there is the 'Earth hasn't moved out of the habitable zone throughout its history' story, making control of this temperature etc. one of God's many miracles – choosing this one out of hundreds of millions of possible histories, nearly all of which failed to keep temperate! Apart from several feedback mechanisms, and that we had several Snowball earths, as well as continents of volcanoes and a few asteroid hits, can we claim that this Earth was the only one that 'made it'?

Thirdly, there is the ('Rare Earth'-type) argument from evolution: in order to get creatures that can describe what happened here, so can find it remarkable, we had to have eukaryotes/cellular life forms/echinoderms then chordates/vertebrates (or, presumably, equivalents, whatever that can mean), amphibians coming out from Devonian fishes ... Dinosaurs and the K-T meteorite had to be supplanted by mammals, and primates then apes had to do the goods. Any break or stop along the line, and we wouldn't have creatures who find the whole business so unlikely that they need to argue anthropically … Unless we agree that 'higher' life forms will arise, sooner or later, on almost any aqueous planet, so that on any planet with extelligence it must look as if the evolutionary history was both necessary and spectacularly unlikely!

Whatever happened, happened; agreed, if the sun had gone nova we wouldn't be here; and it's quite likely that only one in a quintillion planets comes to have physicists. But a hell of a lot of the others might have creatures that remark on their own unlikelihoods!

Basically, it's the old chestnut about how unlikely *you* are to have been born: that your parents met, that your grandparents met and mated, that *that very sperm* fertilized …; or that you live in a house which was not destroyed by the war … wow, you just can't exist!

Start with the idea that, however unlikely, you *do* exist! Then argue away from unlikelihoods into the common elements of existence. There must be plenty of flexibility about laws, about constants (not changing them one-dimensionally, perhaps; but if we change Planck's constant by ten percent and *then compensate* by changing the ratio of electron to proton …), about paths. There must surely be a vast phase space of possibilities, not just one particular universe whose unique solution allowed history to happen! And as soon as you allow that there are many paths, we can surely not be too surprised at existence, in almost any form! If you like, wonder at how long it took to get to physicists from fizzy clays, how long it took to get to physicists from australopithecines, why the Antikythera mechanism didn't bring the Greeks into modern physics; but then think: what happened, happened! And the alternate paths didn't (unless you think they did, in all dimensions and whenever there was a choice ... in which case, you have *more* possibilities, not less!). So the 'real' history sits among a plethora of possibilities, and is not in any sense unique. And to attempt to argue for its uniqueness by constraining the rules until it appears unique, then arguing that it had to be like that – either because God pruned all the other possibilities, or because all the other paths ran into impossibilities (such as extinction …) – is simply mad!

IS: This is a huge area so let me focus on so-called 'fine-tuning' arguments. This is about the 'fundamental constants' in the physical equations for universes – speed of light, Planck's constant, and so on. These are numbers, with no special pattern to them, and it is assumed that any choice of these numbers is in some sense just as likely as any other. The claim, widely publicised, is that our universe is virtually unique in its choice of constants: these are almost the only values that make life possible.

The argument involves the effect of changing the values a little bit. Make the gravitational constant smaller, and stars blow up, galaxies disappear. Make it larger, and everything collapses into a single gigantic black hole. If you change any one of those constants by more than a very tiny amount, it is said, then the resulting universe will be unable to support the organised complexity of life. Having lots of constants compounds this – it is like winning the lottery many times in a row. Since our universe is so improbably 'tuned for life', we then run into mystical anthropic territory: Basically, 'it must have been made specially for us'.

This claim is a wild exaggeration. One source of error is that the effect of each constant is considered in isolation, with everything else unchanged. But a change to one constant may compensate for a change to a different one – if you allow such changes. If not, you are in effect standing near Centrepoint in London, wandering a few yards along Oxford Street and Tottenham Court Road, and then claiming that there are no museums in London because you haven't found any in that limited locality.

In a recent paper in the *Journal of Cosmology and Astroparticle Physics*, Fred C. Adams[27] looked at what happens when you vary just three of the constants, those that are particularly significant for the formation of stars: the gravitational constant, the fine structure constant, and a constant that governs nuclear reaction rates. Crucially, he allowed *all three* to vary independently. He defines 'star' to mean a stable self-gravitating object that generates energy by nuclear reactions. His calculations reveal no sign of fine-tuning. Instead, stars exist for a huge range of constants: in fact, the probability of getting a universe that can make stars is about 25 percent. If you count more exotic objects as effectively being 'stars', such as black holes generating energy by quantum processes, the figure increases to around 50 percent. So, as far as stars go, our universe is not improbably finely tuned, battling odds of billions to one against. It just called 'heads', and the cosmic coin landed that way up.

This is just one flaw in the usual 'fine-tuning' claims. There are many others – including the unstated assumption that the only way to make a universe is to keep the standard equations but change the constants. In *The Collapse of Chaos* we use an analogy with cars. If you take, say, a Ford Mondeo and change the diameters of all the bolts by just a tiny amount (or indeed by a large one) then the car won't work. Either all the nuts fall off, or they don't fit on to the bolts at all. But this does not imply that the Ford Mondeo is the only possible design for a car, uniquely fine-tuned for nuts and bolts to exist. All it means is that when you change the size of the bolt, you must also change the *nuts* so that they still fit. There are tens of thousands of ways to design a working car.

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[27] F. C. Adams, 'Stars in Other Universes: Stellar Structure with Different Fundamental Constants', *Journal of Cosmology and Astroparticle Physics*, 08, 2008: 010.

Another staple of fine-tuning, the 'triple-alpha' process in Red Giant stars that makes carbon, falls to bits because of an even simpler mistake. The claim of fine-tuning involves a remarkable coincidence of energy levels in various atomic nuclei, which allows the nuclear reaction that makes carbon to happen rapidly enough to make a lot of it. But the coincidence is not actually very remarkable, because stars have 'thermostats' which affect their temperature. Coal fires burn at exactly the right temperature to burn coal, because the nature of the chemical reaction affects the temperature. If the temperature is too low, the coal burns faster and the fire heats up. If the temperature is too high, the coal burns slower and the fire cools down. So it sits neatly in between, and the reaction works beautifully. There is nothing mysterious about this: it is merely a matter of negative feedback, which automatically stabilises the reaction and homes in on a temperature that works. It is the same with Red Giant stars.

A common metaphor in fine-tuning arguments is that our universe is 'balanced on a knife-edge'. This sounds dramatic, but it is misleading. To see why, take a steel ruler and a carving knife. First, try to balance the ruler on the edge of the knife. It will tilt, slide, and fall to the ground. This is the 'fine-tuning' metaphor made real. Now try to balance the ruler on your arm. It will obligingly tilt, wobble a little, and settle down to rest in perfect balance. The reason is feedback. Because your arm is rounded, gravity automatically pulls the ruler towards a suitable balance point. It doesn't have to 'aim for' some specific balance point – the correct angle emerges from the natural dynamics. Most natural systems are 'nonlinear' – like the arm, not the knife-edge.

C: Clearly, those who argue that the universe is 'fine-tuned for life' have things the wrong way around – as Victor Stenger has nicely put it: the universe is not fine-tuned for humanity; rather, humanity is fine-tuned for the universe.[28] However, it perhaps ought to be emphasized that the scientists I mentioned in my last question – all of whom seem to agree that the so-called 'fine-tuning coincidences' do indeed cry out for explanation – are in no way guilty of drawing such patently unwarranted teleological conclusions; nor, indeed, are the vast majority of scientists and philosophers who take fine-tuning and anthropic reasoning seriously.[29] Creationists and their ilk will of course always seize upon what is happening in science in order to furnish putative vindications of theological and teleological metaphysics – and, unfortunately, this of course sometimes includes 'believing' scientists.[30] But the fact that, for example, some such people spuriously claim that the Big Bang furnishes evidence for creation of course does nothing to invalidate modern cosmology.

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[28] Victor Stenger, 'Is the Universe Fine-Tuned for Us?' in *Why Intelligent Design Fails: A Scientific Critique of the New Creationism*, (eds) M. Young and T. Edis (New Brunswick: Rutgers University Press, 2004), 184.

[29] For sophisticated treatments of anthropic reasoning see, e.g., Nick Bostrom, *Anthropic Bias: Observation Selection Effects in Science and Philosophy* (London & New York: Routledge, 2002); G.F.R. Ellis, U. Kirchner & W.R. Stoeger, 'Multiverses and Physical Cosmology', *Monthly Notices of the Royal Astronomical Society* 347, 2004: 921-936; Milan Ćirković, 'The Thermodynamical Arrow of Time: Reinterpreting the Boltzmann-Schuetz Argument', *Foundations of Physics* 33, 2003: 467-490; Mark Walker & Milan Ćirković, 'Anthropic Reasoning, Naturalism and the Contemporary Design Argument', *International Studies in the Philosophy of Science* 20, 2006: 285-307; Milan Ćirković, 'Too Early? On the Apparent Conflict of Astrobiology and Cosmology', *Biology and Philosophy* 21, 2006: 369-379; and Milan Ćirković, 'Sailing the Archipelago', this volume.

IS: Yes, but my view is that not only is the 'fine-tuning' argument the wrong way round: basically, it's bogus. Many wildly different kinds of universe would be suitable for (wildly different) kinds of 'life', by which I mean systems as complex as living ones in our universe, with similar features (reproduction, autonomy, and so on). Stuart Kauffman employs that sort of concept of 'life' in his *Investigations*.[31] My point is that the so-called fine-tuning *doesn't* cry out for explanation. As coincidences go, they are no more rare than rolling a die and getting a 6. The 'explanation' required is not to explain why our universe is so terribly, terribly special. It is to realise that it's *not* special at all. Moreover, it's not the conclusions I'm objecting to: it's the hypotheses. The claim that, in effect, our universe is the only kind capable of supporting 'life' is simply wrong. Where that claim leads is another matter. I don't think it leads anywhere.

C: Your complaint about the practice of varying only one cosmological parameter at a time – thus assuming that they are all independent and failing to explore more than one or two axes of the whole phase space – is of course very well-taken, and is a point which others have also raised.[32] However, as Milan Ćirković argues in his contribution to the present volume,[33] this has far more has to do with the numerical intractability of *ab initio* variations of multiple parameters rather than any kind of insidious teleological or theological agenda on the part of the scientists doing the research. Moreover, the fact that such computational limitations exist is surely not a reason to give up exploring these things, but rather simply suggests that one must exercise extreme caution in assigning probabilities (if indeed it makes sense to assign probabilities to an infinite, non-normalisable parameter space at all, which also presents a very significant challenge for proponents of fine-tuning).[34] While, as you point out, several physicists and cosmologists have indeed begun to explore what happens when one varies several constants at a time,[35] and have indeed concluded that the probability of the existence of (e.g.) stellar structures may not be as low as first thought, such models are still based on the same low-entropy initial conditions of 'our' Big Bang, which have been shown, by Roger Penrose among others, to be stupendously improbable themselves (estimated by Penrose to be of the order of about one part in $10^{10^{123}}$ – a number which surely cries out for explanation).[36] Moreover, as Ćirković also argues, it is highly questionable whether such research invalidates anthropic reasoning per se, rather than simply helping to make the problems more tractable and well-defined by providing more useful data to work with.[37]

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[30] For an notable recent example, see Simon Conway Morris, *Life's Solution: Inevitable Humans in a Lonely Universe* (Cambridge: Cambridge University Press, 2003).

[31] S. Kauffman, *Investigations* (Oxford: Oxford University Press, 2002).

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[32] See, e.g., Stenger, op. cit.; Neil Manson, 'There Is No Adequate Definition of 'Fine-Tuned for Life', *Inquiry* 43, 2000: 341-52; Gilbert Fulmer, 'A fatal logical flaw in anthropic principle design arguments', *International Journal for Philosophy of Religion* 49, 2001: 101-110; and Cory Juhl, 'Fine-tuning is not surprising', *Analysis* 66 (4), 2006: 269-275.

[33] Milan Ćirković, 'Sailing the Archipelago', this volume.

[34] See, e.g. T. McGrew, L. McGrew & Eric Vestrup, 'Probabilities and the Fine-Tuning Argument: a Sceptical View, *Mind* 110, 2001: 1027-1037; Colyvan M. Colyvan, J. Garfield & G. Priest, Problems with the argument from fine tuning', *Synthese* 145, 2005: 325-338; and J. Koperski, 'Should We care about Fine-Tuning?', *British Journal for the Philosophy of Science* 56, 2005: 303-319.

[35] See, e.g., Stenger, op. cit.; Adams, op cit.; T. Nakamura, H. Uehara & T. Chiba, 'The Minimum Mass of the First Stars and the Anthropic Principle', *Progress of Theoretical Physics* 97, 1997: 169-171; Anthony Aguirre, 'The Cold Big-Bang Cosmology as a Counter-example to Several Anthropic Arguments', *Physical Review* D64, 2001: 083508; R. Harnik, G. Kribs & G. Perez, 'A universe without weak interactions', *Physical Review* D74, 2006: 035006; and Milan Ćirković, op. cit.

IS: Agreed, it's difficult to do the sums correctly. So that justifies doing them *wrongly*? The universe is not obliged to behave in ways simple enough for humans to calculate. The difficulty of doing anything beyond 'perturbation' calculations, where a few parameters are changed by very small amounts, doesn't mean that the computable cases are the only ones available. It actually strengthens my point, because the claim that anything else cannot possibly support life falls to bits if you haven't got a clue how other possible universes behave. There is a huge difference between claiming that no other possibility works (which in effect is a claim of complete knowledge of the consequences of alternative laws of nature) and pointing out that since we don't know that, and cannot know that, then we cannot make that claim. What's at stake here is the logic of the argument. I'm not trying to prove that our universe is not special. I'm pointing out gaps in the logic of the claim that it is.

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[36] Roger Penrose, *The Emperor's New Mind* (Oxford: Oxford University Press, 1999), 445.

[37] See Ćirković, 'Sailing the Archipelago', this volume.

If by 'invalidates anthropic reasoning *per se*' you mean 'shows that *any* kind of anthropic reasoning is silly' then of course nothing we've discussed does that. What I'm saying is that the 'classic' examples of anthropic reasoning are all flawed. Carbon in stars, fine-tuning – the logic is bad, the arguments are full of holes. I don't reject all anthropic reasoning. I just ask that it be done carefully and with imagination.

It's the Sherlock Holmes point – or, rather, what Holmes failed to mention. 'Once you have eliminated the impossible, then whatever remains, however improbable, must be true'. What Holmes failed to point out is that this line of thinking is hugely dangerous unless you are very, very careful that the things you claim to be impossible really *are* impossible. My view, and that of most mathematicians, I imagine, is that if what remains is wildly improbable, you probably made a mistake earlier on.

I agree with you on the problem of the application of probabilities: my use of probabilities of 25 percent rather than infinitesimal accepts the fine-tuning way of doing it (which is naïve but qualitatively defensible) to show that it doesn't lead to the claimed conclusions. 'Stars' can exist in a huge chunk of parameter space, not a tiny bit. End of story.

As for the idea of the supposed specialness of 'our' Big Bang, Jack and I argue in *Science of Discworld II: The Globe*[38] that Penrose's calculation is absurd. It assumes a purely thermodynamic universe (which is why 'entropy' comes into the story). Here all forces are short-range – acting only at the level of collisions of molecules – and repelling. The result is a long-term trend towards a uniform distribution of matter (disorder). But the real universe has many other forces, notably gravity. This is long-range and attracting – the exact opposite. The result is a long-term trend towards 'ordered', clumpy distributions of matter. If you use a thermodynamic model on a gravitic system, the results won't make much sense.

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[38] Terry Pratchett, Ian Stewart & Jack Cohen, *The Science of Discworld II: The Globe*, op. cit., 194-5. A more extensive treatment can be found in Ian Stewart, 'The second law of gravitics and the fourth law of thermodynamics', in (ed.) N. H. Gregsen (ed.), *From Complexity to Life* (Oxford: Oxford University Press, 2003), 114-50.

I don't actually think the use of 'order' and 'disorder' when discussing entropy is very helpful, because those terms are highly ambiguous, but for the sake of simplicity let's say that a high-entropy state is disordered and a low-entropy state is ordered. Then thermodynamic effects turn order into disorder; gravitic ones do the reverse. So any natural 'final' state of a gravitic universe is highly ordered. If you now pretend it's a thermodynamic system, the initial state must have been *even more* ordered (because entropy increases over time). This leads to Penrose's minuscule estimate for the probability of the presumed initial state that would lead (by *thermodynamic* action) to the final one. However, that's not how it happens. Instead, an initially disordered state naturally clumps under gravity. 'Entropy' measured by the clumping decreases over time. It doesn't increase.

C: While the use of anthropic reasoning in astronomy and cosmology has a long history,[39] the term 'anthropic principle' itself was first introduced by Brandon Carter in the early seventies as a corrective to what he called 'exaggerated subservience to the "Copernican principle"' – that is, the inference from the idea that we are not *special* to the idea that we must therefore be *average* or even *representative*.[40] It was this kind of uncritical acceptance of what has popularly taken to be the chief lesson of the Copernican revolution which in part led many Enlightenment thinkers in the centuries following Copernicus to assume that not only the other planets, but even moons and comets, must be populated by rational beings very similar to ourselves.[41] In *What Does a Martian Look Like*, as already mentioned, you charge much of contemporary astrobiology with a similar kind of (for want of a better word) 'terracentrism', charging it with being 'by its nature too narrow-minded and too unimaginative to tackle the really big questions about aliens'.[42]

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[39] See, e.g., J. D. Barrow and F. J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986); Milan Ćirković, 'Ancient Origins of a

IS: That's a fair summary, and it raises a fascinating issue that I've not thought of before. Anthropic reasoning concludes that we are special; Copernican reasoning concludes that we are not special. The cosmological mainstream (or at

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Modern Anthropic Cosmological Argument', *Astronomical and Astrophysical Interactions* 22 (6), 2003: 879-886; and Milan Ćirković, 'On the First Anthropic Argument in Astrobiology', *Earth, Moon and Planets* 91, 2002: 243-54.

[40] B. Carter, 'Large number coincidences and the anthropic principle in cosmology' in M. S. Longair (ed.), *Confrontation of Cosmological Theories with Observational Data* (Boston: Reidel, 1974), 291; cf. the discussion in 'Dark Matter: Probing the Arche-Fossil. Interview with Roberto Trotta' in COLLAPSE II: 83-169.

[41] On this see, for example, Frank Tipler, 'A Brief History of the Extraterrestrial Intelligence Concept', *Journal of the Royal Astronomical Society* Vol. 22, 1981: 133-145.

[42] *What Does a Martian Look Like?*, op. cit., 5.

least, many prominent members) tends to believe both of these.

Carter's point is the key. I think that it is probably correct to assume that we are not special – not in general terms. But does this imply that we are *representative*? I'd go with Carter: it does not. The reason, to use the central distinction of *What Does a Martian Look Like?,* is that we can be (and virtually by definition always are) special in *parochials* but not in *universals.*

Intelligence is a universal (we have argued, after a lot of debate, and we acknowledge that we may be wrong here – but let's take that as an example anyway). So by the Copernican view, our intelligence is nothing special. There will be lots of intelligent aliens out there.

However, our particular level of intelligence, our use of a brain as the seat of intelligence, what we do with our intelligence – many features will be parochial. Aliens won't do it the same way as us. Which implies that in these respects we *can't* be representative.

In short: to be representative *is* to be special! As soon as diverse histories can lead to the same universal result, each history will be special, and nothing can be representative. Jack and I hit this problem when writing *What Does a Martian Look Like?*: I kept asking Jack to stop saying 'we can't know what aliens look like', and he kept saying 'but it's true'. We compromised by talking of 'placeholders' – 'as long as you don't take this example literally, they might be like *this* ... but not in any of the details'.

C: Perhaps you could explain what you mean by 'universals' and 'parochials'. This distinction was introduced in *Collapse*,[43] developed in *Figments*,[44] and you put it to work in *What Does a Martian Look Like?* in order to hazard educated guesses regarding which kinds of biological features we might hypothetically expect to find exhibited by extraterrestrial life forms. Could you explain how one sets about trying to distinguish between the 'universal' and the 'parochial' in evolution, and what tentative conclusions you have reached regarding the possibilities of alien life?

JC: It is essentially a very simple idea, and argues the 'likelihoods' of events – innovations – in *our* evolutionary story. If an innovation happened just once, this tells us that it is possible, but not how likely it is to have happened – perhaps the invention of DNA was such an event. On the other hand, eyes evolved in many different clades, apparently independently (although there are some puzzling equivalencies in some of the biochemistries), making it appear likely that eyes will evolve. If we 'ran Earth again', or found another planet on which eukaryotes (or equivalents …) had evolved from prokaryote (bacterial/archaean) progenitors, we would expect to find eyes. But DNA? We would not be able to argue for DNA *in the same way* (but there might be chemical reasons to expect it – or not!). Similarly for photosynthesis: there are five extant methods of photosynthesis. Granted an oxygenated atmosphere, then flight would be expected: insects, birds, bats, pterosaurs, and some fishes all invented flight independently; we would expect flying life forms on a re-run Earth, or on another aqueous planet. I have suggested that we call such multiply-invented innovations 'universals', while those innovations – nearly all of them – that happened but once in our evolutionary story I call 'parochial'. Vertebrates are parochial – we won't find that pattern elsewhere (nor would it occur again on a re-run Earth). So are feathers; and hair (but not 'fur' – bumble bees have it for warmth, as do many plants – mammalian hair is a parochial instance of the universal 'fur').

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[43] *The Collapse of Chaos*, op. cit., 404.

[44] *Figments of Reality*, op. cit., 109-134.

Now there is the question of whether our universal/parochials are transferable to other planets, and the answer is: We simply don't know. We don't know how different even the most earth-like aqueous planet will be. But we can certainly rely on the negative: We won't get vertebrates! But whether we'll get flight or photosynthesis … ?

IS: We started out with Jack's working definition: a feature is universal if it has evolved independently more than once, and parochial if not. That works fairly well for life on Earth, but if aliens exist that may be too small a sample. So I argued for a more 'mathematical' definition (or characterisation): if some feature or mode of behaviour offers evolutionary advantages for generic reasons, it's a universal. By 'generic' here I meant that the *reasons* should be valid in many diverse contexts. So having a sense of vision ought to be universal, because it helps you detect danger in almost any form.

On Earth, vision evolved many times, so in this case the two approaches to universality coincide. In a way, my definition is a theoretical one and Jack's is the experimental test. But when it comes to aliens, we can't yet do the experiments.

C: According to your book, many proponents of orthodox astrobiology – most of whom are astrophysicists rather than biologists – 'seem not to have realised that there has been a revolution in evolutionary thinking during the 1980s, just as radical as the Newton/Einstein paradigm shift in physics', one consequence of which being that they 'are ruling out various scenarios for alien life, even though those scenarios already occur on this planet'.[45] 'Our own planet', you suggest, 'is far weirder than anything permitted elsewhere by astrobiological orthodoxy'.[46] For those still not 'in the know' on all this, could you describe what this recent revolution in evolutionary thinking amounts to, and provide some examples of the (from the human point of view) weird and wonderful forms of life only recently discovered on our planet?

JC: The evolutionary paradigm is usually taken, by philosophers and physicists – but also by many biologists – to be that of the 1950s: all the organisms of a population have much the same genome (hey, that's why they belong to the same species …), but a few have mutations that usually make things worse but occasionally make things better (because if you fire bullets randomly at a car engine you'll mostly damage it, rarely improve it!). So most mutations are lost in the first generation ... or so they thought!

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[45] *What Does a Martian Look Like?*, op. cit., 7.

[46] Ibid., 39.

Lewontin's group in the 1970s[47] (and hundreds of others since) discovered that wild animals and plants – and humans – are not like that at all: in a typical individual about 10 percent of the genes are heterozygous (different versions from Pa and Ma) and about a third of genes have different version(s) in the population (say, more than 1/1000 individuals – with rarer mutations, it comes up to about two-thirds or more!). So lots of old mutations are still about, recombining in different assortments in each of the progeny. That's much more like Darwin's picture, incidentally, which he got to by arguing from domestic species (mostly pigeons!). Each of the progeny is different in many genetic respects, and only because of 'genetic assimilation' and other developmental tricks can so many actually develop, the developmental programme is so diverse. Put this against the Malthusian background – so many progeny, so little room. Realise that 1/1000 survival is not unusual, 1/million or even 1/100 million is found in oysters and codfish; 1/8 in songbirds like starling (a female starling lays about sixteen eggs in her life, which 'on average' produce two parents in the next generation – only 'averages' ain't the way to calculate), 1/4 in hippos and rhinos, 1/3 in elephants. Most progeny fail to breed. And because they are all so genetically different from each other, this is mostly because of different programmes; but *because they are all so different* what is being selected is not particular genes, but particular – and very varied – combinations for the next generation. By any number of developmental tricks, these different versions can all develop, but they are not like Ford Model

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[47] R. C. Lewontin, *The Genetic Basis of Evolutionary Change* (New York: Columbia University Press, 1974).

T's, some with bumps and a few with better headlamps etc; they are like handmade cars, all adjusted differently to give much the same results. Add to the puzzle that the parts that they are using are very various, perhaps from the last ten models (and a few from similar models …), and it is clear that the DNA genome ain't even half of the trick – the RNAi (which were thought to be products of 'junk' DNA) turn lots of genes on and off in different tissues, and there are perhaps thirty other tricks we know about (epigenetic tricks, for example, that carry information to the next generation by modifying DNA …) – as well as the hundreds we don't know about yet.

So the picture we should have of alien genetics is not at all the Lego model: has it got the right genes? So diverse is the developmental/genetic system *here* that we have to suppose that at least equivalent complexity would be needed to 'drive' an alien ecology, even just a bacterial-grade one. To get 'higher' organisms we must invent a whole new slew of *really* complicated/complex biology, that involves selection of *genetic variety of progeny*, not just selection of progeny!

We have, now, hundreds of 'anomalous' species on earth, that don't fit the new paradigm of genetics, let alone the 1950s one. From parthenogones (females only ...) in some rotifers, for 100 million years, to a whole slew of genes that have been 'shared' by 'primitive' (bacterial and archaean) genetics, to a variety of genes that have been lifted across from species to very different species by viruses, to cichlid fishes of Lake Victoria with morphologies that are very various, from nearly a metre long to 2cm (a female that is kept in a snail shell by a male, and fed there), we now know of life forms with an enormous variety of life strategies – but with a genetic variety that is only about that of human beings!

C: In both *Collapse* and *Figments* you draw upon the massive evidence for evolutionary convergence to take issue with Stephen Jay Gould's argument that, if one were to re-run evolution on Earth, nothing like human intelligence would evolve a second time around. Intelligence, you argue, is a universal. What, then, do you mean by 'intelligence' here, and what is the evidence of convergence that led you to the conclusion that it is a universal – that is, something one might expect to find on any planet with a comparable biological complexity to that of the Earth? Presumably, unlike Simon Conway Morris in his recent *Life's Solution: Inevitable Humans in a Lonely Universe*[48] – apart from strongly disagreeing with his 'lonely universe' conclusion – you do not suppose that this 'universality' or 'inevitability' of intelligence has any special 'metaphysical' (read: theological) implications!

IS: It's worth noting that Gould himself rather backtracked on his claim. It was a way of dramatising the remarkable diversity of life in the Burgess Shale. (Which may also have been exaggerated, according to more recent studies of the fossils.) We would agree with Gould that *humans* would not evolve the second time round. Not just like us. Too many accidents of history are embedded in our genes. However, that doesn't rule out similarly intelligent creatures evolving by a different route, and we rather think they could – and, given long enough, should.

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[48] See note 30 above.

What do we mean by 'intelligent' here? I don't want to try for a philosophically waterproof definition (too hard). Informally, intelligence (as we experience it) has a number of striking features. The ability to manipulate mental models of the world, to ask 'what if?' questions, to let future prospects affect the present, and so on. As a universal, 'intelligence' ought to have similar features. You can construct your own list.

If we are right that intelligence is universal then it should evolve many times, either in a single run of this planet or in hypothetical multiple reruns. In effect, Jack's experimental test should work. So we would expect some kind of intelligent creature to turn up, some time. If intelligence is a parochial, limited to us and *our* evolutionary history, then Gould would be right, and intelligence would have lost its chance to evolve on Planet Earth.

JC: The answer to the question of whether intelligence is a parochial or a universal, in our evolutionary scheme, comes out as a resounding 'universal': from mantis shrimps to octopuses, geckoes to owls, dolphins to killer whales, creatures that 'think' have evolved many times - here. But can the same be argued for other planets? I like to think that it can; like Ian, I put it into a theoretical context: like vision, intelligence is a general way of dealing with the world, and will be 'chosen' frequently. So my prejudice is that we'll have (equivalents of …) mantis shrimps and killer whales, owls and octopuses on all those planets that have taken the steps towards the multicellular (or bzqwar … I don't know that multicellular is the *only* way 'upwards'!) – intelligence, in a variety of forms, will be rife, as it is here.

But extelligence? That is a quite different matter. There are steps towards extelligence: chimps, meerkats, wild dogs … so it could be claimed as a universal; but then these are all mammals, so should we count this as one single case (Mammalia), thus making it a parochial? Really, however, there is only one case: us. Only we have more information outside the brain (in other brains, initially …) than inside the individual brain – so that a Make-a-Human-Being kit requires pouring a whole lot of cultural stuff into each of us, as we grow up. How likely is that on another planet? Well, taking Ian's stance on universals, pretty damn likely, given time! It's clearly the best way (so far ...) of exploiting intelligence, transforming it into cultural capital that grows down the generations – becoming 'extelligence'.

Simon Conway Morris has an interesting take on this issue. Because he is Christian, he sees the 'highest' form of life on any planet (that's got far enough …) as being effectively, and morphologically, humanoid; essentially, he believes that the form of life 'made in the Image of God' is effectively the top of *any* evolutionary tree. Like Waddington, he believes that our morphology is just about 'right', and uses the (alien) convergences in evolutionary pattern to get there. Well, it may be so. If there actually *is* a real theology, that is to say there actually is a Someone who organized the whole matter, then one would perhaps expect to find that kind of contingency – if the Someone were smaller-minded than I would hope!

C: In *Figments* you introduced the ideas of 'privilege' and 'extelligence' by way of providing an evolutionary account of the origins of the peculiar nature of human intelligence and culture. These are remarkable ideas which one feels really ought to have achieved wider currency than they have so far. Could you briefly explain what you mean by these terms?

IS: I'll let Jack do 'privilege', because it was his idea long ago. 'Extelligence' came from a discussion between us both, but it was my word, so I'll tackle that.

The reason that humans have overrun the planet (and consider themselves Top Dog, or rather Top Species – although there are other contenders, depending on criteria) is *not* that we are intelligent. It helps, but it doesn't go far enough. Purely intelligent mortal creatures have to reinvent the wheel (literally) in each generation. Lessons derived by the exercise of intelligence have to be relearned – they can't be passed on.

But if some sort of cultural memory exists, the next generation can build on the lessons learned by the previous one. The mechanism can be as simple as mother dog teaching the pups where to find water, or as sophisticated as the Internet. But without it, 'civilisation' could never have happened, and as individuals we would be virtually powerless. We'd be back in the caves, battling the monsters, staving off starvation on a day-to-day basis.

Anything that can pass 'cultural capital' or 'know-how' down the generations we call 'extelligence'. It is that part of our intelligence *as a species* that does not reside in all (most) individuals. Until a few thousand years ago each bit of it resided in the brains of specific individuals – the copper-beaters knew all about making things from copper, and so on. It was passed on by word of mouth, often from parent to child.

Our ability to manipulate the planet to our own ends started to take off when we found ways to store this stuff *outside* human brains. We carved it on walls, wrote it in papyrus, whatever. Now the amount of 'extelligence' is limited only by the available space to store it, not by the capacity of one human brain. Its use is limited by our ability to access it, as well.

JC: In my 1977 book *Reproduction*[49] I invented the idea of 'privilege', as that which offspring receive from their parents, to give them a start in life. So yolk, milk, starch, etc., represent food that could have been used by the parent chicken, cow, wheat plant, etc., for its own purposes, but that has been donated to the offspring to help give them a start, to give them privilege. Laying eggs in the right place (e.g., on a paralysed spider, or on a mammalian corpse), counts as privilege – so does sending the child to a special school. So this is a very general concept, emphasizing that the break between generations is not very 'clean'. Equally, of course, teaching/learning is another instance of this passage across the generations, initially in the nest: cats teach their kittens to deal with prey. (This seems to be a solely mammalian trait – other nests, like those of some turtles, crocodilians or even cephalopods seem to have no passage of information – even birds don't seem to 'teach' their young.) From those small beginnings, however, arose languages like those of wild dogs (whose puppies learn the pack's special noises for 'hunt'), leopards, eagles; surprisingly, perhaps, chimps – our closest relatives – don't have much by way of language-learning, perhaps less than dogs; a few monkeys, especially vervets, have tens of 'words'.

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[49] Jack Cohen, *Reproduction* (London: Butterworth, 1977).

Our trick has been to explode this initial trick into complex language, by which we pass a tremendous amount of information from maternal brain to infant brain, accumulating cultural capital across the generations. Priests, as temporary repositories of the cultural capital, made it much more stable, ubiquitous. Then writing, to produce a more permanent store … teachers, specialists in passage, then books, libraries, the Internet. Knowledge outside brains, for which Ian invented the happy word 'extelligence'.

C: In *What Does a Martian Look Like* you suggest that the question of whether extelligence is a universal or a parochial is 'the central question of xenoscience'.[50] What conclusions did you reach?

IS: Well, in brief, if it's *not* a universal it surely *ought* to be one! But it's not yet possible to make too strong a claim. With intelligence, we can argue that there is experimental confirmation of universality: it evolved many times – octopus, dolphin, monkey ... But right now we are the only extelligent species on the planet.

Finding aliens (even bacteria) would be fantastic. Complex aliens, at the level of a snail, would be amazing. The level of intelligence of a cat – awe-inspiring. But what we really mean by 'alien intelligence' is actually *alien extelligence*. That's the big one. It's the extelligent aliens who would be able to build those massive starships and travel across the Galaxy. The merely intelligent ones would reach dolphin level, and stay in their oceans or methane-pools or crystal forests or whatever, stuck on their home world.

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[50] *What Does a Martian Look Like?*, op. cit., 277.

JC: I think there are too many unknowns. We don't know if we can transfer the ideas of universal/parochial to any other planet – though of course I'd like to think that we could! Then there's the whole question of whether extelligence derives naturally from intelligence (does it need a nest, for example? I played with this question in Harrison's *West of Eden* series, inventing an r-strategist extelligence [r-strategists have many offspring, not looked after …]; and we produced another in *Wheelers*). Too many intelligent creatures on this planet *haven't* developed extelligence (even k-strategists, who look after their few babies)! So I'm not optimistic. But there are hundreds of millions of planets out there. Who knows?

C: When first introducing the topic of 'alien science' in *Collapse*, you did so in the context of raising the question of whether the so-called 'laws of nature' discovered by science are genuinely objective features of reality itself, or only 'brain puns' which happen to appeal to the pattern-seeking human mind, by considering the question of the extent to which we might expect alien sciences to be congruent to our own. An idea which has often been forwarded in this connection is that while it is doubtless the case that much of our science is indeed distinctively 'human' or 'anthropomorphic', reflecting the peculiar nature of our species' physiological make-up and idiosyncratic modes of perceiving and conceiving the world, when it comes to *mathematics* or *mathematical natural science*, at least, we can be far more confident that we are indeed tracking genuinely objective patterns of nature itself – patterns which, therefore, we might expect also to have been discovered by any sufficiently advanced science. A century ago, for example, Max Planck characterised the history of the physical sciences in terms of a progressive unification brought about the liberation of the physical world-picture from 'anthropomorphous elements', ultimately resulting in the discovery of 'universal constants' which, he maintained, 'must necessarily retain their meaning for all times and for all environments, terrestrial and human or otherwise'. It is only if such constants retained the same significance for 'the inhabitants of Mars, and indeed all intelligent beings in our universe', he suggested, that it would be meaningful to say that, for example, 'the principle of the conservation energy was valid in nature, before any man was able to think about it, or that heavenly bodies will still move according to the laws of gravity when our earth, with all its inhabitants, has disintegrated'.[51]

This issue of how peculiarly 'human' our own science may be in relation to the phase space of possible sciences in general is a recurring theme of all your co-authored works. What, then, are some of your own conclusions on this issue? Are there any aspects of modern science and mathematics that one might reasonably expect to find represented in any possible science, even that of extraterrestrials with very different modes of perceptual access to the world to our own; or is human science, necessarily and inescapably, only ever going to be *our* science, irremediably marked by the peculiar environment, evolutionary development and modes of access to reality of the human organism and its instrumental extensions? Is mathematics, at least, able to gain traction upon what used to be called the 'primary qualities' of nature, and thus provide knowledge of a reality entirely uncorrelated with peculiarly human modes of access to it; or is mathematics, too, only 'our' mathematics?

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[51] 'Max Planck, 'Die Einheit des physikalischen Weltbildes', *Physikalische Zeitschrift* 10, 1909: 62–75; translated as 'The Unity of the Physical World-Picture' in Stephen Toulmin (ed.), *Physical Reality: Philosophical Essays on Twentieth-Century Physics* (London: Harper and Row, 1970), 1-27; also translated as 'The Unity of the Physical Universe' in Max Planck, *A Survey of Physical Theory* (New York: Dover, 1993), 1-26.

IS: We could let our imaginations run riot and invent aliens with virtually any kind of theory of the workings of the universe, including none at all, but I don't think such speculations would be very useful. On the one hand, it's not a good idea to assume that an alien view of the universe *must* be similar to ours. On the other hand, mathematics and science developed from questions about the world around us, so we might expect aliens to have come to similar conclusions.

There are merits to both arguments, I think. You may have noticed the phrases I used – 'On the one hand/On the other hand' and 'view of'. These metaphors involve human physiology, and you can make a case that (say) our two-valued true/false logic may have been influenced by various dualities in our daily lives. Working from inside the human mind, as we all do, it may be difficult to determine how strongly (muscle-power ...) our world-view (here we go again ...) is influenced by this limitation.

But equally, the number system (1, 2, 3 ...) or the conservation of energy do seem rather basic, and we might reasonably expect aliens to have related concepts. I wouldn't want to place too much weight on that, though. I do think that if aliens have developed similar ways of thinking to us, so that they have some sort of 'alien maths', say, then it should be consistent with ours. A universe in which Fermat's Last Theorem is true on planet Earth but false on Zarathustra is a bit too wild for my taste.

However, it's not at all clear to me that what we think of as basic maths would necessarily be what an alien would think of as basic maths. I'm not worried about, say, base-10 versus base-12 numerals, or whatever: those are parochials, not universals. But would aliens have a concept of whole numbers – counting – at all? Imagine wispy creatures that float in the turbulent atmosphere of a gas giant like Jupiter, always growing whole, being ripped apart by the winds (this is how they breed ...). They might not have counting numbers because there's very little in their world to *count*. Few discrete structures exist: all is flux. 'One, two ... no, it's gone ...'. But their intuition for turbulent fluid flow (which for us is an almost intractable mathematical problem) would be amazingly advanced compared to ours. Some theoretician might introduce 1, 2, 3, ... as a topological invariant for systems of vortices. For these aliens, $2 + 2 = 4$ would be a major theorem. Even more speculatively, a creature made of gravitons (hypothetical particles that carry the force of gravity) would develop a very different physics from us.

If the two races came into peaceful contact, the synthesis of their 'mathematicses' and 'physicses' would be very powerful, and I'd expect some really extensive complicity to transform everything completely. But it would take a lot of effort, because it would all be cross-paradigm to start with.

Many scientists would simply assert that science is science and being human has nothing to do with it. I think this is too simplistic. The other extreme, the notion that science can be anything we all agree on, is worse – it exaggerates the human element, ignores the way scientists try to disprove their own theories, and is ultimately self-destructive. However, science isn't just about the answers you get, but about the questions you ask. Even today, different cultures often ask different questions and use science for different purposes. Aliens might ask *very* different questions. So while one part of me would be delighted if my chosen subject, mathematics, were the basis of reality, the more cynical part doubts that this could be the case.

Gregory Benford, a top-notch science fiction writer and an excellent physicist, once wrote an essay (in *Analog* magazine somewhere, I think) based on the distinction between two very different ways of looking at the world:

(1) Humanity is the context for the Universe;

(2) The Universe is the context for Humanity.

That is: do you (1) think of humans as what's important, and everything else as some kind of support or resource system for us to exploit? Or do you (2) see humans as one small, local consequence of whatever is going on out there is a gigantic universe, about which we know very little?

I've come to realise that almost all of the world-views with which I have serious disagreements adopt (1), and that almost all of my contrary stances are based on (2).

JC: I believe, as you say, that human science is 'necessarily and inescapably, only ever going to be *our* science, irremediably marked by the peculiar environment, evolutionary development and modes of access to reality of the human organism and its instrumental extensions' – yup, afraid so! Think, if we – Rutherford, I suppose – had started with the proton rather than the electron, we'd have a whole different zoo of particles, and different equations and constants, which would explain the natural world just as well. Or do you think that we would have converged on to electrons, and Planck's constant, because they are actually *there*? I have no such confidence; we had a good, workable system, electrons, protons, mesons; as soon as we went down into quarks I was completely persuaded that there are a million such systems, and that we had found another workable one – or invented one, it doesn't make much difference.

C: Finally, looking back on your many years of collaboration together, what would you each single out as the most important contributions which 'the collective entity Jack&Ian' has made to contemporary debates? Which of the ideas of Jack&Ian do you expect might stand the test of time?

JC: I'd like to think that the deep meaning of complicity will open up thinking in that area – people are still thinking that A affects B, then B affects A … when it is at least A' and B' by then … Extelligence is a wild card – it crept up on us from my idea of cultural capital, accumulating across the generations … The idea that simplicity is the problem, not complexity ... And mostly, the meta-idea that one can be serious – deadly serious – without being solemn!

IS: I have a real difficulty here because I have no idea how much influence any of those books has really had. So I hesitate to claim any credit.

For instance, it is very noticeable that conventional astrobiologists are finally beginning to appreciate just how different alien life might be. Focus is shifting, to some extent, from Earth-like worlds to more diverse settings. But I don't think that has happened because we wrote *What Does a Martian Look Like?* I think we just rode the wave a little bit ahead of the scientists who were doing serious research in that area instead of just writing a pop science book about it.

'Extelligence' is a nice concept. Right or wrong, I think it encapsulates an important point of view. I would also like to think that 'complicity' in our sense will turn out to be useful.

Most of all, I'd be delighted if more people took the attitude of the Zarathustrans' 'Institute for Simple Systems' – in which demolishing a wing of the library, because it has been superseded by greater *understanding*, is an event to be celebrated.

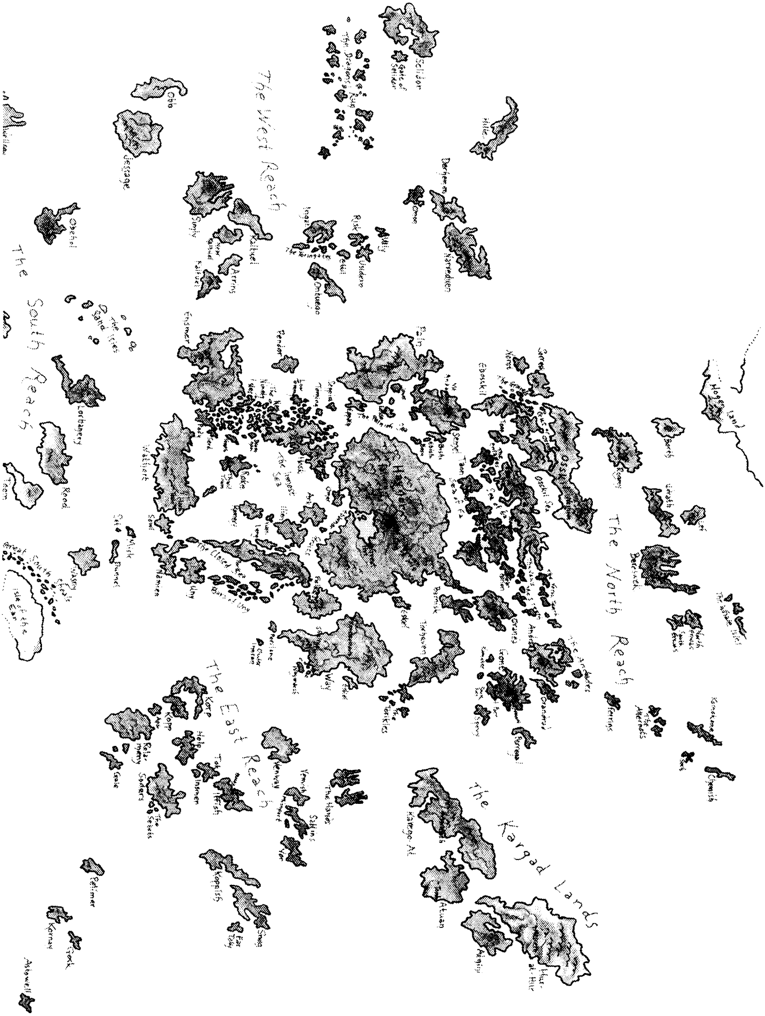
The West Reach
The South Reach
The East Reach
The North Reach
The Kargad Lands

Figure 1. A prototypical archipelago (according to Ursula LeGuin's *A Wizard of Earthsea* [Crockett, Cal.: Spectra, 2004]).

Sailing the Archipelago[1]

Milan M. Ćirković

I made it to the forward deck
I blessed our remnant fleet
Leonard Cohen

1. INTRODUCTION: MULTIVERSE AND ARCHIPELAGO

We live on a small island. We have not yet ventured much beyond our immediate locale on this small island; even our own inconspicuous location still holds great mysteries for us. It seems that we find ourselves near the mountain peak on our island, but even that is uncertain. We have only recently discovered that there are other islands besides our home scattered in a vast (possibly infinite) ocean. And the ocean is dead. It is not just devoid of fishes, algae or anything similar – it is empty of any *conceivable* form of life; it epitomizes the absence of life itself. But recently we have made our first attempt at mapping our surroundings and, in particular, sketching the outline of the ocean shores.

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In this, some of us bear similarities to the great adventurers of the European Age of Exploration in the fifteenth and sixteenth centuries; only in this case the explorers are not sea-captains and conquistadors, but theoretical physicists, cosmologists and philosophers.

Before I explain the central metaphor of the *Archipelago of Habitability*, I wish to emphasize how difficult and different from our modern experiences cartography once was.[2] Imagine the huge tasks facing the explorers of old – for instance, that of mapping a newly discovered South Seas archipelago with the rather crude geographical and navigational means at their disposal. No *Google Earth* or aerial reconnaissance surveys or photography. On the contrary, the explorers of old had to rely on quite uncertain and imprecise navigational aids – including often very vague time-keeping. It is hardly a wonder that their maps were usually very wrong in their details, and at best imprecise and fanciful. This is a point to keep in mind when we discuss this much vaster and more abstract Archipelago.

Five developments in the physical sciences which have taken place in the last ten to twenty years mark the intellectual convergence necessary for discussing the Archipelago:

(1) The emergence of the 'new standard' cosmological model of the flat universe dominated by dark energy (after 1998),[3] connected with the predominance of the inflationary paradigm; especially chaotic inflation seen today as

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[2] Splendid recent histories of the subject can be found in J.N. Wilford, *The Mapmakers* (New York: Vintage, 2001) and R. E. Ehrenberg, *Mapping the World: An Illustrated History of Cartography* (Des Moines: National Geographic, 2005).

[3] E.g., S. Perlmutter et al., 'Measurements of Omega and Lambda from 42 High-Redshift Supernovae', *Astrophysical Journal* 517, 1999: 565-586.

the generic form of the process.[4]

(2) The astrobiological 'revolution' (1995-today), offering a new unified framework for the old set of questions about the place of life and intelligence in the cosmic context.[5]

(3) The rise of string theory as the best candidate for the 'Theory of Everything' and the realization that it implies a huge number of low-energy sectors (or vacua) forming a 'landscape'.[6]

(4) The elucidation of anthropic principle(s) as observation selection effects by Leslie[7] and Bostrom,[8] leading to rejection of the old-fashioned teleological (mis)interpretations.

(5) The rise of an 'information paradigm' in many sciences, from biology to fundamental physics to computer science.[9]

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[4] A. D. Linde, 'Eternally existing self-reproducing chaotic inflationary universe', *Physical Letters, B* 175, 1986: 395-400.

[5] For beautiful reviews of these developments, see D. J. Des Marais and M.R. Walter, 'Astrobiology: Exploring the Origins, Evolution, and Distribution of Life in the Universe', *Annu. Rev. Ecol. Syst,*. 30 (1999), 397-420; D. Darling, *Life Everywhere: The Maverick Science of Astrobiology* (New York: Basic Books, 2001); and D. Grinspoon, *Lonely Planets: The Natural Philosophy of Alien Life* (New York: Harper Collins, 2003).

[6] L. Susskind, 'The Anthropic Landscape of String Theory' (2003), preprint at http://arXiv:hep-th/0302219; B. Freivogel & L. Susskind, 'A Framework for the Landscape', Physical Review D 70, 2004, 126007; and L. Susskind, *The Cosmic Landscape: String Theory and the Illusion of Intelligent Design* (New York: Back Bay Books, 2006).

[7] J. Leslie, 'The Anthropic Principle Today', in J. Leslie (ed.), *Modern Cosmology & Philosophy* (Amherst: Prometheus Books, 1998), 289-310.

[8] N. Bostrom, *Anthropic Bias: Observation Selection Effects in Science and Philosophy* (London and New York: Routledge, 2002).

[9] S. Lloyd, 'Ultimate physical limits to computation', *Nature* 406, 2000: 1047–1054; M. W. Coffey, 'Estimates of universal computational capacity to the present', *Physics Letters A* 304, 2002: 8-12; E. Fredkin, 'An Introduction to Digital Philosophy', *International Journal of Theoretical Physics* 42, 2003: 189-247; G. Chaitin, 'From Leibniz to Ω: Epistemology as Information Theory', *Collapse* Vol. I, 2006: 27-51; M. Tegmark, 'The Mathematical Universe', *Foundations of Physics* 38, 2008: 101-150.

All these developments have contributed something to the tremendous increase in work on various theories of the *multiverse* – a term promoted (if not truly invented) in popular culture by the great British novelist Michael Moorcock.[10] In general (though the particulars may vary), a multiverse is a set of large, causally connected cosmological domains – conventional universes. The multiplication – no pun intended – of multiverses has occurred over a wide spectrum of disciplines, from cosmology and mathematics to quantum information theory to philosophy: see Tegmark's review[11] and the popular books of Rees or Vilenkin[12] on the subject. In the rest of this paper, we shall use the anthropic landscape of string theory as the prototype physical realisation of the multiverse, while strongly emphasising that it serves just a placeholder and that no conclusion is crucially dependent on this choice.

The idea of the Archipelago of Habitability was introduced by Max Tegmark in his intriguing paper on the relationship between mathematical and physical worlds.[13]

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[10] See M. Moorcock, *The Eternal Champion* (Clarkston, Georgia: White Wolf, 1995), esp. the new Introduction.

[11] M. Tegmark, 'Parallel Universes', in J. D. Barrow, P.C.W. Davies & C.L. Harper (eds.) *Science and Ultimate Reality: From Quantum to Cosmos* (Cambridge: Cambridge University Press, 2003).

[12] M. J. Rees, *Before the Beginning: Our Universe and Others* (Cambridge, MA: Helix, 1997); A. Vilenkin, *Many Worlds in One* (New York: Hill and Wang, 2006).

[13] M. Tegmark, 'Is "The Theory of Everything" Merely the Ultimate Ensemble Theory?', *Annals of Physics* 270, 1998: 1-51.

Conceptually:

The Archipelago of Habitability: A set of regions in parameter space describing those parts of the multiverse which are hospitable to life and intelligent observers of any kind.

In the language of physics, the Archipelago is a subset of the anthropic landscape of either string theory or any other overarching 'Theory of Everything' with multiple low-energy solutions ('vacua'). Thus, the Archipelago is part of the abstract space defined by whatever physics determines the structure of the multiverse. It is both logically and physically contingent on the reality of the multiverse; but that is still not saying much, since, as Tegmark emphasizes,[14] simple variants of the multiverse are completely uncontroversial and legitimate consequences of our firmly established cosmological theories. Whether the multiverse is infinite – as in the currently popular cosmological theory of eternal inflation – or finite – as in some construals of the string theory landscape, reflects directly on the structure of the Archipelago as well.

What is an island?[15] It is a set of parameters describing habitable universes which are close in parameter space; whether we can specify the meaning of 'closeness' beyond simple intuition depends crucially on the structure of the multiverse itself. In other words, the multiverse imposes a natural or at least convenient metric upon the Archipelago. By definition, there is at least one island in the Archipelago – our home island. If the multiverse contains arbitrarily small variations in the constants of nature or cosmological parameters or even the mathematical shape of physical laws, than it is reasonable to conclude that the Archipelago is as dense as the remainder of the multiverse; for instance, it is clear that the change in the coupling constants of fundamental forces of 1 part in 10^{50} in comparison to those actually existing in our universe (not those actually measured, since we are unable to measure them to such precision yet!) – will not change anything in the habitable status of our universe. If such minuscule variations are actually realized within the multiverse, a universe otherwise described by identical laws and parameters to ours also belongs to our habitable region = our home island. It is easy to see that various constants and parameters of the multiverse play the role of geographical coordinates in maps of terrestrial archipelagos. Thus, if we start on a land point in, say, Sumatra, and continuously (or in sufficiently small steps) change either longitude or latitude along any chosen direction, we are bound to end up in the ocean. Similarly, if we start with a universe like ours and continuously change some parameter – say the strengths of forces, or the baryon-to-photon ratio, or the cosmological constant – we shall inevitably end up in a universe lacking prerequisites for life and observers. However, in the same manner as it is possible to start in Sumatra and, by a non-continuous increase in longitude, to end up in some other island – for example Borneo or New Guinea – it is possible that after a large interval of non-habitability, our parameter again enters an interval which (with appropriate changes in other parameters) enables the existence of life and observers. Thus, even if we did not know anything about possible different habitable universes

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[14] M. Tegmark, 'Parallel Universes', op. cit.

[15] Cf. M. Houellebecq, *The Possibility of an Island,* trans. G. Bowd (New York: Vintage, 2007).

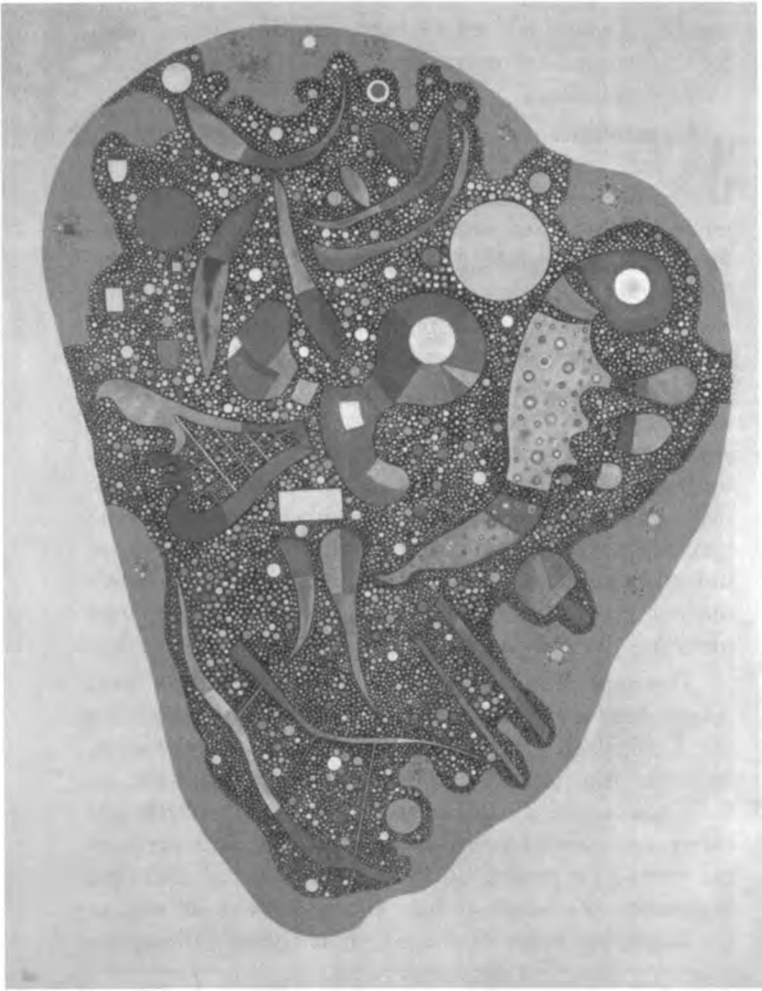

Figure 2. *Colourful Ensemble*, Wassily Kandinsky's 1938 canvas (Musée National d'Art Moderne, Centre Georges Pompidou, Paris), can be regarded as a symbolic representation of the multiverse: no colour is special as long as it is embedded in a wider ensemble.

(see §3), it would still be both rational and prudent to allow for the existence of other islands beyond our home island in the Archipelago.

Copernicanism is inscribed in the Archipelago picture right from the start – we are dealing with the widest conceivable ensemble in which our universe can be embedded, so as to avoid assigning it any special status. From the very beginning of the Copernican revolution, we have witnessed the loss of special status for ever-wider and more encompassing environments. First we concluded that there is nothing special about Earth, then about the Sun or the Solar System. In the 1920s, we finally realized that even our Galaxy, the Milky Way, is just one of billions of galaxies spanning the distance to our cosmological horizon. Now, in the twenty-first century, we should not be surprised to learn that, in spite of the apparent fine-tuning, there is nothing special about the whole of our cosmological domain – our universe – either.[16] Only in that manner will our universe's obvious property of being home to life and intelligent observers be adequately and naturalistically appreciated.

The exposition in the rest of this paper is as follows: After a brief survey of the role of astrobiology in defining the Archipelago (§2), I analyse recent discoveries of other habitable islands in some detail, with an emphasis on their philosophical significance rather than on technical issues and computational procedures (§3). This prepares the ground for putting the recent resurgence of anthropic arguments in cosmology into a new context, as well as for answering some of the common and/or fashionable

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[16] Cf. G. F. R. Ellis, U. Kirchner, and W. R. Stoeger, 'Multiverses and physical cosmology', *Monthly Notices of the Royal Astronomical Society* 347, 2004: 921-36.

criticisms of anthropic reasoning (§4). Most of the latter are based upon the alleged teleology of anthropic reasoning, a widespread and quite robust meme which has infected large segments of both philosophical and scientific populations, but which is nevertheless misleading and wrong. Finally, some summarized points and prospects for further research are given in the concluding section (§5).

2. ASTROBIOLOGY AS MAPMAKING

We are lucky enough to live in an epoch of great progress in the nascent discipline of astrobiology, a discipline which deals with three canonical questions: How does life begin and develop? Does life exist elsewhere in the universe? And what is the future of life on Earth and in space? A host of important discoveries has been made during the last decade or so, the most important certainly being the discovery of a large number of extrasolar planets whose number increases on almost weekly basis; the existence of many 'extremophile' organisms possibly comprising Thomas Gold's 'deep hot biosphere';[17] the discovery of subsurface water on Mars and the huge ocean on Europa, and possibly also Ganymede and Callisto; the unequivocal discovery of amino-acids and other complex organic compounds in meteorites; the modelling of organic chemistry in the atmosphere of Saturn's moon Titan; the quantitative treatment of the Galactic habitable zone; the development of a new generation of panspermia theories, spurred by experimental verification that even terrestrial microorganisms can easily survive conditions of an asteroidal or a cometary impact; methodological progress in the Search for ExtraTerrestrial Intelligence (SETI) studies, etc. However, the epistemological and methodological basis of astrobiology and SETI presents us with a hornet's nest of issues which, with a few exceptions, have not been tackled in the literature so far.

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[17] See T. Gold and F. Dyson, *The Deep Hot Biosphere: The Myth of Fossil Fuels* (New York: Springer, 2001).

One such issue is the role of astrobiology in mapping the Archipelago of Habitability, which, it is worth repeating, is a continuous part of the general parameter landscape – with the sea level defined on the basis of our understanding of habitability. Even more, habitability determines the altitude profile of an island in the Archipelago: how high will it be, will it have steep or shallow slopes, great plains or even depressions inside it, and so on. We all agree that our universe is hospitable to at least some forms of life and there is very strong empirical evidence that significant changes in values of some or all parameters will lead to an inhospitable universe (the subject matter of classical anthropic 'fine-tuning' arguments, to be considered in the next section). Asking about the sea shores of the Archipelago is tantamount to asking Schrödinger's famous question 'What is life?'.[18]

There are many ways of surveying the Archipelago, just as in terrestrial geography one can either do satellite imaging, or search for water, or observe in the infrared, or do mineral prospecting, and so on. It is impossible here to give more than a cartoonishly brief sketch of some of the directions currently being actively pursued (although not always, or even mainly, recognized as belonging to the astrobiological domain; but such is often the historical pathway of young interdisciplinary fields). Research dealing with the preconditions for life and observership as we know them in a physical, chemical or geological sense is a part of the mapping endeavour; most of the research currently done and published, *inter alia*, in novel journals like *Astrobiology* or *International Journal of Astrobiology*, as well as in the older ones like *The Origin of Life and Evolution of the Biosphere*, belongs to this category.

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[18] E. Schrödinger, *What is Life?* (Cambridge: Cambridge University Press, 1944).

On a more general level, the task of astrobiology obviously depends on our ability to recognize life even in its strangest forms (i.e., those most removed from terrestrial experience). Contrary to the arbitrary assertions of some critics, the tradition of speculative thinking about alternative forms of life is as old as astrobiological thinking itself.[19] Speculations – now supplemented by computer simulations – concerning whether life can be based on silicon, fluor compounds, solid-state physics or even nuclear forces belong here and are likely to increase in number and quality in the future. The prevailing tendency even in the most conservative astrobiological circles has been to *increase* the robustness of life (e.g., in discoveries of various extremophiles), thus justifying a heightening of our expectations for the possibility of life elsewhere in the multiverse.

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[19] For a classical example, see R. Shapiro and G. Feinberg, 'Possible Forms of Life in Environments Very Different from the Earth' in M. M. Hart and B. Zuckerman (eds) *Extraterrestrials: Where Are They?* (New York: Pergamon, 1982); and for a modern one, F.J Dyson, 'Looking for life in unlikely places: reasons why planets may not be the best places to look for life', *International Journal of Astrobiology* 2, 2003: 103-10. For a very early SF treatment of the theme, see J.-H. Rosny, 'Another World', in COLLAPSE III, 2007: 255-306.

A particular form of surveying is embodied in research on *artificial life* (Alife). From a rather eccentric game of computer scientists (albeit one with august ancestry, with von Neumann), it has become an important mainstream research discipline with wide-ranging influence and an increasing number of applications within fields such as evolutionary computation, cellular automata, genetic algorithms and even evolutionary art.[20] It is often stated that the goal of Alife is to *recreate* biological systems in a digital environment, but there are at least some distinguished researchers, such as ecologist and computer scientist Thomas Ray, who claim that such experiments are actually *creating* a new kind of life.[21] Clearly, if this strong A-life thesis turns out to be correct, this will have important epistemological implications for cosmology as well, since numerical experiments such as Ray's would make the sea shores of the Archipelago amenable to much more precise probing – something alike to the revolution of Gerardus Mercator and Abraham Ortelius in cartography in the 1560s.

Finally and most pertinently to our goal, we can ask, with Tegmark:[22] What are the minimal conditions for a physical environment containing intelligent observers? Tegmark lists three basic conditions, namely (1) complexity, (2) predictability, and (3) stability. (He imposes them on mathematical structures describing arbitrary physical laws, in accordance with his 'Platonist' position on the relationship between mathematical and physical worlds; but the usage of these criteria does not really hinge on this philosophical viewpoint.)[23] The first necessary condition is almost self-evident: even the most ardent physicalists are unlikely to deny that an excessively high level of complexity is the reason why, among other things, we have not yet managed to create living or intelligent beings in the laboratory. The other two criteria are meaningful if we consider the operation of measurement by which knowledge is received by observers, an operation which requires both that the results do not fluctuate too much in the past or the future, to preclude the use of inference from past experience, and that habitable conditions exist at least during measurements. Of course, these are necessary, but not sufficient criteria for habitability. The search for sufficient criteria, and thus for the outlines of the Archipelago, continues.

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[20] See M. A. Bedau, 'Artificial life: organization, adaptation, and complexity from the bottom up', *Trends in Cognitive Science* 7 (2003): 505-512.

[21] T. S. Ray, 'An Evolutionary Approach to Synthetic Biology: Zen in the Art of Creating Life' in A. Ghosh and S. Tsutsui, *Advances in Evolutionary Computing* (NY: Springer, 2003), 479-517. See also C. Vidal, 'The Future of Scientific Simulations: from Artificial Life to Artificial Cosmogenesis', in C. Tandy (ed.), *Death And Anti-Death, Volume 6: Thirty Years After Kurt Gödel (1906-1978).* In press, preprint at http://arxiv.org/abs/0803.1087.

[22] M. Tegmark, 'Is the "Theory of Everything" Merely the Ultimate Ensemble Theory?', op. cit.

All this (and, arguably, much else) constitutes an 'extended mandate' of astrobiology – and one immediately answering all the conventional criticisms:[24] Almost by definition, it 'looks outward to the general, rather than inward to the particular'. It will, hopefully, provide a much more satisfactory answer to one of the perennial problems of science – Schrödinger's question – in the most general multiverse context.

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[23] Even more precisely, Tegmark uses the term 'self-aware substructure' in order to pose the problem as mathematical, since on the Platonist viewpoint an observer is nothing else than a part of a wider mathematical structure. But the same general reasoning about the criteria applies if we (i) regard observers as physical systems only approximated by mathematical descriptions, and (ii) have a particular physical mechanism of introducing variations (like the spontaneous symmetry breaking in inflationary cosmologies).

[24] E.g. J. Cohen, and I. Stewart, *What Does a Martian Look Like? The Science of Extraterrestrial Life* (Hoboken, NJ: John Wiley & Sons, 2002).

3. VOYAGES OF DISCOVERY

Geography and cartography would be senseless without an appropriate metric; in the terrestrial case, the units of length (such as kilometers and nautical miles) combined with the angular coordinates (such as longitude and latitude), provide us with a hugely successful description of any explored piece of landmass or ocean. The extension of our analogy to the cartography of the Archipelago of Habitability emphasizes the analogous role of changing various parameters of physics (including the very form of low-energy physical laws). Let us forget, for the purposes of this section, the issue of the altitude of points on an island (i.e. the degree of habitability) and suppose that we are dealing with a single-contour map. Classical anthropic arguments from fine-tuning amassed significant empirical evidence that we cannot change the parameters that describe our universe *very much*, at least as long as we keep other parameters constant.[25] For example, the initial low entropy of our Big Bang seems excessively fine-tuned,[26] as does the amplitude of the primordial density perturbations seen as anisotropies in the cosmic microwave background.[27] This would mean that our island is a rather small one, since even small changes in any single coordinate (with other coordinates kept constant) would lead us quickly to the ocean shore. In such a situation, it seems natural that early anthropic thinkers concluded that our island is the only one in existence. They were wrong, but not because of some ulterior and heinous agenda, as it is sometimes implied by opponents of anthropic reasoning; it was perfectly reasonable for them to think so – we might compare their rationality to that of a hypothetical ancient philosopher of Easter Island, pondering the huge ocean surrounding his home.

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[25] For compilation of the evidence up to mid-1980s see J.D. Barrow and F.J. Tipler, *The Anthropic Cosmological Principle* (NY: Oxford University Press, 1986). An updated review is C. J. Hogan, 'Why the Universe is Just So', *Reviews of Modern Physics* 72, 2000: 1149-61.

[26] R. Penrose, *The Emperor's New Mind* (Oxford: Oxford University Press, 1989); M. M. Ćirković, 'The Thermodynamical Arrow of Time: Reinterpreting the Boltzmann-Schuetz Argument', *Foundations of Physics* 33, 2003: 467-90.

But contemporary sailors of the Archipelago have been able to refute this prejudice. In his often cited and almost as often poorly understood study, Aguirre[28] finds a 'cold' Big Bang model – a counterfactual one with low entropy-per-baryon in comparison to our actual Big Bang – which is habitable even according to the very high standards posed by the *terrestrial* kind of life. This type of universe is also capable of producing structure, such as galaxies and stars, as well as the chemical building blocks of life; and in such an astrophysical environment, so drastically different from our own in other respects, there is sufficient time for chemical and biological evolution. Some opponents of anthropic reasoning hailed this result as a long-awaited refutation of the alleged 'anthropocentrism' of such reasoning.[29] Whereas what Aguirre does, in fact, is to discover another habitable region in the parameter space – another island of habitability!

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[27] M. Tegmark and M. J. Rees, 'Why is the Cosmic Microwave Background Fluctuation Level 10^{-5}?', *Astrophysical Journal* 499, 1998: 526-32.

[28] A. Aguirre, 'The Cold Big-Bang Cosmology as a Counter-example to Several Anthropic Arguments', *Physical Review D* 64, 2001, 083508.

While this is a seminal result, it is a far cry from being a 'refutation' or 'disproof' of anthropic reasoning. In fact, supporters of anthropic reasoning have every reason to cheer on Aguirre's bold exploratory voyage: It actually demonstrates that such exploration is meaningful, and that the question of probabilities of observing various parameter values can, at least in principle, be answered quantitatively and operationally. The role of astrobiology sketched in §2 above finds some expression in the endnote of Aguirre's paper, which states:

> I have assumed that the number of independent measurements in a subuniverse is proportional to the number of suitable stars, neglected such effects as, for example, high metallicity leading to more planets upon which multiple civilizations might arise in a single solar system. I have also neglected factors like extinction-causing impacts, radioactivity-induced plate tectonics, etc., which are possibly but not clearly necessary for the evolution of observers.[30]

All these (and many other) factors clearly belong to the domain of astrobiological research. Thus, any elaboration of the classical anthropic arguments, no matter whether supportive or undermining, straightforwardly necessitates the use of astrobiological knowledge. And Aguirre shows that we need such knowledge from our universe (and our experience), even when dealing with other, disconnected parts of the Archipelago.

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[29] Cohen and Stewart, *What Does a Martian Look Like?*, op.cit.; see also 'Alien Science: Interview with Jack Cohen and Ian Stewart', this volume; L. Smolin, 'Scientific alternatives to the anthropicprinciple' (2004), preprint at http://arXiv:hep-th/0407213.

[30] Aguirre, 'The Cold Big-Bang Cosmology', op. cit.: n. 18.

But Aguirre's is not the only island different from our home island discovered so far. In fact, the island discovered by Harnik, Kribs, and Perez[31] is both larger (in both senses discussed above) and more remote from our home universe: They investigated nothing less than a set of conceivable universes without weak interaction ('weakless' universes). Before engaging in the analysis, they explain the methodology:

> We do not engage in discussion of the likelihood of doing simultaneous tunings of parameters nor the outcome of statistical ensembles of parameters. These questions are left up to the ultraviolet completion, such as the string landscape, which is outside of the scope of effective field theory. Instead, we are interested in 'running the universe forward' from a time after inflation and baryogenesis through billions of years of evolution. We will exploit the knowledge of our Universe as far as possible, adjusting standard model and cosmological parameters so that the relevant micro- and macro-physical outcomes match as closely as possible. We emphasize that this is really a practical matter, not one of principle, since any significant relaxation of the 'follow our Universe' program would be faced with horrendously complicated calculations. Put another way, there is probably a wide range of habitable universes with parameters and structures that look nothing like our Universe. For us, it

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[31] R. Harnik, G. Kribs, and G. Perez, 'A universe without weak interactions', *Physical Review D* 74, 2006, 035006.

> is enough to find one habitable weakless universe about which we can make the most concrete statements, hence matching our Universe as closely as possible.

This truly looks like a bold sailors' manifesto! The difficulties bound to be encountered by any stray explorer in the dangerous waters ('horrendously complicated calculations') are explained, and the independence of the basic approach to the form of the multiverse (i.e. string landscape or any other) explicated. This makes the results of the study still more impressive, since they find at least a single piece of rock above the water in the midst of the ocean – an apparently habitable universe missing so crucial an ingredient of our world as one of the four fundamental low-energy interactions. Whether this is just a rock protruding from the waters or a tip of much larger island is unclear at present; Harnik et al. honestly admit that much.

Why, then, do these authors repeatedly perceive themselves as refuting or undermining anthropic arguments? The reasons are at least twofold. First, most anthropic arguments in the literature (like the one on setting of the electroweak scale, criticized by Harnik et al.) are narrowly or even badly formulated. They are based on narrow-minded calculations of the effects of small (one order of magnitude or so) changes in a small number of parameters, and not on a true insight into the underlying physics, which could indicate the way in which multiple parameters could be varied – at least in principle – whilst retaining habitability. A clear parallel here is with the misguided 'rare Earth' arguments[32] in astrobiology of the form: 'if there were no

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[32] Cf. P. D. Ward and D. Brownlee *Rare Earth: Why Complex Life Is Uncommon in the Universe* (New York: Springer, 2000).

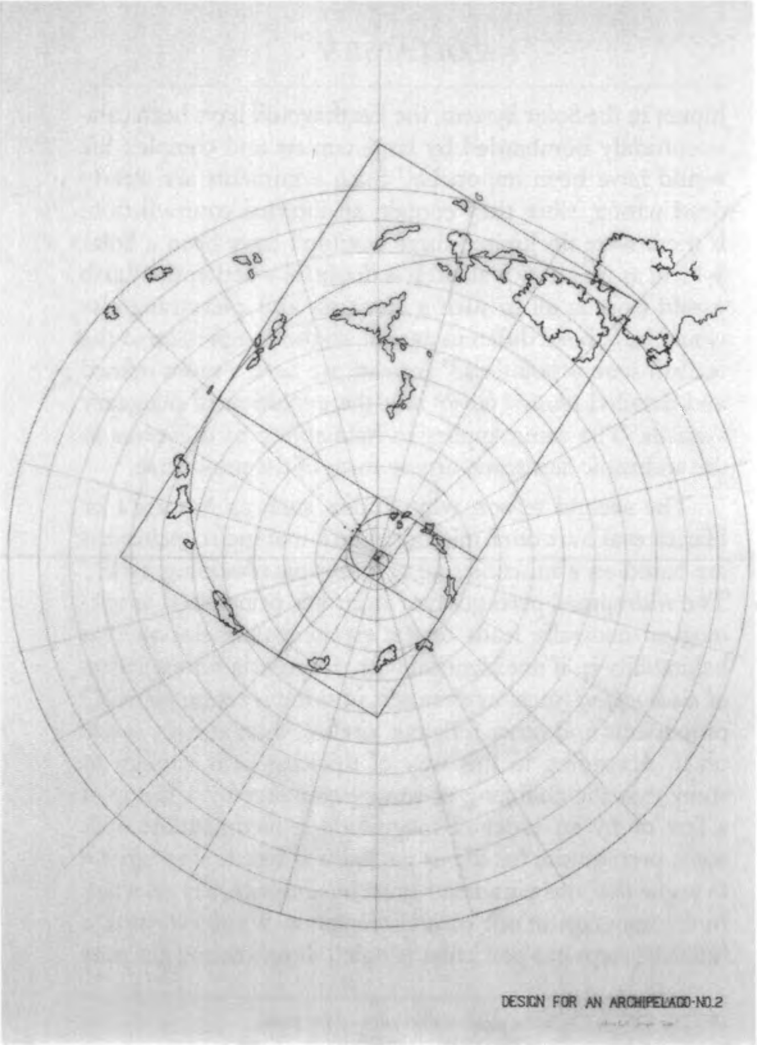

Figure 3. Charles Avery, *Untitled (Design for an Archipelago)* (2008), illustrating both the central metaphor and the possibility of 'deeper' mathematical regularities (here, the logarithmic spiral) underlying the seemingly random position of habitable regions. This is especially appropriate for Platonist multiverses such as Tegmark's, ultimately completely determined by overarching mathematical structures. (Image courtesy of the artist).

Jupiter in the Solar System, the Earth would have been catastrophically bombarded by large comets and complex life would have been impossible.' Such arguments are clearly dead wrong, since they contain an internal contradiction: If there were no Jupiter, there wouldn't have been a Solar System as we know it at all! It is doubtful whether the Earth would exist at all in such a scenario, and everything else would have been different as well, so the comparison to the realistic case is pointless.[33] Instead, we need a more refined and detailed *physical insight* into the evolution of planetary systems. The same applies to habitability of universes in the anthropic landscape or any form of the multiverse.

The second reason why studies such as Aguirre's or Harnik et al.'s are often misconstrued is that such conclusions are based on a misconstrual of anthropic reasoning itself.[34] The widespread perception of anthropic principle(s) as teleological naturally leads to the erroneous conclusion that habitability is, if not identical with the criteria for evolution of *homo sapiens* (such an extremist position is relegated to ID proponents and other religious circles), than at least *centred* on it. According to this way of thinking, it is enough to show that the changing of some parameter by a factor of a few or by an order of magnitude is incompatible with some prerequisite for life as we know it (read: *homo sapiens*) to argue that this parameter must be anthropically selected. In the language of our central metaphor, if you can walk a hundred steps in a particular (single!) direction and get your feet wet, that is enough to prove that you live on an island. This logic is anthropocentric and flawed; it has nothing to do with the real meaning of anthropic reasoning. It may well be true that we are indeed living on an island (after all, even Eurasia can be regarded as a rather large island!), but the justification for it is wrong. And yet, it is appealing for the same extrascientific reasons we shall return briefly to in the next section: viz., the rear-guard actions of both positivists and teleologists, leading to a widely accepted anthropocentric 'noble lie'.

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[33] I thank Chris Chyba for pleasant discussion of this point.

[34] See, e.g., Cohen and Stewart, *What Does a Martian look Like?*, op. cit.; and Quentin Meillassoux, 'Potentiality and Virtuality', in R. Mackay (ed.) **Collapse** II: 55-81 (cf. Meillassoux's comment in **Collapse** IV: 441).

In a more general sense, studies such as that of Chavanis on white dwarf stars in an arbitrary number of dimensions,[35] or Adams on stellar evolution with unconventional parameters,[36] are part of the research helping us elucidate the Archipelago. We do not perceive any direct connection between us and white dwarfs at present, but the elegance and simplicity of the problem of such physical objects in D dimensions gives us a feel for the approaches and ways of thinking necessary to sketch out the cartographical task. Obviously, interest in this sort of research has increased significantly in the last couple of years – we might be on the verge of a true Age of Multiverse Exploration!

4. ANTHROPIC SELECTION AND DETRACTION

Steven Weinberg claimed to have predicted the existence of a small positive cosmological constant in the anthropic manner more than a decade before its actual observational discovery.[37] This theoretical success opened the way for dramatic expansion of anthropic arguments in cosmology. In the current cottage-industry of multiverse predictions in theoretical physics, a special role is reserved for the equation giving a probability that some observer anywhere in the multiverse measures a feature *X*:[38]

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[35] P.-H. Chavanis, 'White dwarf stars in *D* dimensions', *Physical Review D* 76, 2007, 023004.

[36] F. C. Adams, 'Stars in other universes: stellar structure with different fundamental constants', *Journal of Cosmology and Astroparticle Physics* 08, 2008: 010.

$$p(X) = \frac{\sum \sigma_n (X) V_n \rho_n^{\text{obs}}}{\sum V_n \rho_n^{\text{obs}}}, \tag{1}$$

where the index *n* labels all possible vacuum states (all different low-energy '*physicses*' or different universes); in current versions of string theory there is a finite number of such states, although it is huge (10^{500} or so; see Susskind 2003), but in principle it could be infinite. The latter case could pose some interesting problems in the theory of probability,[39] but in general will not preclude the usage of Equation (1) with appropriate weightings, V_n is the spacetime volume belonging to the universe *n*, ρ_n^{obs} is the density of observers in the same universe, and

$$\sigma_n = \begin{cases} 1, \text{ if universe } n \text{ has property } X \\ 0, \text{ otherwise} \end{cases} \tag{2}$$

In principle, V_n is calculable from our understanding of cosmological physics, although in weird enough universes it might be impossible to calculate in practice (or at least in finite time available to human cosmologists!). It is also likely to be infinite in some or most of the universes, so some appropriate weighting procedure is certainly necessary. But, of course, the biggest uncertainty comes from the quantity ρ_n^{obs}, the density of intelligent observers. It is usually assumed to be proportional to the density of galaxies, the latter being the main features of the structure of our own universe. But this is at best uncertain, and at worst fantastically wrong for islands outside of our own home island. Obviously, more sophisticated astrobiology is needed here.

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[37] S. Weinberg, 'Anthropic Bound on the Cosmological Constant', *Physical Review Letters* 59, 1987: 2607-10.

[38] See e.g., S.M. Carroll, 'Is Our Universe Natural?', *Nature* 440, 2006: 1132-36.

[39] Cf. J.D. Hamkins and B. Montero, 'Utilitarianism in Infinite Worlds', *Utilitas* 12, 2000: 91-96; Tegmark, 'The Mathematical Universe', op. cit.

How can the concept of the Archipelago of Habitability help us elucidate Equation (1)? Even very cursory thinking points the way toward what I shall dub 'altitude weighting': Obviously, even islands of identical shape on the map can have vastly different habitabilities – the universes in two groups could have a vastly different density of observers. We have thus far discussed only surface coordinates of islands in the Archipelago; but their essential property (which makes them islands) is their altitude profile. Very high points (analogues of the volcano peaks of the Hawaii islands) represent sets of parameters describing extremely bio-friendly universes, in contrast with bare rocks protruding from the waters, where lifeforms are possible but unlikely or very rare. The same pertains to intelligent observers: regions of high altitude will contain the predominant fraction of the entire set of observers in the multiverse. These regions correspond to high values of ρ_n^{obs} in such regions of the parameter space.

Thus, in order to make anthropic arguments cogent against the background of the Archipelago, we need to weight universes by their 'altitude', i.e. the measure of habitability. Clearly, this is a task for astrobiology in the widest sense: As discussed above, the very definition of the Archipelago is contingent upon resolving the issue of criteria for life to arise in a naturalistic manner. But in order to get the altitude profile, we need much more further effort – we need at least some hold on the emergence and dynamics of intelligent observers, traditionally the province of SETI studies (and the recreational discourse of SF books and movies). On the other hand, there is no discontinuity here: by studying already 'traditional' astrobiological themes like the Galactic Habitable Zone,[40] we expect to survey viable SETI targets and assess the density of extraterrestrial civilizations, even if some specific modifications are made when we consider intelligent observers rather than just complex lifeforms.[41] Obviously, much further research needs to be done in that direction. But the encouraging news is that several approaches have been developed recently which encapsulate elements of the future whole picture, notably the counting of observer-moments discussed by Bostrom in philosophical terms,[42] and the counting of the number of possible observations in a particular universe devised by Starkman and Trotta in the physical domain.[43]

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[40] G. Gonzalez, D. Brownlee, and P. Ward, 'The Galactic Habitable Zone: Galactic Chemical Evolution', *Icarus* 152, 2001: 185-200; C.H. Lineweaver, Y. Fenner & B. K. Gibson, 'The Galactic Habitable Zone and the Age Distribution of Complex Life in the Milky Way', *Science* 303, 2004: 59-62.

[41] N. Duric and L. Field, 'On the detectability of intelligent civilizations in the Galaxy', *Serbian Astronomical Journal* 167, 2003: 1-10; M. M. Ćirković and R. J. Bradbury, 'Galactic Gradients, Postbiological Evolution and the Apparent Failure of SETI', *New Astronomy* 11, 2006: 628-39.

[42] N. Bostrom, *Anthropic Bias,* op. cit.

[43] G. Starkman and R. Trotta, 'Why Anthropic Reasoning Cannot Predict Λ', *Physical Review Letters* 97, 2006: 201301.

There seems to be an epistemological similarity between the proposal of weighting by the astrobiological description ('altitude' in terms of my central metaphor) and Trotta's suggestion[44] that a 'fully Bayesian approach' could resolve the difficulties with anthropic arguments, especially the lack of universal weight criterion for ρ_n^{obs}.

In practice, this task is enormous; perhaps generations of astrobiologists will pass before we get close to quantitative precision. But the enormity of the task should not detract from the fact that it is a well-defined problem from the start. If anything, it should demonstrate how utterly wrongheaded is the classical criticism that the anthropic reasoning is a 'lazy man's approach to science'.[45]

In the remainder of this section, I shall explore some of the more conventional criticisms of anthropic reasoning and discuss how the metaphor of the Archipelago may help us refute or undermine them.[46]

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[44] R. Trotta, 'Dark Matter: Probing the Arche-Fossil (Interview)', **Collapse** II, 83-169; R. Trotta and G. D. Starkman, 'What's the trouble with Anthropic Reasoning?' in C. Munoz and G. Yepes (eds), *2nd International Conference on The Dark Side of the Universe, AIP Conference Proceedings* 878, 2006: 323-29 (preprint at http://arXiv:astro-ph/0610330).

[45] H. R. Pagels, 'A Cozy Cosmology', in J. Leslie (ed.), *Modern Cosmology & Philosophy* (Amherst: Prometheus Books, 1998), 180-86.

[46] I am skipping more bizarre anti-anthropic complaints that occasionally surface in the literature, an example being the charge that 'anthropic principle' is a misnomer (J. Mosterín, 'Anthropic Explanations in Cosmology,' in Hajek, Valdés & Westerstahl [eds], *Proceedings of the 12th International Congress of Logic, Methodology and Philosophy of Science* [Amsterdam: North-Holland Publishing], after many others). While it might be formally true, as Carter and others readily admitted, it hardly advances discussion of real issues involved. Being, in principle, sympathetic to a programme of excising misnomers from the scientific discourse, may I humbly ask that interested philosophers start with concepts such as 'Hubble's constant', 'planetary nebulae', 'forbidden spectral lines', or even 'quark colours' and 'flavours'?

4.1. BETRAYAL OF THE ENLIGHTENMENT?

There is a rather strange tendency in some scientific and philosophical circles to regard anthropic reasoning as a sort of 'betrayal' of the allegedly sacrosanct traditions of scientific explanation dating from the times of Galileo and Newton. Although this form of criticism has never been clearly and unambiguously formulated, it haunts many recent discussions.[47] Roughly, it alleges that we should rationally explore nature as seen from a completely neutral and immobile 'Archimedean' point – not as real, physical beings evolved through various processes of physical, chemical and biological evolution, but as disembodied abstract observers. Only the former viewpoint, suggest these researchers, yields true causal explanations and satisfies the overall goals of science. Anthropic reasoning does not conform to this model and, consequently, 'has no place in physics or cosmology'.[48] In my view, this is entirely wrong on several counts, including some purely epistemological ones, dealing with the nature of explanation of contingent facts, though I cannot enter this complex topic here.

Instead, I would like to point out that such a rear-guard positivist attitude is in itself bound to end either in contradiction or in mysticism. Are observers natural? It is somewhat surprising to see that the same critics of anthropic reasoning tend to believe in physicalist explanations of mental phenomena, including observership itself. This makes the criticism of anthropic reasoning somewhat close to hypocrisy: If observers are part of the nature to be studied, how can one justify ignoring their properties? Should not they be regarded as parts of the wholeness of reality that is to be rationally and empirically explained? Quite contrary to the detractors' assertions, the anthropic programme of elaboration of observation selection effects – of outlining the properties of the Archipelago of Habitability, in the terms of our metaphor – is the continuation of the Copernican revolutionary spirit in overcoming the apparent specialness not only of the Earth and of life on it, including humans, but of the very physical laws, associated mathematical structures, and our universe in general.

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[47] See, e.g., L. Smolin *The Life of the Cosmos* (Oxford: Oxford University Press, 1997), 'Scientific alternatives to the anthropic principle', (2004), preprint at http://arXiv:hep-th/0407213, and *The Trouble with Physics* (New York: Houghton Mifflin, 2006); Pagels, 'A Cozy Cosmology', op. cit; J. Mosterín, 'The Anthropic Principle in Cosmology: A Critical Review', *Acta Institutionis Philosophiae et Aestheticae* 18, 2000: 111-39, 'Anthropic Explanations in Cosmology', op. cit.; and Quentin Meillassoux, 'Potentiality and Virtuality', op. cit.

[48] Pagels, 'A Cozy Cosmology', op. cit.

What is really betrayed here – and with good reason – are relics of the Cartesian dualism which underlay the mechanistic philosophy of classical physics for centuries, as well as positivist attitudes in the last century; that is, until modern science progressed sufficiently to tackle the most general questions of the origin of universe, life and intelligence. To approach problems dealing implicitly or explicitly with the properties of observers (e.g., problems in quantum physics or cosmology or astrobiology) in the same manner as, for instance, classical physicists studied the motion of a pendulum or the planet Uranus is not just epistemologically naïve – it is plain wrong.

4.2. HOW COZY IS OUR UNIVERSE?

A charge occasionally brought against anthropic reasoning (especially in older, pre-Weinberg literature) is that its proponents blithely assume that our universe is at the peak of habitability, i.e. 'the best of all worlds' in terms of life and intelligence, although it is clear that one could conceive a universe significantly friendlier for life than our own.[49] While such panglossianism might indeed have been true for the now discarded teleological construals of the anthropic principle(s), there is no reason to retain any such misperceptions any more.

On the contrary, it is clear from the idea of 'altitude weighting' sketched above how easily the Archipelago view can resolve our difficulties. There is no *a priori* reason for us to believe that we are at the top mountain peak of our own island, still less of the entire Archipelago. One may sympathize with Tegmark's view that the requirement that '[o]ur observations are the most generic ones that are consistent with our existence' is a useful prediction in the multiverse,[50] but its meaning depends on the qualification of 'our' type of observer (human? human-like? planetary? carbon-based? evolved?, etc.). We cannot say in advance whether our home-island is mostly flat or very rugged. Our real altitude and the height profile of our vicinity is a matter for rational and empirical investigation; we should conduct many numerical experiments and calculate how far in various directions we are from both the peak(s) and the shores of our home island. Suppose, for the sake of simplicity, that there is just a single peak, corresponding to the most habitable universe in our region. Determining our distance from the peak is then equivalent to answering the question of how much various parameters would need to be simultaneously changed in order for the number of predicted observers to be increased. Determining our distance from sea level is equivalent to answering the question of how much various parameters would need to be simultaneously changed in order for the universe to cease to be habitable. We may have different intuitions as to the answers to these questions, but the bottom line is that this is a problem to be answered by quantitative astrobiological modelling.

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[49] Echoes of this position can be found in, e.g., J. Maynard-Smith and E. Szathmáry, 'On the likelihood of habitable worlds', *Nature* 384, 1996: 107.

[50] M. Tegmark, 'Is "The Theory of Everything" Merely the Ultimate Ensemble Theory?', op.cit.

4.3. IMPRECISELY DEFINED SHORES?

Klee laments the fact that anthropic arguments are numerically imprecise, often by an order of magnitude or more, and stretch the meanings of terms 'of the same order of magnitude' or 'of similar order of magnitude'.[51] He calls this 'mathematical sharp practice' and concludes that it is usually motivated by extrascientific, namely theistic, reasons. Apart from the old moral about taking up the sword and perishing by it,[52] this criticism sounds like a whiggish charge that Pedro Álvares Cabral or Fernando de Magallanes did not use precise maps; their errors in navigation were often an order of magnitude or more larger than what we in the GPS age know about the *correct* geography. Are their discoveries any the less appreciable for that undeniable fact? Do we mock them – or do we rather celebrate their achievements, while emphasizing the simple means they had at their disposal? Understanding that we are at the very beginning – an overstatement, if anything – of the exploration of the Archipelago of Habitability should lead us naturally to expect large errors in our positioning of its shores – how could it be otherwise?

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[51] R. Klee, 'The Revenge of Pythagoras: How a Mathematical Sharp Practice Undermines the Contemporary design Argument in Astrophysical Cosmology', *British Journal for the Philosophy of Science* 53, 2002: 331-54.

[52] See M. A. Walker and M. M. Ćirković, 'Anthropic Reasoning, Naturalism and the Contemporary Design Argument', *International Studies in the Philosophy of Science* 20, 2006: 285-307, for Klee's own numerical mistakes, as well as his conflating of mathematical and physical fine-tunings.

4.4. THE PROBLEM OF SWARMING ADVANCED OBSERVERS

In a thought-provoking paper, Olum argues that 'a straightforward application of anthropic reasoning and reasonable assumptions about the capabilities of other civilizations predicts that we should be part of a large civilization spanning our galaxy.'[53] This has been quoted by Carroll[54] and others as an instance of anthropic reasoning giving unacceptable results even within a single universe. Starting from the assumption of an infinite universe (following from the inflationary paradigm), Olum conjectures that there are civilizations much larger than ours (consisting of about 10^{10} observers). Spatial extent and the amount of resources at the disposal of such large civilizations would lead, in principle, to much larger number of observers (for example, 10^{19} observers). Now, even if 90 percent of all existing civilizations are small ones similar to our own, anthropic reasoning suggests that the overwhelming probabilistic prediction is that we live in a large civilization. Since this prediction is spectacularly unsuccessful on empirical grounds, with the probability of such failure being about 10^{-8}, something seems clearly wrong here.

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[53] K. Olum, 'Conflict between anthropic reasoning and observation', *Analysis* 64, 2004: 1-8.

[54] Carroll, 'Is our Universe Natural', op. cit.

There are several ways out of Olum's problem, as he himself points out. For instance, we may conceive of a future redefinition of the concept of 'observer' (e.g., in the 'hive-mind' scenarios popular in SF), which would skew the Bayesian factor and resolve the paradox. But even if we restrict ourselves to our universe, there are less strong medicines at our disposal. It can be shown that the knowledge of the particular present epoch, together with some rather uncontroversial astrophysical assumptions, is sufficient to undermine – or, more precisely, to *postpone* – the applicability of Olum's argument.[55] However, this way out may not be open when we generalize to the entire spacetime (understood in a sufficiently wide sense) of the Archipelago – in that case we should ask the question: 'Why we don't find ourselves in a universe where almost all observers belong to large civilizations?' Although this question has not been pursued thus far, one possible approach could be that such universes are strongly suppressed for some at present unclear reason (say, that the observer-moment count peaks strongly before a typical large civilization anywhere can develop). Obviously, this remains a problem for anthropic reasoning generalised to the multiverse in the spirit of Equation (1) above.

4.5. THE PROBLEM OF FREAK OBSERVERS

One of the recently discovered difficulties facing the application of anthropic reasoning to the multiverse is that of so-called freak observers, also called Boltzmann's brains.

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[55] M. M. Ćirković, 'Too Early? On the Apparent Conflict of Astrobiology and Cosmology', *Biology and Philosophy* 21, 2006: 369-79.

Although prefigured by Price, Rees, Bostrom[56] and some other thinkers, it was explicitly posed in the 'disturbing' study of Dyson, Kleban, and Susskind[57] as a consequence of the new standard cosmology dominated by constant vacuum energy (positive cosmological constant). Such a cosmology leads asymptotically to a future-eternal de Sitter spacetime. This is equivalent (in the eschatological limit of future eternity) to a thermal state with a characteristic temperature $\sim 10^{-29}$ K. At first glance, such a low temperature coupled with the extreme dilution of matter at such late epochs is unlikely to yield anything interesting, but in fact like any thermal system, such a late vacuum will fluctuate at a nonzero rate per unit spacetime volume. And out of such fluctuations, across large eschatological time spans, complicated systems, e.g. intelligent observers, can arise, again at a nonzero rate. Since de Sitter spacetime is eternal, such 'freak observers' will be infinite in number (in fact, their production rate will exponentially increase with time) and will thus completely overwhelm 'normal' observers, like us, who emerged through physical, chemical, and biological evolution. Why, then, are *we* not freak observers?

Several recent publications show that the threat has been taken seriously. In particular, Page[58] argues that the simplest answer to the puzzle is that the future is finite and that our universe will vanish before Boltzmann's brains start to dominate the total observers' census. On a more optimistic note (at least from the point of view of non-freak observers), Carlip shows that the time variation of fundamental constants can lead to a small measure of freak observers,[59] and Vilenkin demonstrates that the same effect is achieved by the bubble nucleation in de Sitter vacuum under some fairly reasonable assumptions.[60]

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[56] H. Price, *Time's Arrow and Archimedes' Point* (Oxford: Oxford University Press, 1996); M.J. Rees, *Before the Beginning: Our Universe and Others* (Cambridge, MA: Helix Books, 1997); Bostrom, *Anthropic Bias*, op. cit.

[57] L. Dyson, M. Kleban and L. Susskind, 'Disturbing implications of a cosmological constant', *Journal of High Energy Physics* 10, 2002: 011.

[58] D. N. Page, 'The Lifetime of the Universe', *Journal of the Korean Physical Society* 49, 2006: 711-14 (preprint at http://arXiv:hep-th/0510003).

From the present point of view, the problem of freak observers is easily generalized to a multiverse, since de Sitter spacetime is usually regarded as the source of an inflationary self-reproducing fractal. A rather uncontroversial aspect of anthropic reasoning is that we need to suppress the measure of freak observers in the entire Archipelago (and, clearly, Page's recipe will not work for a multitude of universes) in order to explain our evolution and our ordered observations. Although this problem will require further work, the good news is that there are ways out, such as those indicated in Carlip's and Vilenkin's studies.

5. PROSPECTS FOR AN AGE OF EXPLORATION?

In this essay, I have argued that the bridge between cosmology and particle physics on one side and astrobiology (and certain other 'mundane' disciplines, like artificial life, evolutionary theory, and so on) on the other, can be achieved through an exploration of cosmological parameter space. The Archipelago of Habitability – the set of habitable domains in the multiverse – seems to be a useful metaphor which directs our efforts towards an elucidation of the relationship between astrobiology and cosmology in a wider perspective. It offers directions for tight interdisciplinary collaboration between scientists interested in the properties of life, and those interested in the grand-scale structure of physical reality. It also offers great opportunities for philosophers – notably, the opportunity to generalize classical anthropic reasoning to the entire Archipelago, where all teleological and other unnecessary baggage is explicitly discarded. The relationship between the Archipelago and other multiverses containing intelligent observers considered in both philosophical[61] and scientific literature remains to be elaborated.

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[59] A. Carlip, 'Transient observers and variable constants, or repelling the invasion of the Boltzmann's brains', *Journal of Cosmology and Astroparticle Physics* 6, 2007: 001.

[60] A. Vilenkin, 'Freak observers and the measure of the multiverse', *Journal of High Energy Physics* 01, 2007: 092.

I have also attempted to argue that we may expect a true Age of Exploration of this Archipelago. Is this taking a metaphor too far? Not necessarily, even beyond Borges' idealistic statement – following Chesterton – that a really good metaphor cannot be taken too far; considering how dramatically the informatic revolution has changed our thinking about 'simulated' vs. 'real' worlds, it would be premature to claim that theoretical research on other habitable universes is any more intrinsically speculative than the very concepts of 'computer virus' or 'genetic algorithm' or even 'quantum computer' were a quarter of century ago. At the dawn of the new millennium, not only studies on the observable consequences of the existence of other universes,[62] but also intriguing arguments on simulating

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[61] E.g. D. Lewis, *On the Plurality of Worlds* (Oxford: Blackwell, 1986).

[62] E.g., A. Aguirre, M.C. Johnson and A. Shomer, 'Towards observable signatures of other bubble universes', *Physical Review D* 74, 2007, 063509.

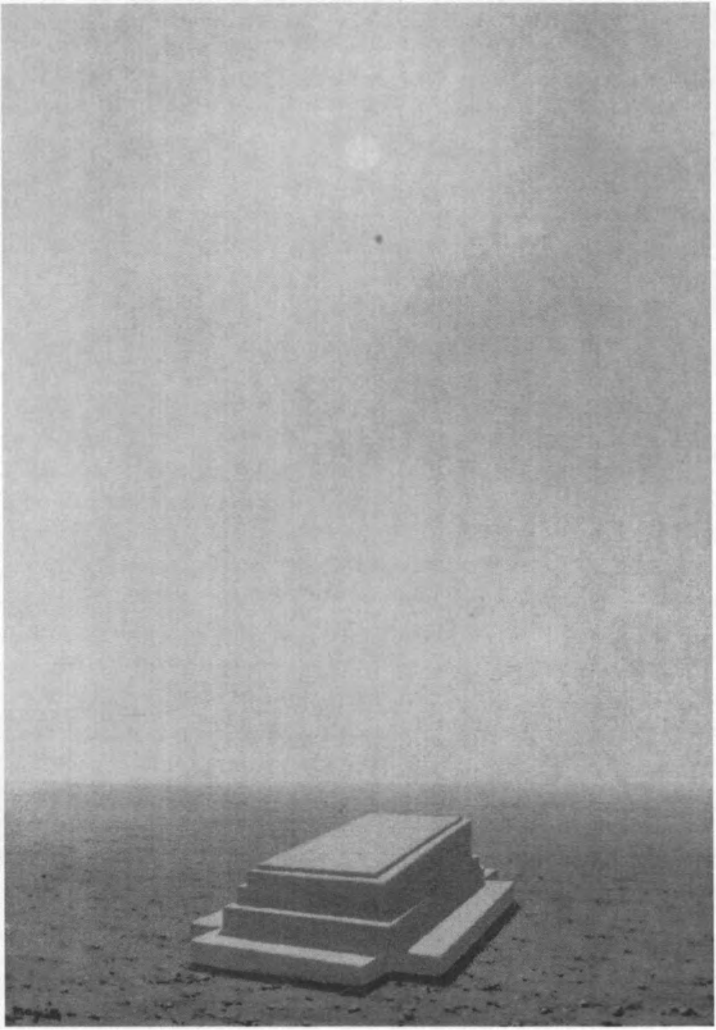

Figure 4. René Magritte's *The Beyond* (1938). The juxtaposition of an artifact and an apparently inhospitable planetary surface (remarkably prescient of our contemporary photographic images of the Martian surface) poses the age-old problem of the distinction between 'natural' and 'artificial' in a general context.

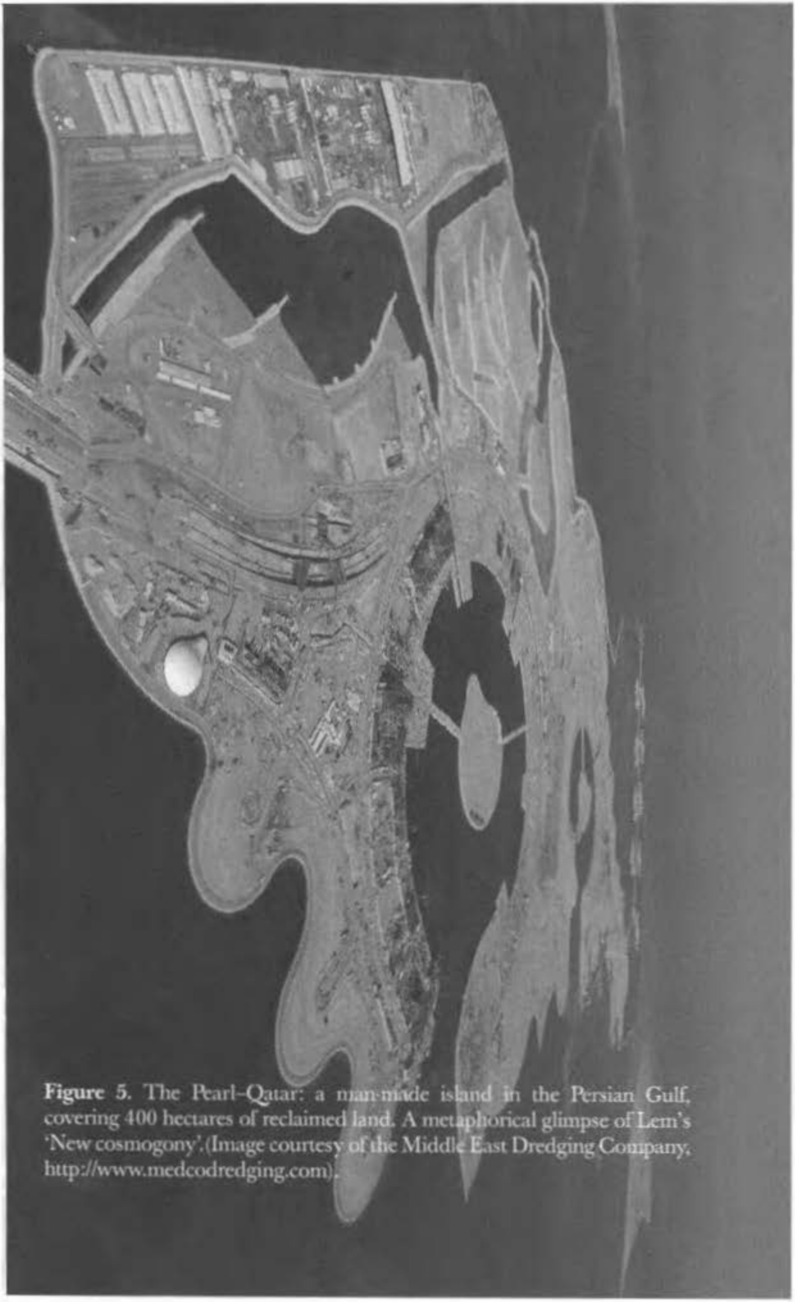

Figure 5. The Pearl–Qatar: a man-made island in the Persian Gulf, covering 400 hectares of reclaimed land. A metaphorical glimpse of Lem's 'New cosmogony'.(Image courtesy of the Middle East Dredging Company, http://www.medcodredging.com).

entire universes,[63] are threads of the same dynamic research activity – threads tightly entangled and intertwined, like the 'natural' and the 'artificial' in Magritte's painting. Further elucidation of this latter, perennial dichotomy could be an unexpected and welcome philosophical benefit.

Ultimately, I have used the concept of the observer here in a purely passive sense, in accordance with the only valid interpretation of anthropic reasoning as observational selection. But what about the vast future times for intentional action accorded to us (and other intelligent observers in the multiverse) by physical eschatology? Could the rules be changed, at least in principle and in the fullness of time, and parts of the landscape modified by intentional influence, like the build-up of artificial islands in today's world (figure 5)? Fortunately, at least two visionary pioneers strode, with giant steps, in that direction; we should keep silent in the huge shadows of Olaf Stapledon[64] and Stanislaw Lem.[65]

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[63] N. Bostrom, 'Are You Living in a Computer Simulation?', *Philosophical Quarterly* 53, 2003: 243-55.

[64] O. Stapledon, *Star Maker* (London: Methuen, 1937).

[65] S. Lem, 'The New Cosmogony', in S. Lem, M. Kandel (ed.) *A Perfect Vacuum* (Evanston: Northwestern University Press, 1993), 197-227.

Where Are They?
Why I Hope the Search for Extraterrestrial Life Finds Nothing[1]

Nick Bostrom

When water was discovered on Mars, people got very excited. Where there is water, there may be life. Scientists are planning new missions to study the planet up close. NASA's next Mars rover is scheduled to arrive in 2010. In the decade following, a Mars Sample Return mission might be launched, which would use robotic systems to collect samples of Martian rocks, soils, and atmosphere, and return them to Earth. We could then analyze the sample to see if it contains any traces of life, whether extinct or still active. Such a discovery would be of tremendous scientific significance. What could be more fascinating than discovering life that had evolved entirely independently of life here on Earth? Many people would also find it heartening to learn that we are not entirely alone in this vast cold cosmos.

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[1] First published in *MIT Technology Review*, May/June 2008: 72-7. Reprinted with permission.

But I hope that our Mars probes will discover nothing. It would be good news if we find Mars to be completely sterile. Dead rocks and lifeless sands would lift my spirit.

Conversely, if we discovered traces of some simple extinct life form – some bacteria, some algae – it would be bad news. If we found fossils of something more advanced, perhaps something looking like the remnants of a trilobite or even the skeleton of a small mammal, it would be *very* bad news. The more complex the life we found, the more depressing the news of its existence would be. Scientifically interesting, certainly, but a bad omen for the future of the human race.

How do I arrive at this conclusion? I begin by reflecting on a well-known fact. UFO-spotters, Raelian cultists, and self-certified alien abductees notwithstanding, humans have, to date, seen no sign of any extraterrestrial intelligent civilization. We have not received any visitors from space, nor have our radio telescopes detected any signals transmitted by any extraterrestrial civilization. The Search for Extra-Terrestrial Intelligent Life (SETI) has been going for nearly fifty years, employing increasingly powerful telescopes and data mining techniques, and has so far consistently corroborated the null hypothesis. As best we have been able to determine, the night sky is empty and silent – the question 'Where are they?' thus being at least as pertinent today as it was when Enrico Fermi first posed it during a lunch discussion with some of his physicist colleagues back in 1950.

Here is another fact: There are on the order of 100 billion stars in our galaxy alone, and the observable universe contains on the order of 100 billion galaxies.

In the last couple of decades, we have learnt that many of these stars have planets circling around them. By now, several hundred exoplanets we have discovered. Most of these are gigantic, but this is due to a selection effect: It is very difficult to detect smaller exoplanets with current observation methods. (In most cases, the planets cannot be directly observed. Their existence is inferred from their gravitational influence on their parent sun, which wobbles slightly when pulled towards a large orbiting planet; or alternatively by a slight fluctuation in their sun's perceived luminosity which occurs when it is partially eclipsed by the exoplanet.) We have every reason to believe that the observable universe contains vast numbers of solar systems, including many that have planets that are Earth-like at least in the sense of having a mass and temperature similar to those of our own orb. We also know that many of these solar systems are much older than ours.

From these two facts it follows that there exists a 'Great Filter'.[2] The Great Filter can be thought of as a probability barrier. It consists of one or more highly improbable evolutionary transitions or steps whose occurrence is required in order for an Earth-like planet to produce an intelligent civilization of a type that would be visible to us with our current observation technology. You start with billions and billions of potential germination points for life, and you end up with a sum total of zero extraterrestrial civilizations that we can observe. The Great Filter must therefore be powerful enough – which is to say, the critical steps must be improbable enough – that even with many billions of rolls of the dice, one ends up with nothing: no aliens, no spacecraft, no signals, at least none that we can detect in our neck of the woods.

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[2] I borrow this term from Robin Hanson's 'The Great Filter – Are We Almost Past It?' (http://hanson.gmu.edu/greatfilter.html), a paper which presents an argument similar to the one expounded here.

Now, an important question for us is, just where might this Great Filter be located? There are two basic possibilities: It might be behind us, somewhere in our distant past. Or it might be ahead of us, somewhere in the millennia or decades to come. Let us ponder these possibilities in turn.

Consider first the possibility that the filter is in our past. This would mean that there is some extremely improbable step in the sequence of events whereby an Earth-like planet gives rise to an intelligent life form comparable in its technological sophistication to our contemporary human civilization. Some people seem to take it for granted that evolution of intelligent life on this planet was straightforward – lengthy, yes, complex, sure, yet ultimately inevitable or nearly so. Carl Sagan appears to have held this view; he once wrote that 'the origin of life must be a highly probable circumstance; as soon as conditions permit, up it pops!'[3] But this view might well be completely mistaken. There is at any rate hardly any evidence to support it. Evolutionary biology, at the moment, does not enable us to calculate from first principles how probable or improbable the evolution of intelligent life on Earth was. Moreover, if we look back at the history of life on this planet, we can identify a number of evolutionary transitions each one of which is a plausible candidate Great Filter.

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[3] C. Sagan, 'The abundance of life-bearing planets', *Bioastronomy News* 7(4): 1–4.

For example, perhaps it is very, very improbable that even simple self-replicators should emerge on any given Earth-like planet. Attempts to create life in the laboratory by mixing water and gases believed to have existed in the early atmosphere on Earth have failed to get much beyond the synthesis of a few simple amino acids. No instance of abiogenesis has ever been observed.

The oldest confirmed microfossils date from approximately 3,500 million years ago, and there is tentative evidence that life might have existed a few hundred million years prior to that date, but no evidence of life before 3,800 million years ago. Life might well have arisen considerably earlier than that without leaving any traces. There are very few preserved rock formations this old and such as have survived have undergone major remoulding over the eons. Nevertheless, there is a period lasting several hundreds of millions of years between the formation of Earth and the first known life. The evidence is thus consistent with the hypothesis that the emergence of life required an extremely improbable set of coincidences, and that it took hundreds of millions of years of trial-and-error, of molecules and surface structures randomly interacting, before something capable of self-replication happened to appear by a stroke of astronomical luck. For aught we know, this first critical step could be a Great Filter.

Since we cannot rerun the history of life multiple times to obtain rigorous statistics, it is difficult to determine conclusively the 'difficulty' of any given evolutionary development. There are, however, some criteria that we can use to identify evolutionary transitions that are at least good candidates for being a Great Filter, i.e. that are both extremely improbable and practically necessary for the eventual emergence of intelligent technological civilization. One criterion is that the transition should have occurred only once. Flight, sight, photosynthesis, and limbs have all evolved several times here on Earth, and are thus ruled out. Another indication that an evolutionary step was very improbable is that it took a very long time for it to occur even after its prerequisites were in place. A long delay suggests that vastly many random recombinations had to be tried before one was found that worked. Perhaps several improbable mutations had to occur all at once in order to leap from one local fitness peak to another: the mutations might individually be deleterious and only fitness-enhancing when they occur together. (The evolution of *Homo sapiens* from one of our recent hominid ancestors, such as *Homo erectus*, happened rather quickly on geological timescales, so this step would be a relatively weak candidate for a Great Filter.)

The original emergence of life appears to meet these two criteria. As far as we know, it might have occurred only once and it might have taken hundreds of millions of years for it to happen even after the planet had cooled down sufficiently to enable a wide range of organic molecules to be stable. Later evolutionary history offers additional candidates for the Great Filter. For example, it took some 1.8 billion years for prokaryotes (the most basic type of single-cell organism) to evolve into eukaryotes (a more complex kind of cell with a membrane-enclosed nucleus). 1.8 billion years is a long time, and as far as we know eukaryotes evolved only once, making this transition an excellent possible Great Filter. Other strong candidates include the rise of multi-cellular organisms and sexual reproduction.

So one possibility is that the Great Filter is behind us. This would explain the absence of observable aliens. Why? Because if the rise of intelligent life on any one planet is sufficiently improbable, then it follows that we are most likely the only such civilization in our galaxy or even in the entire observable universe. (The observable universe contains approximately 10^{22} stars. The universe might well extend infinitely far beyond the part that is observable by us, and may contain infinitely many stars. If so, then it is virtually certain that there exists an infinite number of intelligent extraterrestrial species, no matter how improbable their evolution on any given planet. However, cosmological theory implies that, due to the expansion of the universe, any life outside the observable universe is and will forever remain causally disconnected from us: it can never visit us, communicate with us, or be seen by us or our descendants.)

The other possibility is that the Great Filter is after us, in our future. This would mean that there is some great improbability that prevents almost all technological civilizations at our current human stage of development from progressing to the point where they engage in large-scale space-colonization and make their presence known to other technological civilizations. For example, it might be that any sufficiently technologically advanced civilization discovers some technology – perhaps some very powerful weapons technology – that causes its extinction.

I will return to this scenario shortly, but first I shall say a few words about another theoretical possibility: that the extraterrestrials are out there, in abundance but hidden from our view. I think this is unlikely, because if extraterrestrials do exist in any numbers, it's reasonable to think at least one species would have already expanded throughout the galaxy, or beyond. Yet we have met no one.

Various schemes have been proposed for how an intelligent species might colonize space. They might send out 'manned' space ships, which would establish colonies and 'terraform' new planets, beginning with worlds in their own solar system before moving on to more distant destinations. But much more likely, in my view, would be colonization by means of so-called 'von Neumann probes', named after the Hungarian-born prodigy John von Neumann, who included among his many mathematical and scientific achievements the development of the concept of a universal constructor. A von Neumann probe would be an unmanned self-replicating spacecraft, controlled by artificial intelligence, capable of interstellar travel. A probe would land on a planet (or a moon or asteroid), where it would mine raw materials to create multiple replicas of itself, perhaps using advanced forms of nanotechnology. These replicas would then be launched in various directions, thus setting in motion a multiplying colonization wave.[4] Our galaxy is about 100,000 light years across. If a probe were capable of travelling at one-tenth of the speed of light, every planet in the galaxy could thus be colonized within a couple of million years (allowing some time for the bootstrapping process that needs to take place between a probe's landing on a resource site, setting up the necessary infrastructure, and producing daughter probes). If travel speed were limited to 1 percent of light speed, colonization might take twenty million years instead. The exact numbers do not matter much because they are at any rate very short compared to the astronomical time scales involved in the evolution of intelligent life from scratch (billions of years).

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[4] This scenario was developed by Frank Tipler in 1981.

If building a von Neumann probe seems like a very difficult thing to do – well, surely it is, but we are not talking about a proposal for something that NASA or the European Space Agency should get to work on today. Rather, we are considering what would be accomplished with some future very advanced technology. We ourselves might build von Neumann probes in decades, centuries, or millennia – intervals that are mere blips compared to the lifespan of a planet. Considering that space travel was science fiction a mere half century ago, we should, I think, be extremely reluctant to proclaim something forever technologically infeasible unless it conflicts with some hard physical constraint. Our early space probes are already out there: Voyager 1, for example, is now beyond our solar system.

Even if an advanced technological civilization could spread throughout the galaxy in a relatively short period of time (and thereafter spread to neighboring galaxies), one might still wonder whether it would opt to do so. Perhaps it would rather choose to stay at home and live in harmony with nature. However, there are a number of considerations that make this a less plausible explanation of the great silence. First, we observe that life here on Earth manifests a very strong tendency to spread wherever it can. On our planet, life has spread to every nook and cranny that can sustain it: East, West, North, and South; land, water, and air; desert, tropic, and arctic ice; underground rocks, hydrothermal vents, and radioactive waste dumps; there are even living beings inside the bodies of other living beings. This empirical finding is of course entirely consonant with what one would expect on the basis of elementary evolutionary theory. Second, if we consider our own species in particular, we also find that it has spread to every part of the planet, and we have even established a presence in space, at vast expense, with the international space station. Third, there is an obvious reason for an advanced civilization that has the technology to go into space relatively cheaply to do so: namely, that's where most of the resources are. Land, minerals, energy, negentropy, matter: all abundant out there yet limited on any one home planet. These resources could be used to support a growing population and to construct giant temples or supercomputers or whatever structures a civilization values. Fourth, even if some advanced civilization were non-expansionary to begin with, it might change its mind after a hundred years or fifty thousand years – a delay too short to matter. Fifth, even if some advanced civilization chose to remain non-expansionist forever, it would still not make any difference if there were at least one other civilization out there that at some point opted to launch a colonization process: that expansionary civilization would then be the one whose probes, colonies, or descendants would fill the galaxy. It takes but one match to start a fire; only one expansionist civilization to launch the colonization of the universe.

For all these reasons it seems unlikely that the galaxy is teeming with intelligent life and that the reason we haven't seen any of them is that they all confine themselves to their home planets. Now, it is possible to concoct scenarios in which the universe is swarming with advanced civilizations every one of which chooses to keep itself well hidden from our view. Maybe there is a secret society of advanced civilizations that know about us but have decided not to contact us until we're mature enough to be admitted into their club. Perhaps they're observing us, like animals in a zoo. I don't see how we can conclusively rule out this possibility. But I will set it aside for the remainder of this essay in order to concentrate on what to me appears to be more plausible answers to Fermi's question.

A disconcerting hypothesis is that the Great Filter consists in some destructive tendency common to virtually all sufficiently advanced technological civilizations. Throughout history, great civilizations on Earth have imploded – the Roman Empire, the Mayan civilization that once flourished in Central America, and many others. However, the kind of societal collapse that merely delays the eventual emergence of a space-colonizing civilization by a few hundred or a few thousand years would not help explain why no such civilization has visited us from another planet. A thousand years may seem a long time to an individual, but in this context it's a sneeze. There are planets that are billions of years older than Earth. Any intelligent species on those planets would have had ample time to recover from repeated social or ecological collapses. Even if they failed a thousand times before they succeeded, they could still have arrived here hundreds of millions of years ago.

To constitute an effective Great Filter, we hypothesize a terminal global cataclysm: an existential catastrophe. An existential risk is one where an adverse outcome would annihilate Earth-originating intelligent life or permanently and drastically curtail its potential for future development. We can identify a number of potential existential risks: nuclear war fought with stockpiles much greater than those that exist today (maybe resulting from future arms races); a genetically engineered superbug; environmental disaster; asteroid impact; wars or terrorist acts committed with powerful future weapons, perhaps based on advanced forms of nanotechnology; superintelligent general artificial intelligence with destructive goals; high-energy physics experiments; a permanent global Brave-New-World-like totalitarian regime protected from revolution by new surveillance and mind control technologies. These are just some of the existential risks that have been discussed in the literature, and considering that many of these have been conceptualized only in recent decades. It is plausible to assume that there are further existential risks that we have not yet thought of.

The study of existential risks is an extremely important albeit rather neglected field of inquiry. But here we must limit ourselves to making just one point. In order for some existential risk to constitute a plausible Great Filter, it is not sufficient that we judge it to have a significant subjective probability of destroying humanity. Rather, it must be of a kind that could with some plausibility be postulated to destroy virtually all sufficiently advanced civilizations. For instance, stochastic natural disasters such as asteroid hits and super-volcanic eruptions are unlikely Great Filter candidates, because even if they destroyed a significant number of civilizations we would expect some civilizations to get lucky and escape disaster; and some of these civilizations could then go on to colonize the universe. Perhaps the most likely type of existential risks that could constitute a Great Filter are those that arise from technological discovery. It is not far-fetched to suppose that there might be some possible technology which is such that (a) virtually all sufficiently advanced civilizations eventually discover it and (b) its discovery leads almost universally to existential disaster.

So where is the Great Filter? Behind us, or not behind us?

If the Great Filter is ahead of us, we have still to confront it. If it is true that almost all intelligent species go extinct before they master the technology for space colonization, then we must expect that our own species, too, will go extinct before reaching technological maturity, since we have no reason to think that we will be any luckier than most other species at our stage of development. If the Great Filter is ahead of us, we must relinquish all hope of ever colonizing the galaxy; and we must fear that our adventure will end soon, or at any rate, prematurely. Therefore, we had better hope that the Great Filter is behind us.

What has all this got to do with finding life on Mars? Consider the implications of discovering that life had evolved independently on Mars (or some other planet in our solar system). That discovery would suggest that the emergence of life is not a very improbable event. If it happened independently twice here in our own back yard, it must surely have happened millions times across the galaxy. This would mean that the Great Filter is less likely to occur in the early life of planets and is therefore more likely still to come.

If we discovered some very simple life forms on Mars, in its soil or under the ice at the polar caps, it would show that the Great Filter must exist somewhere after that period in evolution. This would be disturbing, but we might still hope that the Great Filter was located in our past. If we discovered a more advanced life form, such as some kind of multi-cellular organism, that would eliminate a much larger stretch of potential locations where the Great Filter could be. The effect would be to shift the probability more strongly to the hypothesis that the Great Filter is ahead of us, not behind us. And if we discovered the fossils of some very complex life form, such as of some vertebrate-like creature, we would have to conclude that the probability is very great that the bulk of the Great Filter is ahead of us. Such a discovery would be a crushing blow. It would be by far the worst news ever printed on a newspaper cover.

Yet most people reading about the discovery would be thrilled. They would not understand the implications. If the Great Filter is not behind us, it is ahead of us.

So this is why I'm hoping that our space probes will discover dead rocks and lifeless sands on Mars, on Jupiter's moon Europa, and everywhere else our astronomers look. It would keep alive the hope for a great future for humanity.

Now, it might be thought an amazing coincidence if Earth were the only planet in the galaxy on which intelligent life evolved. If it happened here – the one planet we have studied closely – surely one would expect it to have happened on a lot of other planets in the galaxy also, which we have not yet had the chance to examine? This objection, however, rests on a fallacy: It overlooks what is known as an 'observation selection effect'. Whether intelligent life is common or rare, every observer is guaranteed to find themselves originating from a place where intelligent life did, indeed, arise. Since only the successes give rise to observers who can wonder about their existence, it would be a mistake to regard our planet as a randomly-selected sample from all planets. (It would be closer to the mark to regard our planet as though it were a random sample from the subset of planets that did engender intelligent life: this being a crude formulation of one of the sane elements extractable from the motley ore of ideas referred to as the 'anthropic principle'.)

Since this point confuses many, it is worth expounding it slightly. Consider two different hypotheses. One says that the evolution of intelligent life is fairly easy and happens on a significant fraction of all suitable planets. The other hypothesis says that the evolution of intelligent life is extremely difficult and happens perhaps only on one out of a million billion planets. To evaluate their plausibility in light of your evidence, you must ask yourself, 'What do these hypotheses predict that I should observe?' If you think about it, it is clear that both hypotheses predict that you should observe that your civilization originated in places where intelligent life evolved. All observers will observe precisely that, whether the evolution of intelligent life happened on a large or a small fraction of all planets. An observation selection effect guarantees that whatever planet we call 'ours' was a success story. And as long as the total number of planets in the universe is large enough to compensate for the low probability of any given one of them giving rise to intelligent life, it is not a surprise that a few success stories exist.

If – as I hope is the case – we are the only intelligent species that has ever evolved in our galaxy, and perhaps in the entire observable universe, it does not follow that our survival is not in danger. Nothing in the above reasoning precludes the Great Filter from being located both behind us *and* ahead of us. It might both be extremely improbable that intelligent life should arise on any given planet, and very improbable that intelligent life, once evolved, should succeed in becoming advanced enough to colonize space.

But we would have some grounds for hope that all or most of the Great Filter is in our past if Mars is indeed found to be barren. In that case, we may have a significant chance of one day growing into something almost unimaginably greater than we are today.

In this scenario, the entire history of humankind to date is a mere instant compared to the eons of history that lie still before us. All the triumphs and tribulations of the millions of peoples that have walked the Earth since the ancient civilization of Mesopotamia would be like mere birth pangs in the delivery of a kind of life that hasn't really begun yet. For surely it would be the height of naiveté to think that with the transformative technologies already in sight – genetics, nanotechnology and so on – and with thousands of millennia still ahead of us to perfect and apply these technologies and others that we haven't yet conceived of, human nature and the human condition will remain unchanged for all future times. Instead, if we survive and prosper, we will presumably develop into some kind of posthuman existence.

So this is why I conclude that the silence of the night sky is golden, and why, in the search for extraterrestrial life, no news is good news. It promises a potentially great future for humanity.

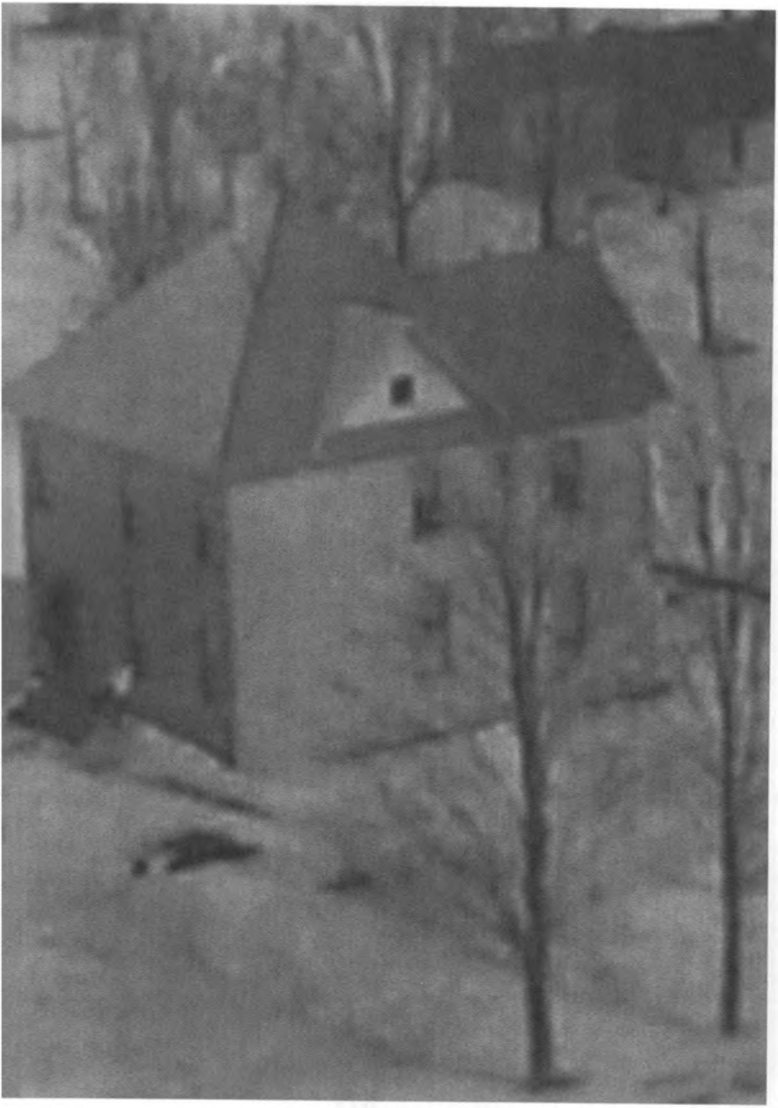
None of this means that we ought to cancel our plans to have a closer look at Mars. If the red planet ever harboured life, we might as well find out about it. It might be bad news, but it would tell us something about our place in the universe, our future technological prospects, the existential risks confronting us, and the possibilities for human transformation: issues of considerable importance.

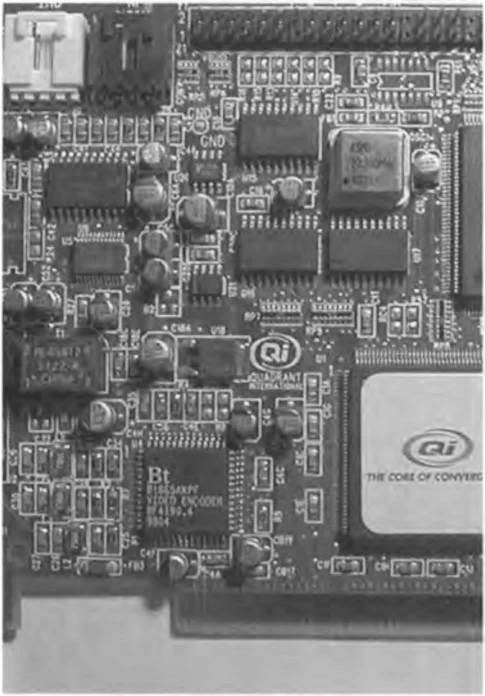
It is impossible to know in advance what insights might be gleaned by applying the kind of careful and systematic study to such big questions that we apply every day to smaller and less consequential technological and scientific problems. There may be surprising arguments and ideas out there merely waiting to be discovered. Some of these might even turn out to have practical ramifications of such importance as to change our whole scheme of priorities. Perhaps the greatest benefit from the SETI program will result if it prompts thinking about these larger matters.

Theoretically, smart ambitious scholars could start thinking without waiting for such prompts. Expensive instruments, however, have a way of lending scientific status and respectability to a field of inquiry. Academics are keen to put as much distance as possible between themselves and the kooks and cranks that flock to these big questions. If large telescopes, NASA satellites, and complicated mathematical data analysis are involved, it becomes harder for outside observers to mistake the work for the ramblings of UFO-nuts and other crackpots. There may be no signals from space, yet those with their antennas tuned to more anthropomorphic wavelengths are sure to pick up a buzz of social signaling in people's attitudes towards the search for extraterrestrial beings. Such social background noise might in fact be one of the main obstacles to intellectual progress on many big-picture topics.

Random Sampler from a Blocktime Animation

Keith Tyson




GND
QUADRANT INTERNATIONAL
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VIDEO ENCODER
THE CORE OF CONVERG

The Phoenix of Nature: Kant and the Big Bounce

Martin Schönfeld

For Fred Beiser, Mike Friedman, and Paul Eisenberg.[1]

There is a profound concept, the Phoenix of Nature, which deserves another look. Recent theoretical progressions are structuring information in startling ways. In light of this emerging information gestalt, a clarification of the Phoenix seems timely. The point is to advance towards a future integration of Kant.

The Phoenix of Nature appears in Kant's second book, Universal History of Nature and Theory of the Sky. It emerges only once, in part two, chapter seven (Academy Edition 1:321), but it can be understood as the idea that holds the book together. Universal History of Nature was published anonymously in 1755. Most printed copies were committed to the flames, supposedly accidentally, but probably intentionally. Its key idea was provocative. Kant's authorship contributed to his academic marginalisation until 1770.

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1. Frederick C. Beiser (Syracuse) first pointed me towards the 'phoenix of nature' as a lacuna in Kant interpretation. Michael Friedman (Stanford) helped me to understand the scientific and heuristic relevance of Kant's thought. Paul Eisenberg (Indiana) patiently discussed with me my misgivings about Schopenhauer's criticism of Kantian philosophy. When I thought the Copernican turn precluded identification of Nature's deep structure, in Schopenhauer's or any other way, Paul Eisenberg encouraged me to look for a new reading of the Copernican turn, to integrate Kant's critical legacy with Kant's metaphysical and cosmological heirs. I thank them for inspiration.

The Phoenix is not part of conventional interpretations of Kant. It would be sensible for this situation to change, not least because this would allow mainstream scholarship to step out of its self-imposed isolation. Other research approaches, by workers in other disciplines, recognize the Phoenix and its implications. But a bridging of the disciplines, however timely, comes at a price. Philosophy will need to abandon its self-complacent, self-serving scepticism, deal at last with the patterns of outward reality, and become once more what it had been in Kant's enlightened day: *Weltweisheit* or world wisdom.

1. Conventional Neglect: Omitting the Phoenix

Historians of philosophy know that Kant wrote for nearly sixty years, from 1745 to 1802, but most of the scholarly attention is focused on what Lewis White Beck called the 'astonishing decade', the 1780s, which saw the publication of major works – the *Critiques*, the *Groundwork*, and *What is Enlightenment*, to name just a few.[2] The texts prior to the first *Critique*, the pre-critical writings, from 1746 to 1768, are by and large ignored. The critical works are available and taught in college. The early texts are not even read by most Kant experts. This is not because the early texts are juvenilia; they aren't: Kant wrote his first book, *Living Forces*, when he was in his twenties, the second, *Universal History*, in his thirties, and the third, *One Possible Proof-Ground for a Demonstration of Divine Dasein*, when pushing forty.

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[2] 'I know of no way to describe the 1780s except to say that they were the astonishing decade.' L W Beck, *Early German Philosophy: Kant and his Predecessors* (Cambridge, Mass.: Harvard, 1969), 433.

The critical work has generated a mountain of commentary and analysis, while studies on the early texts are few and far between. Conventionally, we think of the critical Kant as belonging to a small handful of great thinkers, but we think of the early Kant as a flawed figure with an inconsequential body of work. The difference in reception between the two halves of the Kantian oeuvre could hardly be any starker.

The book on the Phoenix, *Universal History of Nature*, is neither well-known nor in print.[3] A literature search of the Phoenix will come up empty, at least as long as one scans bibliographies of Kant scholars. *Kant-Studien* has existed for a century, but its first article on that book appeared only a few years ago (2003). The article's title is just the book title ('Kants "Allgemeine Naturgeschichte und Theorie des Himmels" (1755)'), revealing how basic the scholarship has remained.[4] The paper falls in clear sections: on views before Kant, on the book, part I, part II, and on views after Kant.[5]

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[3] There is an online translation, *Universal Natural History and Theory of the Heavens*, by Ian Johnston at Vancouver Island University, at http://records.viu.ca/~johnstoi/kant/kant2e.htm. The website, dated September 2008, and accessed October 2008, refers to a print edition by Richer Resources Publications (Arlington, VA), which, however, is not listed in the catalogue of the press. An earlier translation, also called *Universal Natural History and Theory of the Heavens*, by Stanley Jaki, was published by Scottish Academic Press (Edinburgh, 1981), and is out of print. The first translation, by William Hastie, titled *Kant's cosmogony, as in his essay on the retardation of the rotation of the earth and his natural history and theory of the heavens*, appeared in 1900; it was reprinted by Greenwood (New York, 1968), and University of Michigan Press (Ann Arbor, MI, 1969); both editions are no longer available. The Cambridge Edition of the Works of Immanuel Kant, ed. Paul Guyer and Allan Wood, has slated *Universal History of Nature* to appear in the volume *Natural Science*, ed. Eric Watkins, but this volume is nearly ten years overdue, and no fixed publication date has been set. In English, Kant's second book is not available in print.

[4] To my knowledge, there is no publication in *Kant-Studien* on Kant's first book, *Living Forces*, 1747, to date either.

[5] S. Lalla, 'Kants "Allgemeine Naturgeschichte und Theorie des Himmels" (1755),' *Kant-Studien* 94, 2003: 426-53.

The Phoenix isn't mentioned; neither is part III. After twenty-seven pages, the author concludes in the even-handed way that has become typical of conventional philosophy: Kant's approach was promising but also weird; his ideas were interesting but problematic; today it'd be tough to make scientific sense of them; their content is unverifiable, and this is probably a good thing.[6] Conclusions of this sort show two things: the scholarly consensus in first-rate philosophy journals – and the isolation of philosophy from scientific disciplines.

The differences between the early texts and the critical work come down to a contrast in perspectives. This contrast hinges on the so-called Copernican Turn. According to *Critique of Pure Reason* (B xvi) we tend to assume that concepts conform to objects, but doing so hasn't led to progress in metaphysics; so we might as well turn it upside down and assume the opposite, that *objects conform to concepts*, and see whether this would lead to progress. A corollary of the Copernican Turn is that any thing we take as an object is already an object conforming to concepts, which means an object seen is an object changed. When looking at things as they are in themselves we organize impressions into concept-conforming representations; it is these representations that we look at. Things in themselves are inaccessible. We are cognitive versions of King Midas: whatever we touch doesn't turn into gold but into appearance. Perception alters the perceived. And here's the rub: The early texts are precisely inquiries into things as they are in themselves. The Copernican Turn seems to rule such inquiry out and thus invalidate the early texts.

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[6] Lalla, op. cit., 453: 'Rein retrospektiv hatte Kant einen vielversprechenden Ansatz geliefert, die Anfänge der eigenen Naturgeschichte explanativ einzuholen, um sich so ein solides Fundament für die Bestimmung aller sich aus dieser Urphase ergebenden Prozesse zu geben. Laplaces Glaube an die Vollständigkeit und die vollständige Verfügbarkeit aller dafür notwendigen Faktoren ist angesichts einer Quantenphysik nur noch schwer nachvollziehbar. Ob die Hypothese einer zeitlosen Determination des Gegebenen astronomisch sinnvoll ist (unabhängig davon, ob es anthropologisch wünschenswert ist), steht also heute, wie damals, buchstäblich in den Sternen.'

2. CHALLENGING THE COPERNICAN TURN: THE CONCEPTUAL ROUTE TO THE PHOENIX

But first appearances can be deceptive. That the Copernican Turn is an obstacle for grasping things as they are in themselves doesn't mean the obstacle is insurmountable. Yet that there may be a way around an invalidation of the early inquiries doesn't mean that the Copernican Turn was a failure either. It wasn't. It was a stunning success. The *Critique* changed discourse to such an extent that its year of publication divides what led up to it, Early Modern Thought, and what played out afterwards, the Age of Modernity. Kant's proposal settled the debate between rationalists and empiricists. Over the question of the roots of knowledge, rationalists stress the internal activity of the mind and appeal to mathematics as a case in point. Empiricists stress the external passivity of the mind and appeal to pretty much everything else. Kant integrated both views in a bigger picture: the mind is passively absorbing data and actively shaping appearances. The mind is passive and active. Cognition is an interactive process. Interactivity is the Midas Touch of perception, and since we perceive only what is absorbed-plus-shaped, the unshaped things in themselves elude our grasp. The conclusion of their indeterminacy is an effective weapon for social freedom. The critical work delivered the *coup de grace* to religious dogma. The elusiveness of the thing in itself means that transcendent truth is obscure and cannot be enforced. The critical insight was a milestone along the way toward more enlightened, secular, and open societies.

But freedom, in excess, is indulgence; there can be too much of a good thing. Ultimate religious truths are not ultimate natural patterns. Conceptually they are distinct. While the critical release from religious dogma is a lasting legacy, the critical suspension of metaphysical inquiry is not. Contrary to what one might expect, the Copernican Turn doesn't entail total inaccessibility of things as they are in themselves. There is a way to get to them, indirectly, through the environmental backdoor, so to speak.

Consider what things in themselves are: mind-independent material taken up in the cognitive process. While following the Copernican Turn we know *something* is mind-independent. Something is out there.

'Out there' are environmental structures that are mind-independent parts of reality. For a subject to *prevail* in such structures requires that the subject's representations match the real thing. If they fail to match up, the subject would be cognitively dysfunctional. It would bump into things, not procreate, be eaten, and soon die.[7] But a subject happily surviving in the mind-independent environment is different: it shapes absorbed sense data into appearances; it makes objects conform to concepts – but does so in such a way that the structure of its representation is an isomorphic echo of the structure of its environment. Conceptual form mirrors environmental form. For elementary evolutionary reasons, rational cognition makes objects conform to concepts that have worked out. Thus objects conform to concepts that fit. Things as they are in themselves are inaccessible and yet isomorphic mirrors of cognized appearances, at least in the case of surviving subjects. Accordingly the critical path leads to ultimate natural patterns after all. In this light, the Copernican Turn doesn't invalidate the results of Kant's early pursuits; it suspends them awaiting confirmation. For the concept at issue, the Phoenix, confirmation seems to have arrived.

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[7] D Hoffman, in 'The Interface Theory of Perception,' forthcoming in *Object Categorization: Computer and Human Vision Perspectives*, ed. S. Dickinson et alia (Cambridge University Press), argues that, on evolutionary grounds, it is *not* the case that our senses have been shaped to the end of estimating true properties of the world, but instead that 'perceptions constitute a *species-specific user interface* that guides behaviour in a niche' (3). This approach seems to run counter to my isomorphism thesis, but I think it is compatible with my suggestion. Isomorphism does not mean identity. Our visual perception of a cave is distinct from its auditory perception by a bat. It seems hard to imagine what it is like to be like a bat, and what sonic picture of the cave a bat might represent to its mind. Clearly the sonic cave-representation is as much a species-specific user interface as a visual image of the cave by humans. However,

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isomorphism means mapping by a rule. And while a sonic map differs from the visual map, both are related such that component information in either not only translates to the appropriate node in the respective other map, but also translates to the cave as it exists independent of any perceiver. As both maps work, humans walking in a cave are capable of avoiding stalagmites looming in the flashlight, just as it is possible for a bat flying there to swerve around the same stalagmites echoing its cries. In this way, the Copernican Turn fits to a cognitive realism. Things as they are in themselves emerge as isomorphic mirrors of cognized appearances, as mentioned. It should further be noted that this use of 'thing in itself' differs from the usage in Schopenhauer, for instance, who takes 'thing in itself' as referring to a universal quintessence, and not the individuated structure of nature. L. W. Beck, in the glossary to the third edition of *Critique of Practical Reason* (New York: Kessinger, 2004), xxv, adds a clarification that '*Ding an sich* is an expression Kant employs only once in the second *Critique*, his usual locution being *Ding an sich selbst*. According to Gerold Prauss (*Kant und das Problem der Dinge an sich* [Bonn, 1974]), the latter locution is adverbial rather than adjectival, and elliptical for "thing regarded as it is in itself". The distinction [...] suggests that there are two *kinds* of things, viz., appearances and things in themselves, whereas the second suggests that there is one kind of thing in two contexts (as it appears, and as it is regarded in itself)'. The isomorphism thesis I wish to submit concerns the 'latter' kind; thus suggesting a 'two-aspect' interpretation. The price my thesis pays is that its acceptance does interpretive violence to Kant such that a problem left unresolved according to the textual evidence would find an arguable resolution upon further thought.

3. A UNIVERSAL SINGLE RULE: THE PHOENIX

The Phoenix of Nature is the idea that all environmental structures are subject to the rule of rise and fall. Everything oscillates, from simplicity to complexity to simplicity, along a line of quasi-reincarnations. No matter how long winter lasts, there'll be another spring. Such is life. Such is nature. In fact, such are all natures. In the beginning of the chapter on the Phoenix, Kant notes:

> The Universe, with its immeasurable greatness, endless diversity, and beauty, which shines up at all angles, puts us in a state of silent wonder. And whenever the idea of all this perfection fires up the power of imagination, the understanding falls into a state of delight, as soon as one considers how so much splendour and grandeur flows from a single universal rule, in eternal and right tact.(1:306.16-23)[8]

Nietzsche praised the Pre-Socratic depth of *Universal History of Nature.*[9] Like Anaxagoras or Heraclitus, Kant suspects *ek-pyrosis*, the eternal recurrence of *world burn*. Thus rise follows fall follows rise. For Nietzsche, the shape of quintessence, Kant's Phoenix, is a 'kind of swinging', a 'sort of vibration,' which, slowed down, would look like a dancing mathematical figure or a moving formal frame.[10] The largest formal frame – the largest environment – is the Universe. In German, 'universe' is the *All*. This isn't a static background against which nature's dance plays out. The *All*, the background, itself is dance. It is a chain steadily swinging from trough to peak to trough, or from a prone state to an evolved state to a prone state. Some cosmologists call the Phoenix 'the Big Bounce'. Here's Kant's take on the Phoenix:

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[8] Kant, *Werke* (Academy Edition), 1:306.16-23: 'Das Weltgebäude setzt durch seine unermeßliche Größe und durch die unendliche Mannigfaltigkeit und Schönheit, welche aus ihm von allen Seiten hervorleuchtet, in ein stilles Erstaunen. Wenn die Vorstellung aller dieser Vollkommenheit nun die Einbildungskraft rührt, so nimmt der Verstand andererseits eine andere Art der Entzückung ein, wenn er betrachtet, wie so viel Pracht, so viel Größe aus einer einzigen allgemeinen Regel mit einer ewigen und richtigen Ordnung abfließt.'

[9] Nietzsche, *Philosophie im tragischen Zeitalter der Griechen* (*Philosophy in the Tragic Age of the Greeks*), § 17, in *Sämtliche Werke: Kritische Studienausgabe*, ed. G Colli, M Montinari (Munich/Berlin: DTV/De Gruyter 1980), 1:865.

> The Phoenix of Nature burns himself up only to return from his ashes, come back to life, and be young again. If we now follow the Phoenix through all infinity of time and space, and if we see how Nature, even in the aspect of decay and obsolescence, is not depleted of raw emergence; if we see how, at the other edge of creation and in the realm of unformed, raw matter, Nature proceeds with steady steps toward expansion of the plan of Divine unfolding and fills all time and all space with its miracles – if one sees all this, then the mind, pondering such vistas, will sink into deep wonder. (1:321.13-22)[11]

Between remarks on universal rule and the Phoenix, Kant details the relation of emergence and entropy:

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[10] Nietzsche, *Werke*, 1:866.2-4: 'eine bewegte mathematische Figur [...] eine Art der Schwingung'.

[11] Kant, *Werke* (Academy Edition), 1:321.13-26: 'Wenn wir diesen Phönix der Natur, der sich nur darum verbrennt, um aus seiner Asche wiederum verjüngt aufzuleben, durch alle Unendlichkeit der Zeiten und Räume hindurch folgen; wenn man sieht, wie sie sogar in der Gegend, da sie verfällt und veraltet, an neuen Auftritten unerschöpft und auf der anderen Grenze der Schöpfung in dem Raum der ungebildeten rohen Materie mit stetigen Schritten zur Ausdehnung des Plans der göttlichen Offenbarung fortschreitet, um die Ewigkeit sowohl, als alle Räume mit ihren Wundern zu füllen: so versenkt sich der Geist, der alles dieses überdenkt, in ein tiefes Erstaunen'. For the translation above, note that I read *sie* ('she,' 1:321.16) as denoting nature.

It appears that the end, fated to the worlds as to all matters natural, is subject to some law. Recognizing this law will lend the theory a new touch, a touch of rightness. By this law, the end touches those worlds closest to the cosmic centre first, just as conception and organization had first started next to this centre. From there, doom and destruction radiate outward step by step in ever farther reaches from the centre. Through general dissipation of motion, the whole universe, having completed its period, will eventually be buried in uniform chaos. Yet Nature on the other side, at the opposite edge of the evolved cosmos, is busy steadily spawning worlds from the raw stuff of scattered elements. Nature on one side decays at centre. Nature on another side is young and fertile in new creations. So the evolved cosmos is placed in between, bounded by limits on either side – the ruins of destroyed nature, and a chaos of a still unformed nature. And if we imagine that (as would be likely) the time-span of a world matured to perfection outlasts that of a world forming up, then regardless of all the damage wreaked constantly by transience, the Universe's circumference will nonetheless and on the whole expand. (1:319.19-1:320.2)[12]

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[12] Kant, *Werke* (Academy Edition), 1:319.19-1:320.2: 'Es scheint, daß dieses den Welten, so wie allen Naturdingen verhängte Ende einem gewissen Gesetze unterworfen sei, dessen Erwägung der Theorie einen neuen Zug der Anständigkeit giebt. Nach demselben hebt es bei den Weltkörpern an, die sich dem Mittelpunkte des Weltalls am nächsten befinden, so wie die Erzeugung und Bildung neben diesem Centro zuerst angefangen: von da breitet sich das Verderben und die Zerstörung nach und nach in die weiteren Entfernungen aus, um alle Welt, welche ihre Periode zurück gelegt hat, durch einen allmählichen Verfall der Bewegungen zuletzt in einem einzigen Chaos zu begraben. Andererseits ist die Natur auf der entgegengesetzten Grenze der ausgebildeten Welt unablässig beschäftigt, aus dem rohen Zeuge der zerstreueten Elemente Welten zu bilden, und indem sie an der einen Seite neben dem Mittelpunkte veraltet, so ist sie auf der andern jung und an neuen Zeugungen fruchtbar. Die ausgebildete Welt befindet sich diesemnach zwischen den Ruinen der zerstörten und zwischen dem Chaos der ungebildeten Natur mitten inne beschränkt, und wenn man, wie es wahrscheinlich ist, sich vorstellt, daß eine schon zur Vollkommenheit gediehene Welt eine längere Zeit dauren könne, als sie

4. ULTIMATE NATURAL PATTERN: THE BIG BOUNCE

Kant stares into the abyss, and the abyss stares back. Such a reflected stare can easily turn monstrous. And still he marvels, with a smile.[13] What he is doing in *Universal History of Nature* is to map out the history of histories. Nature's history is universal in space; it concerns everything that coexists. It is also universal in time, concerning everything that ever was and ever will be. Kant looks for structure and finds it. He claims to see the ultimate natural pattern. Is this madness? Conventional philosophers, whose trade is to shrink Big Questions down to harmless nuggets, would of course nod, emphatically. But they would be wrong. Kant's gaze is clear-sighted. His speculation in *Universal History of Nature* is coherent and systematic. His contentions agree with the facts as we know them and have emerged as anticipations of what we are meeting now at the boundaries of knowledge. The Phoenix of Nature, swinging to entropy and back, has returned to academic discourse as the Big Bounce.

Since the Big Bounce is not yet as familiar as the Big Bang, one might as well start with the latter, 13.7 billion years ago, when nature flared outward from a prone singularity. The Big Bang is at the heart of the research consensus known as the Standard Model. The Big Bang is the rational inference from the red-shift of galaxies far

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bedurft hat, gebildet zu werden: so wird ungeachtet aller der Verheerungen, die die Vergänglichkeit unaufhörlich anrichtet, der Umfang des *Universi* dennoch überhaupt zunehmen.'

[13] F. Nietzsche, *Jenseits von Gut und Böse*, § 146, *Werke*, 5:98: 'Wer mit Ungeheuern kämpft, mag zusehn, dass er nicht dabei zum Ungeheuer wird. Und wenn du lange in einen Abgrund blickst, blickt der Abgrund auch in dich hinein.' ('He who fights with monsters should look to it that he himself does not become a monster. And when you gaze long into an abyss the abyss also gazes at you.' F. Nietzsche, *Beyond Good and Evil*, trans. R.J. Hollingdale (London: Penguin, 1990).

outside the Milky Way, a red-shift first measured nearly a century ago. Distant light reaches us in elongated wavelengths without exception. Chased through a prism, such light unfurls into lopsided rainbows: skinny in the blue, fat in the red. The one explanation that has held up (and hardened through other confirmed predictions) is that light red-shifts as its sources recede from us and each other. Like dough rising, nature expands outward. Like raisins in the dough, nebulae pull away from one another. Like a coil being stretched, wavelengths of their reddening light lengthen to an observer. So much is clear: a chorus of data tells us that nature expands like a wavefront of a primordial, bygone bang.

A recent addition to the Standard Model is the Big Rip. It is the rational inference from the acceleration of cosmic expansion measured a decade ago.[14] Galaxies are pulling away from one another, and from us, faster than they used to. The travelling wavefront is gaining velocity. Nature's expansion is speeding up. Yet any given acceleration, of any frame within another, eventually hits the tolerance limit of the framework of acceleration. When the limit is hit, the dynamic geometry will reorder itself, which is a polite way of saying that things will fly apart.[15]

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[14] P Garnavich et al., 'Constraints on cosmological models from Hubble Space Telescope observations of high-z supernovae', *Astrophysical Journal* 493, 1998: L 53; S Perlmutter et al., 'Discovery of a supernova explosion at half the age of the universe,' *Nature* 391, 1998: 51-54; A G Riess et al, 'Observational evidence from supernovae for an accelerating universe and a cosmological constant,' *Astronomical Journal* 116, 1998: 1009-1038. For a summary, cf. 'Special Report: revolution in cosmology,' *Scientific American* 280.1, 1999: 45-6.

[15] M Edesio et al., 'Does the Big Rip survive quantization?' *General Relativity and Gravitation* 38, 2006: 1609-1622, B Gumjudpai, 'Slow-roll, acceleration, the Big Rip, and WKB approximation in a non-linear S-type formulation of scalar field cosmology,' *Journal of Cosmology and Astroparticle Physics* 6, 2008: JCAP 09, 2008: 028.

Big Rip points to Big Crunch.[16] When things rip, the fabric that holds them will tatter and unravel. While one tends to think of a dimensional fabric as what holds things together, it may be more exact to think of it as what holds them apart. Untethered from their place, nothing will hold the displaced at bay. Ripped, the fabric and its places will buckle, crumple, and fold. It'll crunch.

The Big Crunch would stop at a singularity. This is the Universe squeezed together as tight as it gets; parameters shoot off to infinity or nearly so. It is the null point. It is a prone state harbouring the Big Bang and contains all the conditions for yet another cosmic inflation. So the cycle starts all over again. Ergo the Big Bounce.[17] As Big Bounce, the Phoenix returns and suggests the ultimate natural pattern.

5. PERSPECTIVAL CONVERGENCE ON ABSOLUTES

Conventional philosophers are so in love with questions that they are at a loss what to make of answers. Thus scholarly lacunae perpetuate themselves, and inconvenient truths such as the Kantian cosmogony are best ignored. But one can play the scepticist game only for so long. In the end, information prevails. Remember how the *Critique* ends: anybody, so Kant says, can do research any way they like. But research that leads somewhere is not only systematic but also on a track that is equidistant from two extremes: the Hume extreme, denying everything, and the Wolff extreme, affirming everything. By themselves, doubt and dogma are sterile. It's only what's in between that is fertile. Between them unfolds the critical path. If we follow it, odds are that we'll answer the Big Questions that have troubled reason for so long.[18] Thus the critical path leads to ultimate patterns. While absolutes are nowadays outside the philosopher's comfort zone, they are the bread and butter of cosmology. Absolutes are the limits of reality, edges so extreme that they are invariably the same. The Phoenix wave of the cosmos, the Big Bounce, is such an absolute, and so are its geometro-dynamic parts: the trough that is the Big Bang; the peak that triggers the Big Rip; the fall-to-trough that is the Big Crunch; and the rise-to-peak that follows the Big Bang.

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[16] S Elitzur et al., 'From Big Bang to Big Crunch and beyond,' *Journal of High Energy Physics* 6, 2002:JHEP 0206, 2002: 017.

[17] N Turok et al., 'From Big Crunch to Big Bang with AdS/CFT,' *arXiv* version 3, 12/27/07, 0711.1824; G Niz, N Turok, 'Classical propagation of strings across a Big Crunch/Big Bang Singularity,' *Physical Review D* 75, 2007: 026001; M Brown et al, 'The Phantom Bounce: A New Oscillating Cosmology', *Journal of Cosmology and Astroparticle Physics* 6, 2008: JCAP 03, 2008: 002; P Dzierzak et al., 'Quantum Big Bounce,' *arXiv* version 1 10/17/08 0810.3172.

The Big Bounce makes news because it is the convergent outcome of two distinct research programs. Theoretical physics involves two major rival approaches to the ultimate limit. One is string theory, and another is loop quantum gravity theory. String theoreticians have insisted on the possibility of a Big Bounce for years already.[19] This insistence didn't raise many eyebrows since string theory is full of strange claims. But in 2008, researchers who work for the competition, loop quantum cosmology, and who proceed from quite different assumptions, have arrived at just the same conclusion once more.[20]

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[18] *Critique of Pure Reason*, conclusion, A 856/B 886; in *Werke*, 3:552. Compare Kemp Smith's translation: 'As regards those who adopt a *scientific* method, they have the choice of proceeding either *dogmatically* or *skeptically*; but in any case they are under obligation to proceed *systematically*. I may cite the celebrated Wolff as a representative of the former mode of procedure, and David Hume as a representative of the latter, and may then, conformably with my present purpose, leave all others unnamed. The *critical* path alone is still open. If the reader has had the courtesy and patience to accompany me along this path, he may now judge for himself whether, if he cares to lend his aid in making this path into a high-road, it may not be possible to achieve before the end of the present century what many centuries have not been able to accomplish; namely to secure for human reason complete satisfaction in regard to that with which it has all along so eagerly occupied itself, though hitherto in vain.' See Kant, *Critique of Pure Reason* (New York: St Martin's press, 1965), 668-9.

Inquiries that are on to something exhibit certain traits. One sign is that investigators find themselves suddenly very busy. Activity teems, publications abound, and bibliographies grow longer and longer. Another sign is that inquiries that come from different theoretical locations, use different tools, and approach a question from different angles suddenly find themselves converging on the same answer. When inquiries draw close to an absolute, a relative convergence fuses the perspectives into one view.

So it appears the cosmos is indeed how Kant describes it: *a place in between* and bounded by limits on either side (1:319.32-33). Looking backwards, we see the Big Bang as a bottleneck from a past universe. Looking forwards, we see cosmic acceleration as the first harbinger of future ruin and another Big Bang.

Thus philosophers who wish to break with the conventionality of their field can no longer afford to ignore

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[19] M Gasperini, G Veneziano, 'The pre-Big Bang scenario in string cosmology,' *Physics Reports* 373.1-2, Jan 2003: 1-212, hep-th/0207130; non-technical version: G Veneziano, 'The myth of the beginning of time,' *Scientific American* 290.5, May 2004: 54-65.

[20] The cover title of the October 2008 issue of *Scientific American* has the headline: 'Forget the Big Bang: Now it's the Big Bounce – quantum gravity theory predicts the universe will never die.' See also M Bojowald, 'Follow the bouncing universe,' *Scientific American* 299.4, 2008: 44-51; cf. online version 'Big Bang or Big Bounce?' and M Bojowald, 'Loop quantum cosmology,' *Living Reviews in Relativity* 11.4, July 2008, lrr-2008-4.

Kant's second, burned book, and its core idea, the Phoenix of Nature. For a decade now, string theorists have pointed out the genius of the early Kant, and a handbook on cosmology issued in 1998 from these quarters characterises the cosmogony of *Universal History* as 'the essence of modern models'.[21] After the corroboration from loop quantum gravity, sceptical loopholes would seem to have closed. Now we may wonder what this conceptual triumph means. Determining this, I suspect, defines philosophy's task in this century. Let the scientists figure out the answers to the Great Questions, and let the philosophers add the answers up, rationally, synthetically, and thereby fill the void of monotheistic bankruptcy by crafting a new world wisdom.

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[21] P. Coles, ed., *The Routledge Companion to the New Cosmology* (London/New York: Routledge, 1998), 240.

On Creation in the Total Extent of its Infinity in Both Space and Time[1]

Immanuel Kant
Translated by Martin Schönfeld

The Universe, with its immeasurable greatness, endless (1.306) diversity, and beauty, which shines up at all angles, puts us in a state of silent wonder. And whenever the idea of all this perfection fires up the power of imagination, the understanding falls into a state of delight, as soon as one considers how so much splendour and grandeur flows from a single universal rule, in eternal and right tact. The Sun, with its powerful attraction at the centre of all orbital rings, forces the inhabited planets of its system to cruise eternal rounds. The planetary world system, as we have seen, is completely made up of the basic stuff of all world-matter. Originally, this matter was spread out. The fixed stars, which the eye finds in the hollow deep of the sky – an abundance that seems to suggest a kind of wastefulness – are all suns and system-centres similar to our own.

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[1] Chapter Seven of Kant's *Allgemeine Naturgeschichte und Theorie Des Himmels oder Versuch von der Verfassung und dem mechanischen Ursprunge des ganzen Weltgebäudes, nach Newtonischen Grundsätzen abgehandelt* [*Universal History of Nature and Theory of the Heavens or An Essay on the Constitution and the Mechanical Origin of the Entire Structure of the Universe Based on Newtonian Principles*] (1755). Page numbers in the margin refer to the Akademie edition of Kant's Work

The method of analogy suggests that these far-flung systems were formed in the same way as the one in which we live. The method of analogy further suggests that these systems, too, evolved from the smallest particles of basic matter. These particles used to fill the infinite sweep of Divine Presence, which we call empty space.[2]

1.307) If it appears now that all worlds and world-structures share a pattern of emergence; that among the elements the force of attraction is unlimited and universal, and the force of repulsion is just as efficacious and general; and that at infinity the large and the small are both small – if this is all true, should then not all world-structures organize as one network and systematically interact as well? A systematic interplay, to wit, that would be equal to that of the celestial bodies in our solar neighborhood? And if this is so, would the world-structures then not have to link up just like Saturn, Jupiter, and Earth do, all of which are systems of their own, and yet connect into even larger system?[3]

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2. The 'infinite sweep of Divine Presence' (*diesen unendlichen Umfang der göttlichen Gegenwart*) raises a question as to how to read the text. Kant often uses words such as 'God,' 'Divine,' and 'revelation' (*Gott*, *göttlich*, *Offenbarung*), making the text sound like an exercise in rational theology. Yet the actual claims made by Kant suggest that such a conventional reading is misleading. Here, God and Nature merge; Nature is creative; and 'God' appears to denote a kind of 'universal world spirit' or 'Proteus of Nature'; see also the 1754 essay *Aging Earth* (2:211.29 and 2:212.15). While Kant hesitates to come out as a pagan ('free-thinker') or pantheist ('Spinozist'), we should note that such views were not tolerated in Germany until the Jacobi-Mendelssohn controversy in 1783. *Universal History of Nature* was written in the context of censorship. In 1725, Christian Gabriel Fischer (1686-1751), professor of natural philosophy, espoused pagan-pantheist perspectives; he was fired from the Albertina, banned from Königsberg, and exiled from Prussia.

3. Earlier in the book (Part I), Kant considers the Milky Way and other galaxies. He reasons that an analogy obtains between the evolution and structure of the Milky Way and other galaxies. He infers that the Milky Way is a star cluster rotating around a central axis; centrifugal forces flatten the poles, make the equator bulge, and compress the cluster into a disk (1:249-252). William Herschel confirmed Kant's conception in 1811. In 1750, five years before Kant published *Universal*

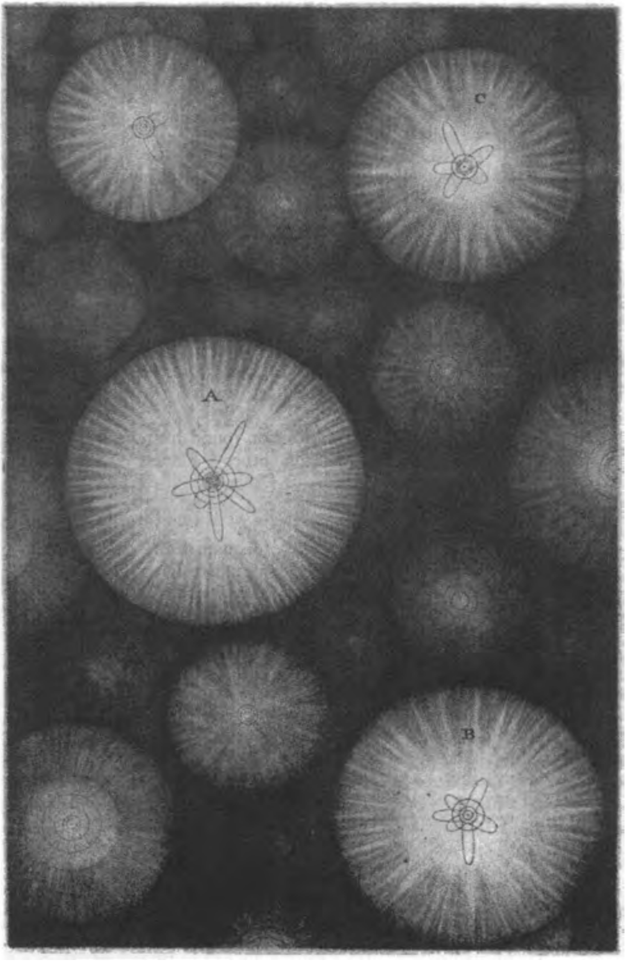

Plate XVII in Thomas Wright's *An Original Theory or New Hypothesis of the Universe* (1750): 'A kind of perspective View of the visible creation, wherein A represents the Sun, B, that supposed round Syrius, and C, the region about Rigel. The rest is a promiscuous Disposition of all the Variety of other Systems within our finite Vision, as they are supposed to be posited behind one another, in the infinite Space, and round every visible Star. That round every Star then we may justly conjecture a similar system of Bodies, governed by the same Laws and Principles with this our solar one, though to us at the Earth for very good Reasons invisible.'

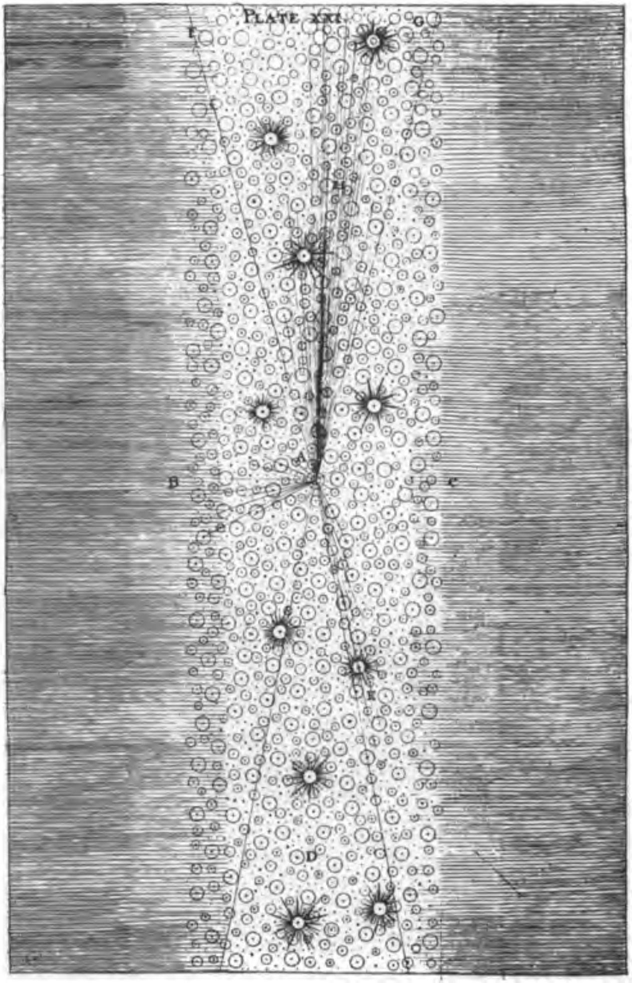

Plate XXIII in Wright (1750): The phenomena of the Milky Way – 'a vast infinite gulph, or Medium, every Way extended like a plane, and inclosed between two Surfaces [...] all the Stars scatttered promiscuously [...] as to fill up the whole Medium with a kind of regular Irregularity of Objects.'

Suppose you take a given point within the boundless space in which all the suns of the Milky Way formed. Suppose further that at that very point Nature's evolution from chaos arose by an unknown cause. Then the greatest concentration of mass will have accreted there. So a body of huge attractive force will have condensed. This will have given the galactic centre-point the power to draw all other emergent star systems into a vast enveloping sphere, and to make them sink toward itself as their gravity-well. Thereby the point will have forged a system around itself, analogous to the system created by the Sun in its own small sphere, and made from the same elementary basic matter that had moulded the planets. Observation makes this conjecture virtually certain. The star cluster emerges as a system because it serves as a frame of reference for a collectively shared plan, just as the planets, clustering around the Sun, are the frame of our solar system. The Milky Way is the zodiac, as it were, of these higher world-structures. These structures hardly deviate from the zodiac-zone; their light always illuminates the ribbon of the Milky Way. Similarly, the planetary zodiac glints in discrete spots through the sunshine illuminating these spheres, even though these spheres are just a few sparse points. In the higher world-structure, each sun creates with orbiting planets a system of its own. That suns everywhere form systems, is a circumstance that does not prevent such suns from being elements of an even larger system – just like the fact that Jupiter or Saturn serve as centres to their lunar companions does not prevent such planets from being integrated into the tight

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History, Thomas Wright suggested the idea of a disk-like Milky Way, but, as various commentators have pointed out, the credit should go to Kant: Wright only states the notion while Kant explains it.

organization of a larger system. Is it not possible to see in this precise agreement of organization – Milky Way here, solar system there – the same cause, and the same type of causation?

So: if the stars are organized as a system whose circumference is informed by the gravitational sphere of its central mass, then will it not be likely that even more star systems
1.308)– more Milky Ways, as it were – evolved in the boundless field of space? Earlier we were amazed to see celestial figures arise as such star systems – such Milky Ways, if I may express myself thus – that cohere by a communally shared design.[4] Such star systems show themselves in elliptic guises, because they are angled at various degrees against the eye. Infinite distances from the eye weaken their light to a gleam. Their diameter is, so to speak, infinities and infinities larger than that of our solar system. And yet, these star systems have surely evolved in the same way and unfolded from the same causes; furthermore, the

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[4] The idea that the fuzzy blobs faintly visible on a dark and clear night could be star clusters originated with Thomas Wright, who called them 'knots of stars'. Kant read a review of Wright's *Original Theory and Hypothesis of the Universe* (1750) in *Freie Urteile und Nachrichten zum Aufnehmen der Wissenschaften und Historie überhaupt* (1751). Just as Kant extrapolates from our solar system to the Milky Way, so he extrapolates from the latter to other galaxies. Calling them 'foggy stars' (*neblichte Sterne*, 1:254-1:255), he argues they are not just knots, but rather *systems* of stars. In 1761, Johann Lambert suggested a similar view in *Cosmologische Briefe*. In the 1780s, Charles Messier prepared a catalogue listing 103 nebulae. In 1802, William Herschel published a catalogue of 2,500 nebulae; in the 1830s, his son, John Herschel, added 1,300 more. In 1864, William Huggins discovered through spectrographic analysis that nebulae differ from stars and speculated they are of some luminous fluid. At the end of the nineteenth century, most astronomers assumed nebulae were proto-stars *inside* the Milky Way. Kant's idea, that they are Milky Ways in their own right, was marginalised. In the 1920s, Heber Curtis revived Kant's idea, calling such nebulae 'island universes'. In 1924, Edwin Hubble examined M 31 (the Andromeda nebula), determined its location to be outside the Milky Way, and verified Kant's idea. See M. Schönfeld, *Philosophy of the Young Kant* (Oxford: Oxford University Press, 2000), 116 and 272.

Nebula NGC346 (Credit: NASA,ESA,Hubble Heritage Team [STScI/AURA]).

same dynamic engine that had structured them continually maintains them.

Now, if we see these star systems, in turn, as links in the great chain of Nature as a whole, then we will have just as much reason as before to think of these links as being concatenated in reciprocal networks.[5] By the law of primordial evolution that governs all Nature, we should think of these connections as already weaving another system. That even greater system would be ruled by the gravitational pull of a central body inside its regular frame, with an even larger attractive force than all the others considered thus far.[6] The force of attraction is the cause of the systematic organization among the stars of the Milky Way. This force is active even in the distances of these world structures. In fact, its power is such that it would actually knock them out of their systematic places and bury the world in inexorably looming chaos, if it were not for the steady radiation of centrifugal forces serving as counterweights. In their interplay, attractive and centrifugal forces yield the relation that grounds systematic organization. Attraction connects substances through mutual dependencies. Now, surely, this force must be a property of matter, and it must reach as far as co-presence, which is a property of space. Speaking more precisely, attraction must be the very relation that unites the parts of Nature in one space. Hence attraction stretches through the whole sweep of space towards the depth of infinity. Light reaches us from these distant systems, but

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[5] 'Star systems' (*Sternensystemata*), here, are galactic systems; see Kant's previous paragraph.

[6] This is the first conjecture in history about the possibility of a Local Group in the Virgo Cluster.

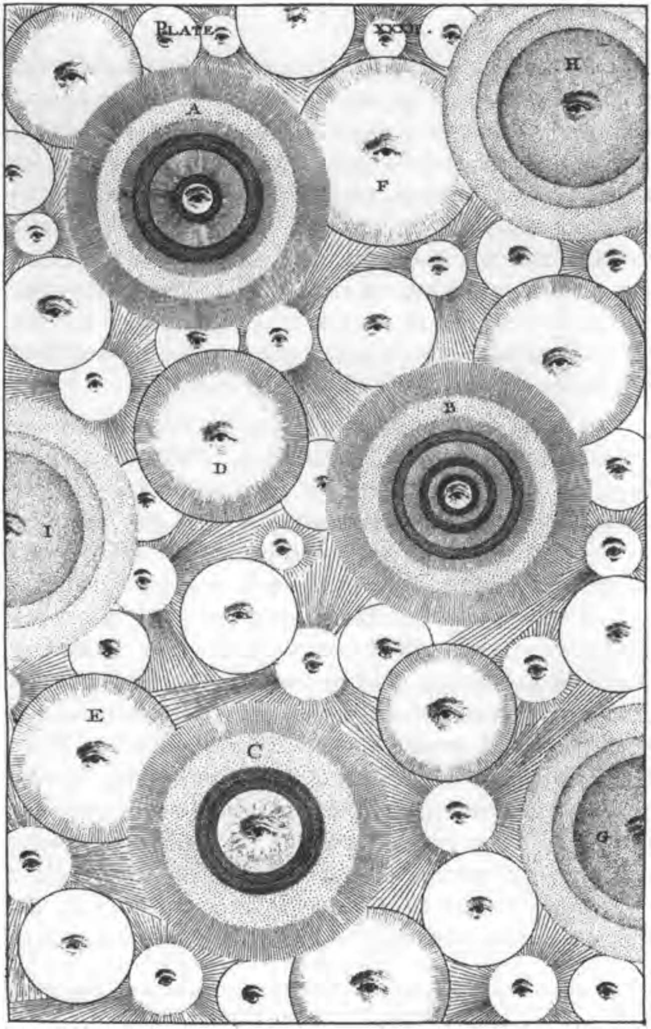
PLATE XXXII.
A
B
C
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H
I

Plate XXXII in Wright (1750): A sectional view of 'the endless Immensity [...] an unlimited Plenum of creations not unlike the known Universe'.

light is merely an impressed motion. Should then not attraction reach that far, too? Attraction is the primordial source of motion; it is more ancient than motion, and it 1.309) does not need external causes. Also, attraction cannot be stopped by any obstacle, since it acts without resistance in the inner reaches of matter, even when Nature is fully at rest. Considering this, I ask: Will attraction not have set star systems in motion as well? And will attraction then not be the cause of all the systematic connection and the permanence of Nature's links, which protects them from dissolution here, just as in the smaller frames?

But then, what is going to be the ultimate end of these systematic arrangements? Where will creation ever stop? Note that creation, since it is proportional to the might of Infinite Being, cannot have boundaries at all. Enclosing the realm of revelation within a sphere of the radius of the Milky Way does not bring us one step closer to the infinity of God's creative power than putting this realm into a ball the size of an inch. All that is finite, involves limits, and can be measured, is equally far away from infinity. Is it not incoherent to conceive of a divinity as acting with an infinite small part of its creative potential? Or to take the infinite power of divinity as a force inert and sealed up, forever wanting for some way of showing itself adequately? This power, after all, is the cornucopia of the true boundlessness of natures and worlds. So, is it not far more decent – or, to say it again, with more precision: is it not *necessary* – to take creation as it would have to be such as to testify to that very

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7. Kant's first question appears to refer to the Christian concept of a coming eternal afterlife (*künftige Folge der Ewigkeit* 1:309.34). The infinity of 'varieties and change' (*von Mannigfaltigkeiten und Veränderungen* 1:309.35) comes into play in that an eternal afterlife counts as real eternity only if it is an actually infinite time span. The essence

power that cannot be measured by any yardstick? Thus the cosmic field of the revelation of the Divine traits must possess the infinity of these traits themselves.

Eternity would not be big enough to contain the traits (1.310) of a Supreme Being unless infinity is also expressed as a spatial field. Complexity, form, beauty, and perfection are certainly relations of elementary fields and substances that constitute the stuff of the cosmic system. This is evident in the eternal designs crafted by Divine Wisdom. It is also appropriate to this wisdom that such designs unfold by implanted universal laws along unconstrained courses. So, with sound reason, we can say that organisation and design of the world will occur along a time flow, step by step, as the

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* [*Kant's footnote*] The concept of the world's infinite extension has opponents among the experts of metaphysics; a recent example is *Magister* Weitenkampf. Now since these gentlemen cannot grant this idea because of the alleged incoherence of the notion of a set without numerical limits, I just want to ask this: When eternal afterlife comes, will not its future flow contain a genuine infinity of varieties and change?[7] And is not this infinite set fully present once and for all in the Divine Understanding? (1:310) Now, if it were possible that God realised in a successive series the notion of infinity that presents itself to His understanding, why should not the same concept be able to denote another infinity, in a *connected network* that is spatial? And if this were so, would it not thereby make the circumference of the world without borders? While one seeks for an answer to this question, let me use this opportunity to solve a problem related to an explanation of the nature of numbers; a question deserving of clarification. A power guided by supreme wisdom reveals itself in creation: does the set of actually created revelations constitute a fraction compared to the set of what this power *could* have created?

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of time is flow, visible in varieties and change. Without change there is no time; and without time, there is no eternity – if eternity were *outside* time, it would be a stasis and thus nothing. Christians distinguish between creator and creation, conceiving the former as active and infinite, the latter as passive and finite. Echoing the views of Martin Knutzen (1713-51), Johann Weitenkampf (1726-58) argued against a possibly infinite extension of nature. Knutzen, a Christian, held the chair of metaphysics and logic in Königsberg when Kant attended college. As a teacher, Knutzen promoted Weitenkampf and Friedrich Buck (1722-86), but made Kant drop out in 1748 over his *True Estimation of Living Forces* (w. 1744-47, p. 1749). Weitenkampf and Buck were candidates for Knutzen's succession in 1751; Buck gained the chair of metaphysics and logic in 1756.

unfolding of a stock of created Nature-stuff. The sole direct effect crafted by Divine Presence is pure matter, whose properties and powers ground all change. Hence Divine Presence must at one point be so rich and complete that the development of its compositions in the flow of eternity can radiate along a plan that has everything that can be; that does not accept any measure; and that, in short, is infinite.

So: since, now, creation must be spatially infinite, too – or, at least, has been actually infinite over matter already from the start, and is bound to be infinite as regards form via an evolutionary process – then it follows that cosmic space will teem with an infinite number of worlds. Now, earlier we said that systematic connection informs all specific parts. Does this mean that systematic connection will also inform the Whole? Will the Universe, the All of Nature, be structured as a unified system, by the bond of attraction and repulsion? Yes indeed, I say. For imagine 1.311) there were only isolated world systems, without a shared link to a whole, and that these systems made up an actually infinite set. Imagine, further, a precise equilibrium among all the attractive forces of all these disparate parts from all sides; an equilibrium that would protect such a system from the ruin threatened by such mutual inward attraction. Clearly, this scenario requires such a perfectly exact determination of dynamically balanced distances that the tiniest shift would pull the Universe into doom, surrendering it to collapse. While such a pull may take eons, it will inexorably lead to this end. A cosmic organization that does not sustain itself without a miracle lacks the property of permanence that is a trait of Divine choice. To such choice it would be far more appropriate if the whole creation were made into a single system.

PLATE. XXXI.

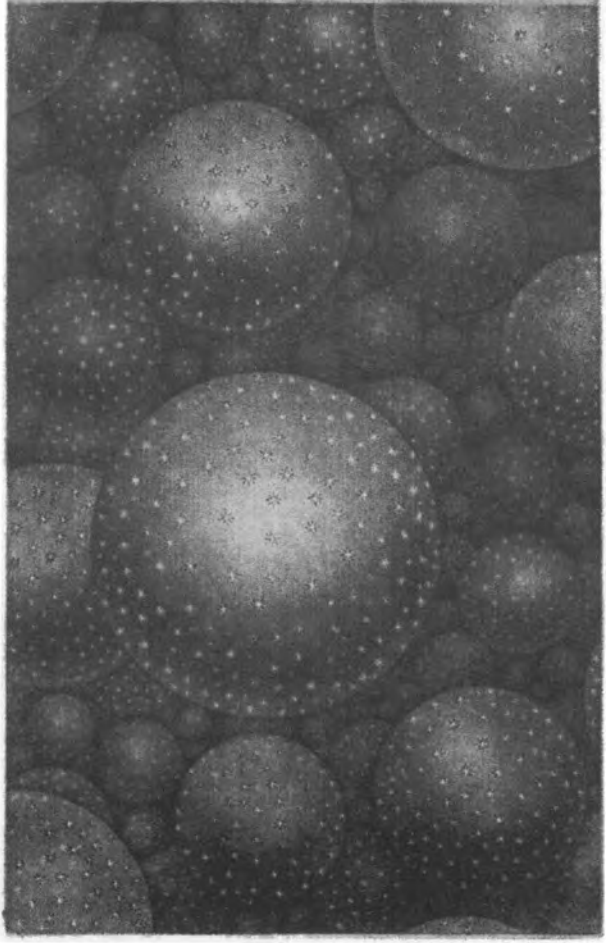

Plate XXXI in Wright (1750): '[A]s the visible creation is supposed to be full of siderial Systems and planetary Worlds, so on, in like similar Manner, the endless Immensity is an unlimited Plenum of creations not unlike the known Universe; a partial view of Immensity, or without much Impropriety perhaps, a finite view of Infinity.'

Galaxy NGC1672 (Credit: NASA,ESA,Hubble Heritage Team [STScI/AURA]-ESA/Hubble)

In this system, all the worlds and world structures that fill up the whole spatial infinity form a network around a common centre. A scattered swarm of world systems would collapse with undiminished momentum into doom and destruction no matter how far apart they were from one another, unless systematic motions create a relational order towards one universal centre. Such a cosmic mid-point would be the attractive centre of the Universe and the column that holds up Nature.

Nature's universal centre and gravity-well is the same in Nature's evolved and raw states. At this centre mass would surely concentrate towards the greatest attraction. Its gravitational field would hold all worlds and structures which have been produced over time and will be produced unto eternity. One can probably assume that Nature started to form around this universal centre and gravity-well. There the systems would also cluster with maximum density. The farther they were placed from the centre, the thinner their dispersion would be, until they lost themselves in the infinity of space. We can identify this rule by analogy with our solar system. Indeed, its makeup serves to illustrate a further dynamic feature: over vast distances the pull of the primary body at the centre fuses with the attractive forces of orbiting sub-systems so that the systematic attraction radiates essentially from one mass against even farther systems. This will help us to comprehend the whole of (1.312 Nature, in the whole infinity of its sweep, as one single system.

Now let us see how Nature's universal system evolves in lawful mechanical ways from a material striving towards complexity. In the infinite spatial dispersion of the elementary, primordial matter, there must be a place with the highest density of basic material. There evolution happens first. This process yields the mass that is the column sustaining the Universe. Granted, infinite space does not really have a centre point. But if one considers a given relationship based on real degrees of primordial mass density, one can arguably speak of a centre-point within infinity – it would simply be the place of peak material density. Outside this centre, density rarefies according to distance. The formation of a mass with maximum attraction defines the centre as the gravity-well into which all other elementary matter will sink, even when such matter is simultaneously weaving its own specific networks. So it will not matter how far the evolution of Nature reaches – this centre of the infinite sphere of creation unifies the entire cosmos into a system.

Now here is something vital that demands applause and deserves full attention. It is this: As a consequence of Nature's organization according to the described system, creation, or rather, Nature's evolution, begins at this centre-point, spreads out step by step in steady progression, towards all farther reaches, and fills infinite space with worlds and subordinate systems along the flow of eternity. Let us savour this vision for a moment with quiet pleasure. I find nothing that elevates the human spirit to nobler reverence than the part of the theory that concerns creation's successive completion. This part opens to the spirit a vista into the boundless field of omnipotence. As soon as one grants that matter, or the stuff of world formation, is not homogenously scattered in the whole spatial infinity of Divine
1.313) Presence, but is instead spread out according to a law, which

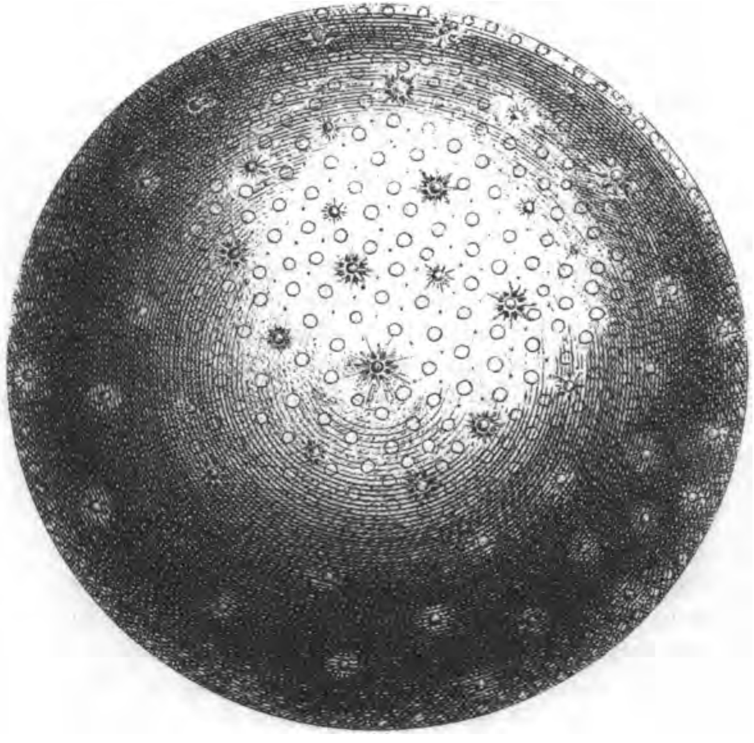

Plate XXIV in Wright (1750): ‘A representation of the convexity, if I may call it so, of the intire creation, as a universal Coalition of all the Stars consphered round one general Center, and as all governed by the same Law.’

is perhaps a law concerning particle density, then Nature's first stirring will have tied the start of evolution to this centre-point. After this start, and as the next evolutionary step, the space beyond the centre shapes worlds and world-orders into a systematic structure around this centre. This happens gradually and over time. The span of a given time is proportional to the size of the work to be completed. In any finite time-period it is possible to structure only a finite sphere around this centre-point. The infinite remainder, meanwhile, will quarrel with confusion and chaos. The farther areas in such infinity are from the sphere of evolved Nature, the further they will be from a state of full evolution. Seen from our perspective in the Universe, it would seem as if we looked at wholly completed creation and, so to speak, at an infinite array of systematically connected world-orders. And yet, from what has been said, it follows that we must be quite close to the centre-point of Nature; at any rate so close that Nature has already evolved from chaos here and attained its appropriate perfection. But if we could step outside this evolved sphere, we would see chaos. The random scattering of elements is inversely proportional to the proximity to the centre-point. The closer the scattering is, the more it will have already partially emerged from the raw state and be on its way toward full evolution. But the farther the scattering is, the more it will lose itself with each outward step into utter dispersion. If we could travel outside this sphere, we would see how the spatial infinity of Divine Presence and its store-house of possible natural forms are buried in a night of silence, a night filled with matter that serves as building material for future generations of worlds. Impulses set this matter into motion.

A faint stirring will be the onset of the very motions that are going to make these boundless desert-spaces come alive. Many millions of years and centuries will perhaps go by before our home-sphere of evolved Nature will expand to thrive in these spaces with that kind of completion that is its feature now. And perhaps a time span of similar length will have to pass before Nature takes such a great step (1.314) into chaos. But how long it will take does not matter, for the sphere of evolved Nature is incessantly busy with its expansion. Creation is not the work of an instant. Creation starts with the production of an infinity of substances and matters. It then continues with producing ever higher levels of fertility throughout eternity. Millions of years, no; whole mountain ranges of millions of centuries will pass, during which always new worlds and world-orders come into existence and reach maturity, one by one, in remote reaches far from Nature's centre. Whatever systematic organization the parts have with respect to one another, all of them attain a universal relation to the cosmic mid-point that had become the primordial and creative centre through the gravitation of its extraordinary mass. The infinity of future time-flows will make all spaces of God's presence wholly come alive. Step by step, this infinity will turn these spaces into the regularity that is appropriate to the fittingness of Divine design. If we could, with bold imagination, sum up the whole eternity, as it were, in a single notion, then we would also be able to see the whole spatial infinity filled with world-orders and thus see creation complete. But in the flow of eternity futures are always infinite and pasts always limited. So the sphere of evolved Nature can only be an infinitely small part of the essence that carries the

Young stars in the extended arms of the Southern Pinwheel Galaxy M83 (Credit: NASA/JPL-Caltech/VLA/MPIA) seed of future worlds, and that seeks to evolve from chaos over shorter or longer periods. Creation is never done. Creation has a beginning but not an end. creation is constantly in the process of generating new dawns of Nature, new things, and new worlds. The work that it completes is proportional to the time the work takes. Creation needs an eternity to animate the whole boundless reach of infinite spaces with worlds without number and end. One can say of it what the greatest of the German poets writes about it:(1.315)

Infinity! Who can fathom you?
For you worlds are days, and humans are instants;
Perhaps the thousandth sun is now turning,
And a thousand more are still in store.
Like a clock, animated by a weight,
A sun hurries on, moved by divine force:
Its spring winds down, and another strikes,
You, though, stay the same and count them not.
von Haller[8]

It is no small delight to sweep one's power of imagination beyond the boundary of completed creation and outward into the arena of chaos, and to see how Nature is first half-raw, outside the sphere of the unfolded world, and then loses itself into the distance, along all degrees and gradations of imperfection into utter unformed space. Some might say such audacity deserves rebuke. Is it blameworthy to feign a hypothesis and to praise it as a model of rational delight? Is it perhaps all too arbitrary to contend that Nature is created only in its infinitely small part; that infinite spaces are still fighting with chaos; and that in the far future these spaces will contain entire armies of worlds and world-orders, in all their order and beauty? I am not so committed to the consequences of my theory, that I would not see how this speculation – a successive expansion of creation through infinite spaces filled with creative material – is vulnerable to the reproach of indemonstrability. Granted, this map of infinity contains a model that seems destined to be hidden forever from human understanding. And yet, I expect from those readers who know how to estimate degrees of probability, that they do not reject out of hand and as sheer lunacy such a map. I expect this, especially if one considers the method of analogy. For analogies must always and everywhere guide us as soon as the understanding lacks the thread of incontrovertible proof.

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[8] Albrecht von Haller (1708-1777), *Unvollkommene Ode über die Ewigkeit* (1743; alternative title *Unvollkommnes Gedicht über die Ewigkeit*), stanza 4; cf. 1:315. Compare also the nice translation by Ian Johnston at http://records.viu.ca/~johnstoi/kant/kant2e.htm

Now, one can support the analogy through acceptable reasons as well, and the reader, whose approval I hope to gain, may perhaps add even more important ideas. We need to keep in mind that creation has the trait of I.316) permanence only through a balance between the universal striving of attraction permeating all parts of nature, and an equally universal counter-striving. With centrifugal forces, this counter-striving sufficiently repels the inclination of attraction towards collapse and chaos. Together these strivings constitute Nature's universal systematic order. This compels us to assume a cosmic centre that holds all parts of the Universe in a relation of connectivity, and it is this that turns Nature into a system. Add to this the notion of the evolution of astrophysical bodies from dispersed elementary matter, as was explicated in the previous chapters. Since we do not tie this notion to any specific system here but instead apply it to Nature at large, we assume a primordial chaos of elementary matter dispersed in space. Such chaos, in natural fashion, must generate a centre of the entire creation. The whole of Nature is a sphere of active mass that coheres in this centre. In this way, a universal relation obtains that integrates all worlds into a single framework. But in infinite space it is hardly possible to conceive of a type of scattering of primordial matter that leads to a true centre point and gravity-well of Nature as a whole, unless Nature enacts lawfully, increasing entropy from this point outward toward its farthest reaches. Such a law will also posit a difference in time needed by a system in the various regions of infinite space to bring its unfolding to fruition and maturity. This interval would be the shorter the closer the area of an evolving world-order is to the creative centre. At the centre it takes less time to create the systematic unfolding than in the distance, for material elements are more densely concentrated in the former. Since they are more thinly dispersed in the distance, they will accrete later into organization.[9]

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[9] Kant's idea is that things closest to the stellar or galactic centre would form first and those farthest away, last. This is an aspect of his famous Nebular Hypothesis, verified by G. Kuiper and K. v. Weizsäcker in 1949. According to this hypothesis, put forward elsewhere in *Universal History*, a condensing cloud ripples with tides and forms a gravity-well to concentrate matter until it lights up. The flow of matter to this well – the future Sun – deflects laterally through internal collisions. The laterally-deflected matter revolves around the proto-Sun. The revolving matter coheres into orbital bands. Thus the solar system grows from a cloud. Orbital bands become lumpy; bigger lumps absorb smaller ones; the matter clusters condense into planets. Planets form sooner the closer they are to the centre. The farther one travels from the Sun, the deeper one looks into its past: beyond Neptune wait the old lumpy orbital bands – the Kuiper Belt. Even farther out, beyond the orbital bands, one arrives at the oldest shrouds of the rippling cloud – the Ort Cloud.

ebula NGC346 (Credit: NASA,ESA,Hubble Heritage Team(STScI/AURA)

If one considers now the whole hypothesis developed here, and considers it in its full scope, over both what I have said, and what I shall still lay out, one will not think that the boldness of its implications is inexcusable. 1.317) Every world-order that matures to perfection has a growing and inexorable tendency toward its own doom. This may be counted among the reasons that warrant that the Universe is more fertile in the production of worlds in other areas, to compensate for its deterioration elsewhere. The full range of known Nature may be as small as an atom compared to what is hidden from view above or below our sights, but it still confirms this fertility of Nature. This fertility is boundless, for it is the exertion of Divine Power itself. Countless animals and plants are daily destroyed and fall prey to transience. And yet, no less are created by unexhausted fertile powers of Nature elsewhere to repopulate the emptiness. Large stretches of inhabited land emerge from the seas in an auspicious epoch and are again buried by them, but elsewhere Nature fills the gaps, makes other lands from the watery depths, and blankets the new lands with more fertile riches. In the same way, worlds and world-orders fall apart and are swallowed up by abyssal eternities, and yet creation is constantly busy crafting new evolutions in other celestial regions, compensating loss with gain.

One should not be surprised to see that God's works are transient even on their largest scale. Everything finite, everything with a beginning and an end, contains the mark of limited nature – it has to perish; it has to end. The span of a world-order is so long-lasting in virtue of the magnificence of its designs that it approaches eternity when seen from our perspective. Perhaps thousands, perhaps millions of centuries go by without the destruction of world-orders. And yet a vanity within all finite natures is constantly busy at work to destroy them. Eternity may have all sorts of eons, but in the end all eons lead through steady decline at last to the moment of downfall. *Newton*, that great admirer of God's traits in the perfection of His works, connected deep insight into Nature's grandeur with great reverence for the revelation of Divine Omnipotence. In virtue of the natural trend of the mechanics of motions towards decline, he (1.318) found it necessary to announce in advance Nature's decay. If, as a central consequence of frailty, a systematic organization gets over eons of time even the tiniest conceivable step closer to the state of dissolution, then there must come a moment in the infinite run of eternity when gradual loss will have exhausted all motion.

We must not regret the downfall of a world system as a true loss for Nature. Nature demonstrates its wealth in a kind of wastefulness. While some of its parts pay tribute to transience, Nature maintains its entire scope of perfection through countless new creations. How many flowers and insects are destroyed by a single cold day! But even though they are magnificent works of art and proofs of Divine Omnipotence, how little are they missed! Abundance replaces this loss elsewhere. Humans, the apparent masterpiece of creation, are not exempt from this law either. Nature shows itself just as rich, just as unexhausted in creating the greatest of creatures as in creating the least of them. Nature shows that even their doom is a necessary shadow in the abundance of her suns, since their creation costs her nothing. Destructive consequences of contagion, earthquakes, and floods wipe whole nations off the map, but it never seems that this is to Nature's detriment. In the same way, whole worlds and systems leave the stage after having played their role. The infinity of creation is so large that a world or a Milky Way of worlds appears by comparison just as small a flower or an insect compared to the Earth. And while Nature decorates eternity with its mutable creations, God keeps busy forming the the basic stuff that develops into even grander worlds.

> Who sees with equal eye, as God of all,
> A hero perish, or a sparrow fall,
> Atoms or systems into ruin hurl'd,
> And now a bubble burst, and now a world
> Alexander Pope[10]

1.319) So let our sight get used to these terrifying upheavals. They are the common paths of providence. Let us see them with a kind eye. And indeed, nothing fits better than this sight to the wealth of Nature. For if a system of worlds, in the long course of its duration, exhausts all the diversity that its organization can contain, and becomes a redundant link in the chain of beings, then nothing will be more appropriate than for it to play the final role in the drama of the unfolding transformations of the Universe. Paying its dues to mortality is the final role of any finite thing. As we have suggested, Nature shows already in the small parts of its whole notion the very rule of its way that eternal Fate prescribes to everything. And I say it again: Size is no obstacle to doom. For everything that is large becomes

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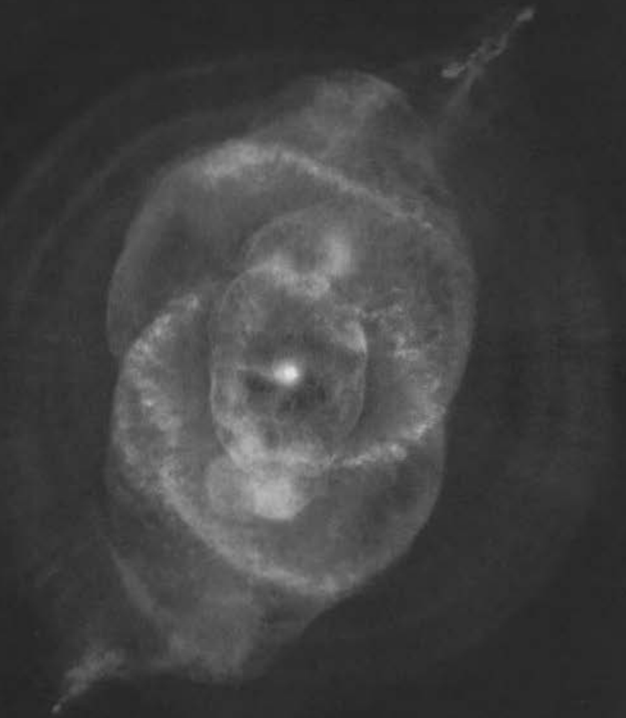
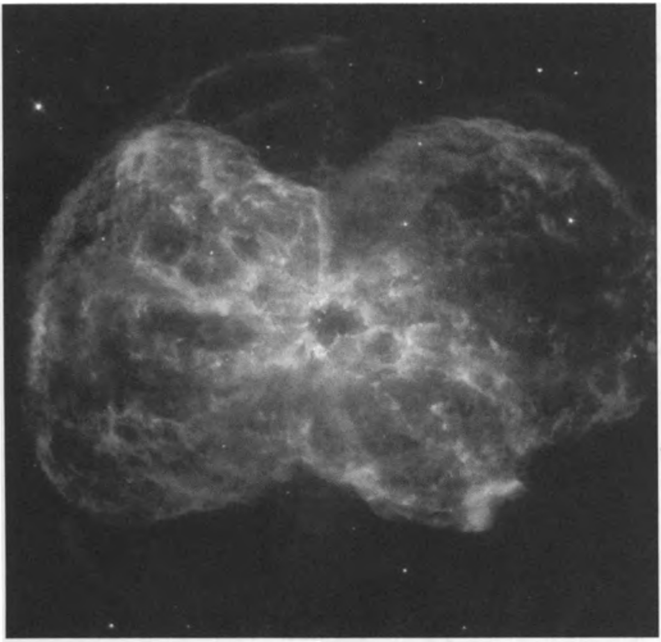
[10] Alexander Pope (1688-1744), *Essay on Man* (1733-34), Epistle 1, lines 87-90. Kant cites a very literal translation by B. H. Brocke (1740); cf. 1:318



Composite image of NGC 6543 or Cat's Eye Nebula. (Credit: [X-ray] NASA/CXC/SAO; [Optical] NASA/STScI).

small, and becomes, as it were, a point if compared to the infinity that creation represents in unlimited space and in the flow of eternity.

It appears that the end, fated to worlds as to all matters natural, is subject to some law. Recognizing this law will lend the theory a new touch, a touch of rightness. By this law, the end touches those worlds closest to the cosmic centre first, just as conception and organization had first started right next to this centre. From there, doom and destruction gradually radiate outward into ever farther reaches from



Solar Nebula (credit NASA,ESA, K.Noll[STScl]).

the centre. By general dissipation of motion, the whole Universe, having completed its period, will eventually be buried in uniform chaos. And yet, at the opposite limit of the evolved sphere, Nature is steadily busy spawning worlds from the raw stuff of scattered elements. That is to say, at the one limit Nature rots at the centre, and at the other limit Nature is young and fertile in new creations. Thus the unfolded world is placed in between, constrained by either boundary: The ruins of nature already destroyed; and the chaos of nature yet unformed. And if we imagine, as would be likely, that the length of time of a thriving mature world outlasts that of a young world forming, then regardless of all the damage done by transience, the Universe's circumference will nonetheless and on the whole expand. (1.320)

Now if we want to leave room, finally, for an idea that is just as plausible as it is appropriate to Divine works, then the satisfaction given by such an account of Nature's mutations will soar to the highest degree of delight. Nature is capable of hoisting itself out of chaos into regular order and elegant systematicity. Yet a diminution of motions sinks Nature into new chaos. Is it impossible to believe that Nature might be equally capable of reconstituting itself just as easily from this new chaos as from the old, and of renewing its former structure? The standstill of the machine brought the springs to rest that impelled the stuff of dissipated matter towards motion and order. But could these springs not be wound up once more by the rarefied field of forces? And could they not once again be curbed by the very same general rules toward harmony, whereby original evolution had come about? One won't have to tarry long with misgivings, as soon as one considers the following: A terminal weakening of orbital motions within the world system will make

planets and comets without exception crash into the Sun. The Sun, in turn, will absorb an immeasurable energy increase through the admixture of so many big lumps. This energy increase will be especially great since distant spheres of the solar system consist of the lightest and most combustible materials of nature, by the theory previously laid out. Through new nourishment and the most volatile matter, the fire will flare up into greatest violence. It will doubtless not only dissolve everything into its smallest elements but also radiate and dissipate them into the very same distant spaces that such matters had occupied before the first evolution of Nature. This radiation and dissipation will happen through a force of expansion proportional to the heat, and with a velocity not weakened by any resistance in the dimensional medium. The near-total dissolution of its matter then dampens the violence of the central conflagration. By next linking attractive and repulsive forces, the old productions and systematically related motions will be repeated with no lessening of regularity. In this way Nature will organize a new world system.[11] When a particular
1.321) planetary system decays in this way; when it reorganizes itself by essential forces out of such disorder; when it even repeats this process more than once – eventually an era is bound to come, when even the great system of stars will decay in its motions and sink into chaos. There is little doubt that the concentration of such a boundless lot of fiery charges (which these burning suns are) will dissolve in nameless glow, dissipate in the old realm of its evolutionary

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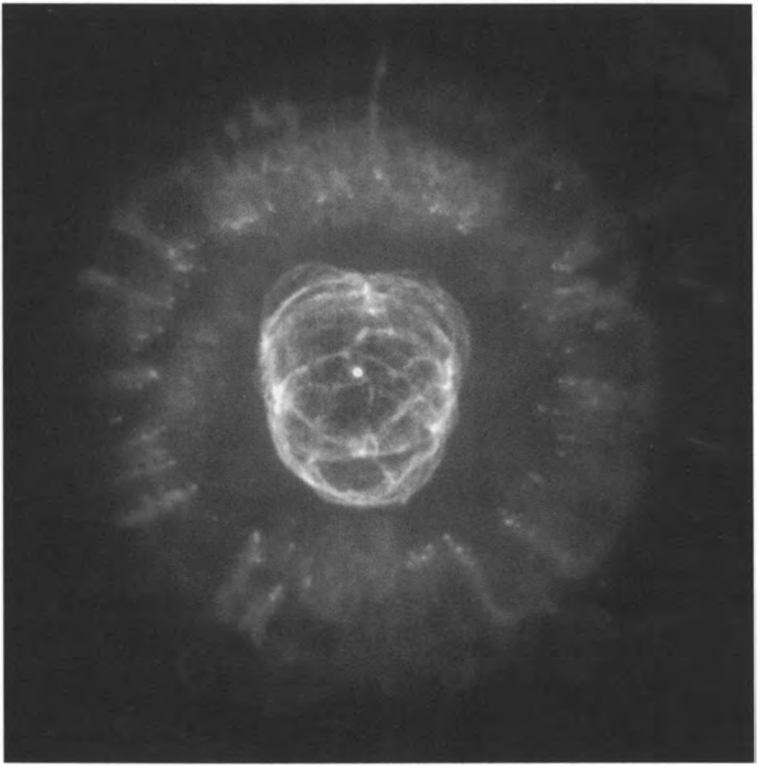
[11] This may well be the first conjecture in history about generations of stars. According to current knowledge, the first and long extinct generation consisted of blue hydrogen stars; in their nuclear furnace, the heavier elements of the periodic table formed that make up the more recent populations of stars. The younger a star is (such as the Sun), the higher will be its metal content.



Eskimo Nebula (Credit: NASA, Andrew Fruchter and the ERO Team [Sylvia Baggett (STScI), Richard Hook (ST-ECF), Zoltan Levay (STScI)]). A photograph of a dying star. 'Ten thousand years ago this halo of gas and dust was part of the central star. The aging star then expelled its outer layers into space in successive bursts, forming what astronomers call a planetary nebula. All ordinary stars like the Sun will eventually meet a similar fate.' (Carl Sagan, *The Varieties of Scientific Experience*, London and New York: Penguin, 2006, 267.)

Supernova Remnant 63A. (Credit: NASA, ESA, HEIC, and The Hubble Heritage Team [STScI/AURA]).

sphere, and accordingly supply the materials to new evolutions by the same mechanical laws. In this way the emptiness can come alive again with worlds and systems. The **Phoenix of Nature** burns itself up only to return from its ashes, come back to life, and be young again.[12] If we now follow the Phoenix through all infinity of time and space, and if we see how Nature, even in the aspect of decay and obsolescence, still has the power for new creations; if we see how, at the other edge of creation and in the realm of unformed, raw matter, Nature proceeds with steady steps toward the expansion of the plan of Divine unfolding, and fills all time and all space with its miracles – if we see all this, then the mind, pondering such vistas, will sink into deep wonder. Yet the mind is discontent with this grandiose object whose transience can never appease the soul, and wishes to get to know that very being up close whose understanding and grandeur are the light source shining through the whole nature as from a centre. With what kind of reverence shouldn't the soul regard its own being, considering that it is supposed to survive all these transformations? It can tell itself what the philosopher-poet says about eternity:

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[12] My emphasis: On the 'Phoenix of Nature' see my own contribution to this volume.

When next a second Nothingness will bury this world,
When from the All nothing will stay but the place,
When still other skies, bright with other stars,
Will have completed their course:
Then you will be as young as now, just as far from death,
And be as eternally future-bound as you are today.
von Haller[13]

O how happy will reason be, when, among the tumults (1.322) of the elements and the ruins of nature, it is set on a steady height that lets it see the wreckage caused by the frailty of things in the world as if it were a current rushing by its feet. A happy blessedness, which reason may not even dare to wish for, is taught by the Revelation as what we can hope for with conviction. When the shackles that bind us to the vanity of creatures fall off in the very instant that is tuned to the transformation of our essence, the immortal ghost, freed from the dependence of finite things, will find the pleasure of true luck-spiritedness in the community with infinite being. Nature as a whole has a universal and harmonious relation to the well-falling of divinity. Nature is capable of filling a rational creature, which finds itself joined to the arch-source of all perfection, with nothing but steadfast contentment. Seen from this central perspective, Nature will display pure safety, pure integrity, on all sides. Its mutable scenes fail to unsettle the happy poise of a ghost once raised to such height. In foretasting this state with sweet hope, a mind which is still embodied, can already train its mouth in singing these songs of praise that once will sound in all eternities.

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[13] Albrecht v. Haller (1708-1777), 'Unvollkommene Ode über die Ewigkeit' (first printing 1743).

> When, once in time, the frame of the world flees back into its own nothingness
> And the work of your hands does not differentiate by day and night anymore:
> Then my moved character, firmed by you, should try,
> To draw to your throne in honour and respect of all your power
> My mouth, filled with thanks, should through all eternities
> Prepare unending praise to you and your majesty;
> And yet no praise would be perfect – for o Sir! So tall are you,
> That eternity won't suffice to give praise fit to your dignities.
>
> Joseph Addison[14]

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[14] Joseph Addison (1672-1719), 'Some Pieces of Divine Poetry', stanzas 12 and 13, *Spectator* 453 (9 Aug 1712); Kant cites a rather free translation by Louise v. Gottsched, b. Kulmus ('die Gottschedin', 1713-62). The poem above is a literal re-translation from Gottsched's paraphrase. Compare Addison's original: 'When Nature fails, and day and night / Divide thy works no more, / My ever grateful heart, O Lord, / Thy mercy shall adore. / Through all Eternity to Thee / A joyful song I'll raise; / For, oh! Eternity's too short / To utter all Thy praise.'

Prospects for Post-Copernican Dogmatism: The Antinomies of Transcendental Naturalism

Iain Hamilton Grant

> For it is not because there is thinking that there is being, but rather because there is being that there is thinking.
> Schelling[1]

> [T]he fundamental error of dogmatism [...][is to] search outside the I in order to discover the ultimate ground of all that is in and for the I.
> Fichte[2]

What is the dogmatism against which transcendental philosophy launched its Copernican revolution? Since Kant's invention of the thing-in-itself, we are apt to think dogmatism in terms of an access problem,[3] and therefore to conclude that any philosophy is dogmatic that, through insufficient attention to its own conditioning, denies that there is an access problem. Yet characterising dogmatism as access-positivism does little to define it positively, providing only a formal regression to inhibit speculative or rational egress beyond reflection, as the Fichte citation above makes sun-clear. Nevertheless, the Fichtean egress-prohibition has latterly been posited as a positive criterion of 'philosophically effective' transcendental arguments:

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[1] F. W. J. Schelling, *Sämmtliche Werke*, ed. K F. A. Schelling, 14 vols (Stuttgart und Augsburg: Cotta, 1856-61), vol. XIII, 161 n., trans. B. Matthews, *The Grounding of Positive Philosophy* (New York: SUNY, 2007), 203 n.

[2] J. G. Fichte (1971) *J. G. Fichtes sämmtliche Werke*, ed. I. H. Fichte, 8 vols (Berlin: Walter de Gruyter, 1971), vol. IV, 174, trs. D. Breazeale and G. Zöller, *The System of Ethics* (Cambridge: Cambridge University Press, 2005), 165.

[3] For an excellent recent account of the access problem, see Chapter One of Quentin Meillassoux's *After Finitude* (London: Continuum, 2008).

> The transcendental argument must not invalidly infer objective and/or unrestricted conclusions from purely subjective and/or merely parochial premises.[4]

Again, following Fichte, this criterion is expressly designed to counter any claim to a 'transcendental naturalism', which comes close, as Bell claims, to an oxymoron.[5] It follows from the above criterion that the only valid transcendental argument is one that demonstrates and asserts the parochial subjectivism of its premises. What is striking is that the double assertion of subjectivity and parochialism is asserted against the rest of being or nature. We must ask, however, whether the Bell-Fichte subjective parochialism thesis does in fact exhaustively define transcendentalism, so that to reject the one is to dismiss the viability of the other, and thus to assert that there can be no other basis for transcendental philosophy. If this is so, in so far as transcendentalism's parochialism constitutes its putative value, it also constitutes grounds for its rejection. If not, we cannot conclude a transcendental naturalism to be oxymoronic.[6]

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[4] D. Bell, 'Transcendental Arguments and Non-Naturalistic Anti-Realism', in R. Stern (ed.) *Transcendental Arguments. Problems and Prospects* (Oxford: Oxford University Press, 1999),189-210, at 192.

[5] Ibid., 194.

[6] The prospect of a naturalistically grounded transcendental philosophy is precisely

Consider, for example, Schelling's claim above: It is a transcendental argument in that it stipulates what conditions the possibility of thinking without reducing these conditions to any given or particular domain of objects. Hence Kant's having noted, with regard to Schelling's *System of Transcendental Idealism*, that 'transcendental idealism is realism in an absolute sense'.[7] In accordance with this absolute realism, Schelling's thesis stems from his ontological naturalism:[8] Being is the necessary condition of thinking and not vice versa.

The point to note is that neither claim is inherently inconsistent, that both are transcendental, and accordingly, that transcendental positions are themselves open to counterpositions. Given this, in what follows, we shall argue that transcendental philosophy is itself a dogmatism,[9] and

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what Kant sought by way of the 'ether proofs' in the *Opus postumum*, trans. by E. Förster, (Cambridge: Cambridge University Press, 1993), 62-99. Transcendental philosophy is then defined as the 'system of *ideas*, which are problematic (not assertoric) in themselves [...] but must nevertheless be thought as possible forces affecting the rational subject' (ibid., 250), necessitating a *dynamica generalis* (ibid., 224) to ground *both* the system of objects *and* the system of ideas.

[7] *Opus postumum*, op. cit., 255.

[8] 'Anything whose conditions simply cannot be given in nature, must be absolutely impossible' (Schelling, *Werke* III, 571). Although it could be argued that the 'positive philosophy' of the *Grounding* is incompatible with the 'negative philosophical' theses of the *System of Transcendental Idealism*, this would be to disguise the extent to which Schelling's naturalism is precisely the kind of 'absolute realism' with which Kant identifies 'transcendental idealism'.

[9] As indeed Fichte claims in the 'Review of *Anesidemus*': 'the [Dogmatic] system holds open the possibility that we might someday be able to go beyond the boundary of the human mind, whereas the Critical system proves that such progress is absolutely impossible, and it shows that the thought of a thing possessing existence and specific properties in itself and apart from any faculty of representation is a piece of whimsy, a pipe dream, a nonthought. And to this extent the Humean system is sceptical and the Critical system is dogmatic – and indeed negatively so' (*W* I, 16; Eng trans. by D. Breazeale in *Fichte: Early Philosophical Writings*, Ithaca: Cornell University Press, 1988, 70-1).

shall do so on the basis of the applicability of three criteria specified by transcendental philosophers for the identification of dogmatism. These criteria are:

C.1 *Logical*: the susceptibility of dogmatic systems to internally consistent but antinomic counter-systems.[10]

C.2 *Metaphysical*: the attempt to provide a ground or cause of beings external to the I, or to satisfy the Principle of Sufficient Reason;[11] and

C.3 *Ontological*: the thesis that beings are things or objects.[12]

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[10] '[Reason, in] its dogmatic employment [...] lands us in dogmatic assertions to which other assertions, equally specious, can always be opposed' (Kant, *Critique of Pure Reason*, trans. N. Kemp Smith, London: Macmillan, 1958, B22-3; hereafter CPR). '[I]n the dogmatic procedure of reason [...] unavoidable contradictions of reason with itself have long since undermined the authority of every metaphysical system yet propounded' (CPR: A10/B23-4). In 'the dispute between the idealist and the dogmatist [...] reason gives us no principle of choice [... and n]either of these two systems can directly refute its opposite' (Fichte, *Werke* I, 429-432; trans. by P. Heath and J. Lachs, *The Science of Knowledge*, Cambridge: Cambridge University Press, 1982, 12-14).

[11] While metaphysics, 'as science [...] has to deal [...] only with itself and the problems which arise entirely from within itself, and which are imposed upon it by its own nature, not by the nature of things which are distinct from it' (CPR: B23), 'dogmati[sm] claim[s] acquaintance with the constitution of the object fuller than that of the counter-assertion' (CPR: A388). See also Fichte, *Werke* IV, 174; *System of Ethics*, trans. and ed. by Daniel Breazeale and Günter Zöller (Cambridge: Cambridge University Press, 2005), 165: '[T]he fundamental error of dogmatism [...][is to] search outside the I in order to discover the ultimate ground of all that is in and for the I'. Wayne Martin confirms this diagnosis in his *Idealism and Objectivity: Understanding Fichte's Jena Project* (Stanford: Stanford University Press, 1997), 37: 'dogmatists are not identified simply as those who assert that things-in-themselves exist; rather they are those who assert that things in themselves constitute the ground of experience'.

[12] '[*D*]*ogmatic* enquiry concern[s] things (objects), [whereas] a *critical* enquiry concern[s] the limits of my possible knowledge' (CPR: A758/B786). Dogmatism thus 'requires an insight into the nature of the object such that we can maintain the opposite of what the proposition has alleged in regard to this object [...] claiming acquaintance with the constitution of the object fuller than that of the counter-assertion' (CPR: A388). 'Any philosophy is [...] dogmatic, when it equates or opposes any thing to the self as such;

Since (3) can itself be construed as satisfying (2), it may be subsumed under it. Our purpose in stating it separately is threefold. Firstly, to highlight the crucial role played by 'things' not only in the determination of the nature of dogmatism, as above, but also in the development of transcendental philosophy's *ontology*, for which the concept 'thing-in-itself' asserts only the most elementary determination of existents; but transcendental philosophy is itself dogmatic when it concludes that *therefore they exist at all*, and that this is how being is, as when, for instance, it asserts that 'concepts of relation presuppose things which are absolutely [*schlechthin*] given, and without these are impossible'.[13] That is, the condition of possibility of objects of intuition – even of their distinction – is simply 'things absolutely given'. At this point, transcendental philosophy, whose 'supreme concept [...] is the division into the possible and the impossible', can avoid dogmatic ontological commitment only at the cost of antithesis:

> Thus the object of a concept to which no assignable intuition whatsoever corresponds is = nothing. That is, it is a concept without an object (*ens rationis*), like noumena, which cannot be reckoned among the possibilities, although they must not for that reason be declared to be also impossible.[14]

Although the 'things absolutely given' on which the objects of intuition depend are neither possible nor

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and this it does in appealing to the supposedly higher concept of a thing (*ens*), which is thus quite arbitrarily set up as the absolutely highest conception. In the critical system, a thing is what is posited in the self; in the dogmatic, it is that wherein the self is itself posited' (Fichte, *Werke* I, 119-120; *Science of Knowledge*, 117).

[13] CPR: A284/B340.

[14] CPR: A290/B346-7.

impossible, and therefore not susceptible of a transcendental investigation, their existence cannot be denied: The very essence of the dialectic, or the unavoidable errors entailed by reason's own nature, we might say. Yet as Kant's naturalistic inquiries continue (the analysis of fundamental forces in the *Metaphysical Foundations*, for example; that work's assuaging of Kant's doubts concerning chemistry as a science, and its possible applicability to emergent neuroscience; or more explicitly, the 'ether proofs' of the *Transition from Metaphysics to Physics*),[15] this possible-impossible determination *that there are things* becomes increasingly open to dispute: Perhaps things are not 'absolutely given', but instead forces assume ontological and explanatory priority over things. At issue here is the susceptibility of parochial (in Bell's sense) transcendentalisms to naturalistically driven ontological change. By criterion (1), then, the revealed contestability of a thing-based ontology demonstrates the transcendental philosophy's propensity for dogmatism.

The second reason for the initial separation of condition (3) from (2) is to accommodate a recent argument made by Wayne Martin concerning Fichte's identification of dogmatists not 'simply as those who assert that things-in-themselves *exist*' but rather as 'those who assert that things-in-themselves *constitute the ground of experience*'; or, in other words, that 'the I is a thing'.[16] Such arguments – properly parochial, in Bell's sense – highlight the implicit assertion that an argument is transcendental if and only if it avoids dogmatic assertion and *therefore* susceptibility to counter-assertion ('things-in-themselves do/do not exist'). Such transcendentalisms therefore tend to propose a metaphysics without ontology. The third and final reason for the initial distinction is therefore to raise the question as to whether this is possible. For dogmatisms, by contrast, argue that *any consistent metaphysics is an ontology, and any consistent ontology is a metaphysics.*

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[15] See Kant, *Aus Soemmering, Über das Organ der Seele*, *Ak.* XII, 33-7, trans. by Anulf Zweig as 'From Soemmmering's *On the organ of the soul*' in Immanuel Kant, *Anthropology, History and Education*, ed. by Gunter Zöller and Robert Louden (Cambridge: Cambridge University Press, 2007), 219-226; and Alexander Ruerger, 'Brain water, the ether, and the art of constructing systems', *Kant-Studien* 86, 1995: 26-40. The *Transition between Metaphysics and Physics* was the working title by which what became Kant's *Opus postumum* was contemporarily known (cf. Schelling, *Werke* VI, 8).

Consider a metaphysical problem such as causality. When Kant examines self-organisation in the third *Critique*, he makes precisely the claim that its ubiquity in experience cannot warrant any assertion or denial of its existence in nature. Yet this 'problematic' address to natural causality nevertheless finds that it is 'necessary for reason to think' that 'matter can receive more and other forms than it can get through mechanism'.[17] Rational necessity avoids ontological commitment if and only if it does not entail that the theses concerning matter and causation so necessitated are *not* theses concerning matter and causation at all, but only reason; or, in other words, if the thesis, although rationally necessary, is contradictory. If the rational necessity so identified is not to be contradictory, then they are indissociably ontological theses. In other words, a resolutely problematic metaphysics must either satisfy the principle of sufficient reason, or break the law of non-contradiction. Neither, for the same reason, can ontology be separated from metaphysics unless the latter does not concern being at all. If it does not, it can only concern not-being, and is then not metaphysics, but meontology. If it does, then the distinction is untenable. Or ontology is not concerned with being, but with the reason-of-being, its *logos*. Such an account must either again face the problems encountered by Kant's 'rational necessity', or the reason-of-being must become the sole focus of ontological enquiry. This is why many of the immediate post-Kantians understood the transcendental undertaking as a 'critique of natural cognition'[18] or of the 'natural antithetic';[19] that is, an inquiry into the nature of reason itself.

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[16] Martin, *Idealism and Objectivity*, op. cit., 36-7.

[17] I. Kant, *Kants gesammelte Schriften* (Henceforth *Ak.*), ed. Königlich Preussischen Akademie der Wissenschaften (Berlin: Georg Riemer, later Walter de Gruyter, 1900-), vol. V, 411; trans. W.S. Pluhar, *Critique of Judgment* (Indianapolis: Hackett, 1987).

It is precisely this that Schelling's thesis about being denies. For it asserts not only that being is the necessary *condition* of thinking, but also that being is *first* necessary *in order that there be* thinking; being is the cause and ground of thinking, so that the Sufficient Reason for thinking is indistinguishable from ontology. Schelling's is, on this reading, a transcendental dogmatism, specifying conditions of possibility by satisfying criteria (1) and (2) above. As to the non-separable criterion (3), Schelling will indeed deny, following from the force-ontologies developed by early experiments in electromagnetism, that 'things' can provide an adequate ontological basis for either the natural sciences or for speculative naturalism. If this is taken to mean that any ontological thesis resting on forces rather than things is for that reason non-dogmatic, then the difference between transcendental and dogmatic naturalisms rests on contingent differences in the ontologies of the natural sciences.

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[18] Schelling, *Werke* XI, 526.

[19] CPR: A407/B434.

The dilemma initially facing a transcendental naturalism is accordingly that it must either assert determination by contingent entities of whatever nature (things, forces) or assert parochialism and admit that even in those of its theses that putatively address nature, no such address takes place insofar as the 'nature' in question is *phenomenal only*. The problem with this perhaps over-familiar claim, for those of us steeped in Kantian lore, is that there is an implicit assertion that nature as it is in itself is separable from nature *kat' anthropon*, as Kant says – nature as it appears *for us*. For this asserts in turn that phenomenal nature *is not nature*, which therefore transcendental philosophy *does not and cannot address*. This is exactly the problem that Kant encounters when he attempts the transition, firstly, from the dogmatic naturalism of his pre-critical to the properly critical works; and secondly, from metaphysics to physics in his final accounts of transcendental philosophy. If the Copernican revolution does not resolve this problem, then the problems Kant encountered remain ours: How, if at all, is a nondogmatic account of the relation of reason to nature possible?

1. EVERY CONSISTENT DOGMATISM IS A NATURALISM

> How then is the Critical system different from what was previously described as the Humean one? The difference consists entirely in this: the Humean system holds open the possibility that we might someday be able to go beyond the boundary of the human mind, whereas the Critical system proves that such progress is absolutely impossible, and it shows that the thought of a thing possessing existence and specific properties *in itself* and apart from any faculty of representation is a piece of whimsy, a pipe dream, a nonthought. And to this extent the Humean system is sceptical and the Critical system is dogmatic.[20]

> If thetic be the name for any body of dogmatic doctrines, antithetic may be taken as meaning not dogmatic assertions of the opposite, but the conflict of the doctrines of seemingly dogmatic knowledge in which no one assertion can establish superiority over the other.[21]

It would be a matter of considerable irony that a *Copernican* revolution in philosophy should have put paid to the project of a *Universal Natural History* – were it true. It does not, however; yet this is precisely what it is considered to have achieved: Having put an end to worries about how to adequate intellect to thing, since things must now instead comply with intellect. Yet how is any 'unthinged' naturalism to survive the revolutionary injunction? Are such 'things' reducibly those that are intellect-compliant, or are all things so? Must they be made so? Of necessity or by reconstruction? If the occasion for the revolution is that it has proven impossible to integrate reason with nature as it is in itself, what becomes of the problem of the integration of reason and nature after it?

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[20] Fichte, *Werke* I, 16; *Early Philosophical Writings*, ed. and tr. Daniel Breazeale (Ithaca: Cornell University Press, 1988), 70-71.

[21] CPR: A420/B448.

It is immediately evident that not only does the problem of nature not disappear from the transcendental philosophy, but also that, as the critical project progresses, it resumes the central role it enjoyed under Kant's precritical or dogmatic-naturalist period. The engagement with chemistry in the first *Critique*, which persisted long afterward;[22] the problem of the teleological judgment of nature with regard to the *actuality* of self-organising beings in the third. But nowhere is this cohabitation of dogmatic naturalism with transcendental philosophy more immediate than in Kant's final, unfinished project, known under the title *Transition from Metaphysics to Physics*,[23] with its ether deductions and its attempt to square transcendental deduction with *ontogenesis*.[24]

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[22] For a survey of Kant's chemism, see M. Lequan, *La chemie selon Kant* (Paris: PUF, 2000). On Kant and the sciences more generally, see M. Friedman, *Kant and the Exact Sciences* (Cambridge: Harvard University Press, 1992), E. Watkins (ed.) *Kant and the Sciences* (Oxford: Oxford University Press, 2001), and M. Friedman and A. Nordmann (eds), *The Kantian Legacy in Nineteenth-Century Science* (Cambridge: MIT, 2006). For a substantial philosophical account of the persistence of naturalism in the critical philosophy, see J. Edwards, *Substance, Force and the Possibility of Knowledge* (Berkeley: University of California Press, 2000), and for the naturalism in the *Opus postumum*, E. Förster, *Kant's Final Synthesis* (Cambridge: Harvard University Press, 2000). For my own account of the conflict between somatism and field physics in Kant's philosophy of nature, see *Philosophies of Nature After Schelling*, 2nd edition (London: Continuum, 2008).

[23] Schelling, *Werke* VI, 8: 'In the year 1801 he [Kant] was still labouring, in those few hours in which his power of thinking remained free, on a work: *Transition from Metaphysics to Physics* which, had age allowed him to complete it, would doubtless have been of the greatest interest.'

[24] What I have in mind here is the *Transition*'s discussions of 'how matter becomes a physical body' (Kant, *Ak.* XXI, 476-7). I discuss this in *Philosophies of Nature after Schelling*, op. cit., 59-81.

Allowing that the Copernican revolution was expressly undertaken to eradicate (at least Kant's) dogmatic naturalism; and acknowledging also that the problem Kant held dogmatism incapable of resolving is the integration of reason and nature into a single and consistent philosophical system; then the purpose of the critical philosophy is to prepare a transcendental resolution of reason and nature. The beginnings of this can be seen in the first *Critique*'s account of nature as 'the dynamical whole of all appearances', as opposed to 'world', which designates 'the mathematical sum-total' thereof.[25] Dynamics is invariably the means whereby the transcendental philosophy undertakes to avoid the fate of dogmatic naturalism without eliminating nature. Force-fields provide, by disputing criterion (3), above, egress from dogmatism without sacrificing nature, while the dynamical categories enable a reconstruction of reason as itself a dynamical and productive system. In the overt transcendental naturalism of the ether deductions, ether will finally integrate freedom with natural causality in a single, necessary and a priori, physical medium, long after the failure of the third *Critique*'s analogical attempt to achieve the same end. Of the ether, Kant writes that

> the question is whether it is to be regarded, not just as a *hypothetical material*, in order to explain certain appearances, but a real world-material – given *a priori* by reason and counting as a principle of the possibility of the experience of the system of moving forces [...] The existence of this material, and the necessity of its *a priori* presupposition, I now prove *a priori* in the following manner.[26]

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[25] CPR: A418-9/B446.

[26] Kant, *Ak.* XXI, 216; *Opus postumum*, ed. and tr. Eckhart Förster (Cambridge:

With this, Kant seems to condemn his physics to the same fate as his geometry: Changes in the sciences apparently undermine the a priori necessities Kant ascribes to their theses. At the same time, therefore, the transcendental project in general is opened to charges of dogmatism on the grounds of susceptibility to antinomic dispute. Yet the reason why Kant argues for the a priori necessity of the ether as world-material is this: that *dynamics composes being from actions, not things.* As Kant writes, 'the moving forces of matter are what the moving subject itself does to [other] bodies'.[27] The twofold gambit of this claim, as of any transcendental naturalism, is that the transition from things to actions is sufficient both to avoid dogmatic traps concerning antithetical ontologies of things-in-themselves (are such disputes only possible between rival claims as to the nature of *things*?); and to integrate reason and nature into a single system susceptible to determination by free and self-constitutive acts (ontogenesis, categorial synthesis, etc.), now cast as causes. The problem is *whether the transcendental determination of nature is in fact a determination of nature at all*, i.e., a determination 'at once *a priori* and physically conditioned',[28] or merely a determination of the nature of Reason. If nature is *not* so determined, then things are not intellect-compliant, and dogmatism's inconclusiveness or revisability becomes the price to pay for the failure of the Copernican experiment. If it *is*, then the question is *either*: What kind of nature is it that is directly determinable in accordance, as Kant twice stipulates, with the 'power of

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Cambridge University Press, 1993), 67.

[27] Kant, *Ak.* XXII, 326; *Opus postumum*, op. cit., 110.

[28] E. Förster in Kant, *Opus postumum*, op.cit., xi, citing *Ak.*XXII, 138-9; 46.

desire' as cause?;[29] *or*: What is the nature of reason such that it can so determine nature?

It is freedom and/or reason – or their *necessary combination*, as Fichte was first to point out – that denaturalises as a precondition of nature taken as an objective of transcendental philosophy. Accordingly, transcendental anti-naturalism has its avatars: Heidegger, for instance, in *On the Essence of Ground* (1929), comparing the dogmatic with the transcendental concept of 'world' in Kant's *Inaugural Dissertation* and first *Critique*, respectively, concludes in strict accordance with the replacement of the dogmatist's things with actions, that 'world never *is*, but *worlds*'.[30] Thus 'there are reasons' why, Heidegger insists, 'nature is apparently missing [from this account], not only nature as an object of natural science, but also nature in an originary sense':[31] Nature is not original, but only appears as a determination of world *for* a form of attention paid to it.

While Heidegger's remains a Copernican transcendentalism, Husserl's 1934 work 'Foundational Investigations of the Phenomenological Origin of the Spatiality of Nature: The Originary Ark, the Earth, Does not Move' reverts to a more Cartesian, or *Archimedean* strategy. In a reprise of the first of the antinomies of pure reason,[32] the essay begins the search for a 'a transcendental theory of natural scientific knowledge'[33] by arguing *against* the 'absurdity – indeed, the absurdity' of naturalistic accounts of the origins of world, and *for* a world that is instead constituted by and for experience. Nature and its causes are not things, but 'elaborated intuitions', and *for experience*, indeed, as its condition, the Earth, even as a body, *does not move*. The paradox is alarming: What began with the Copernican revolution has returned, on transcendental grounds, to Ptolemaic geocentrism, to a 'restitution of a sense of the earth as ground beyond Copernicus', as Merleau-Ponty describes Husserl's undertaking.[34]

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[29] Kant, *Ak*. V, 9n: *Critique of Practical Reason*, trans. L.W. Beck (New York: Macmillan, 1993) and *Ak*.V 177 n., *Critique of Judgment*, op. cit., 16.

[30] Heidegger, 'Kant's Thesis about Being' in M. Heidegger, *Pathmarks*, ed. W. McNeill (Cambridge, Cambridge University Press, 1998), 126.

[31] Ibid., 370 n. 59.

[32] CPR: A426/B454ff.

Such transcendentalisms amplify their Kantian inheritance, and in particular the problem of whether a transcendental naturalism *can supply* a naturalism at all. In light of these latter examples, the answer would clearly be in the negative. For precisely this reason, the post-Kantian fate of the transcendental project reveals something about that project in turn – its susceptibility to antinomy:

THESIS	**ANTITHESIS**
Nature precedes the thinking it spawns	Thinking precedes the Nature it thinks

What is important to note is that the antinomy revolves around the problem of ontological as opposed to conscious priority, just as Schelling's thesis stipulates. A naturalistic ontological solution will therefore think this priority in terms of physical conditionality, while a transcendental anti-naturalist solution will, by contrast, think it in terms of the co-natality of *Ich* and *nicht-Ich* (Fichte), of experience and its ground (Husserl), or of the priority of projection over world (Heidegger). We will return to these solutions below.

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[33] E. Husserl, 'Foundational Investigations of the Phenomenological Origin of the Spatiality of Nature: The Originary Ark, the Earth, Does not Move' (1934) in Maurice Merleau-Ponty, *Husserl at the Limits of Phenomenology*, trans. and ed. Leonard Lawlor and Bettina Bergo (Evanston: Northwestern University Press, 2002), 117-131: 117)

[34] Ibid., 67.

The antinomy or 'natural antithetic' echoes either side of the transition in Kant's own work from dogmatic to transcendental naturalism. For example, the *Universal Natural History* provides reasons for the critical project that are themselves naturalistic:

> If one looks for the cause of impediments, which keep human nature in such a deep debasement, it will be found in the crudeness of the matter into which his intellectual [*geistige*] part is sunk, in the unbending of the fibres and in the sluggishness and immobility of fluids which should obey its stirrings. The nerves and fluids of his brain deliver only gross and unclear concepts [...].[35]

In this light, Kant's post-Copernican attention is directed not away from nature, but towards the nature of 'self-constituting' reason,[36] a 'natural dialectic'. In the above passage, nature clearly conditions thinking; while in the post-Copernican period, the causes of such impediments are found to 'aris[e] from the very nature of our reason'.[37] Thus we have a first element, corresponding to criterion (1) above, in a definition of the dogmatism it is the Copernican project to supplant:

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[35] Kant, *Ak.* I, 356.

[36] 'Transcendental philosophy is the autonomy of ideas, insofar as they form, independently of everything empirical, an unconditioned whole, and reason constitutes itself to the latter as a separate system' (Kant, *Ak.* XXI, 79; *Opus postumum*, op. cit., 246). This is also clear from CPR, where Kant defines critical philosophy as that 'science [which] has to deal [...] only with itself and the problems which arise entirely from within itself, and which are imposed upon it by its own nature, not by the nature of things which are distinct from it' (B23).

D.1 *Any philosophy is dogmatic whose theses can be antinomically disputed.*[38]

It follows from this that, if transcendental theses are susceptible to antinomy, their assertion is dogmatic. Since they are so susceptible, then it cannot be concluded that the Copernican revolution entails the elimination of dogmatism, which is why naturalism remains a problem for transcendental philosophy.

A second element towards a definition of dogmatism may also be drawn from Kant's neuro-anatomical critique of human reason. It is clear from the above passage, as well as from other works of the 1750s and 60s, that the dogmatism at issue during the critical revolution is indeed any metaphysics that might support a *dogmatic naturalism*. On one view, the critique of such naturalism attests to Kant's conversion to the 'experimental method' in the consideration of nature, leaving all a priori reasonings regarding nature blinded by their want of experimentally derived intuitive content. On another, however, it is not empty concepts but the determination of causes that presents the problem. The *Universal Natural History* makes it clear that the causes of conceptual confusion are the materials from which the brain is composed. 'Dogmatism in its pure form is materialism', wrote Hegel.[39] It is not that this must necessarily be wrong, but rather that the determination of the specific causes of contingent things is held to determine reason in turn. That is, if a contingent neural architecture (others are conceivable) is responsible for unclear concepts, then reasoning concerning concepts is duly inflected by such neurology. This is why the first *Critique* stipulates that while the proper means for 'determining the limits of [all] possible knowledge' are a priori, 'when my ignorance is contingent [*zufällig*] it must incite me [...] to a dogmatic enquiry concerning things (objects)'[40] – precisely because it is the principle of the Copernican revolution that it is not objects that determine thought, but rather thought that determines objectality. Fichte makes the point explicitly:

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[37] CPR: A669/B697.

[38] '[The] dogmatic employment [of reason ...] lands us in dogmatic assertions to which other assertions, equally specious, can always be opposed' (CPR: B23).

> It is by the *principle of causality* that dogmatism wishes to explain this nature of intelligence in general, as well as its particular determinations.[41]

This is extremely telling: Not only does it clarify the reasons for Kant's apparent abandonment of the geological, cosmological and mechanical investigations that preoccupied him during his precritical period, but specifies a dimension of dogmatism that, though often overlooked, remains crucial in the struggles of the post-Kantian philosophers against the mechanistic materialism then migrating from the natural sciences into philosophy (hence Fichte's constant complaints against Spinoza).

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[39] G.W.F Hegel, *The Difference Between Fichte's and Schelling's System of Philosophy*, ed. and trans. by H.S. Harris and Walter Cerf (New York: SUNY, 1977), 126.

[40] CPR: A758/B786.

[41] Fichte, *Werke* I, 436; *The Science of Knowledge*, ed. and tr. Peter Heath and John Lachs (Cambridge: Cambridge University Press, 1982), 17.

D.2 *Any philosophy is dogmatic for which (physical) contingencies determine the possibilities of reason*

It should be noted that D.2 adds to C.2 and 3, insofar as the latter stipulate that dogmatism locates the ground of being in things, which D.2 recasts in terms of determinability. Thus, rather than rejecting the world of physically contingent states of affairs, transcendental naturalism will, on the above grounds, argue for the primacy of actions determining by free causes over objects determined in accordance with necessity.

2. THE NECESSARY INDETERMINACY OF BEING

The claim that dogmatism is in fact dogmatic naturalism is supported not only by Kant's overt assertion that dogmatism always entails the assumption of the principle of (efficient) causality in its explanations,[42] that is, of the things (*cosa*) which ground experience, but also by subsequent anti-dogmatist philosophers, chief amongst whom is Fichte. Yet the rejection of causal explanations in metaphysics is only one element of a transcendental naturalism designed to replace it; an additional, *ontological* part of this programme derives from Kant's critique of the primacy of the law of non-contradiction, initially presented in the *New Elucidation* (1755). Proposition I of that work states that 'there is no unique, absolutely first, universal principle of all truths'.[43] The ground of this argument stems from the problems into which basic ontological propositions fall if the law of non-contradiction is held to fulfil the office of such a principle. Drawing on Parmenidean propositions (what is, is; what is not, is not), Kant argues that any truly simple proposition must be either affirmative or negative. If the one, then not the other, and so neither can be universal, since an affirmative proposition cannot be the principle of a negative one, and vice versa. Even the proposition that might be held indirectly to prove the above assertion false, namely, that 'everything of which the opposite is false, is true',[44] is itself an affirmative rather than a negative proposition; just as its antithesis, that is, 'everything of which the opposite is true, is false', is a negative one. Since neither can be derived from its antithesis, neither could have a foundation save in itself, from which it follows that there are two propositions, rather than one unique one. Moreover, from the combination of these two propositions the principle of identity is derived. Kant states this concisely in the following terms: 'whatever is, is, and whatever is not, is not'.[45] The principle of identity is *synthetic* and *necessarily true*, but not a priori, insofar as the principle maintains the difference between being true of reason and being true of things.

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[42] See, for example, Kant's attempts to determine the causes involved in a putative alteration of the Earth's axial rotation (*Ak.* I, 183-191) and of 'The Age of the Earth, physically considered' (*Ak.* I, 193-214). Critically reflecting on this procedure in the Antinomy of pure reason, Kant writes: 'the assertions of the thesis, on the other hand, presuppose, in addition to the empirical mode of explanation employed within the series of appearances, intelligible [*intellektuelle*] beginnings; and to this extent its maxim is complex. But as its essential and distinguishing characteristic is the presupposition of intelligible beginnings, I shall entitle it the dogmatism of pure reason' (CPR A466/B494). Finally, in the *Critique of Judgment*, Kant notes: 'Now as we talk about the systems that try to explain nature as concerns final causes, we must note carefully that the dispute among all of them is dogmatic – i.e., the dispute is about objective principles concerning the possibility of things, whether through causes that act intentially or only those that act unintentionally' (*Ak.* V, 391).

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[43] Kant, *Ak.* I, 388; *Theoretical Philosophy 1755-1770*, trans. and ed. by David Walford and Ralf Meerbote (Cambridge: Cambridge University Press, 1992), 6.

[44] *Ibid.*

[45] Kant, *Ak.* I, 389; *Theoretical Philosophy*, op. cit., 7.

The pertinence of Kant's adoption of this Parmenidean couple[46] consists in its abandonment of a *single* first principle, and its replacement with *two* such principles on the one hand, and their *derived synthesis* in the Principle of Identity on the other. This synthetic aspect is further borne out when we consider the place of existence [*Dasein*] and not-being [*Nichtsein*] in the first *Critique*'s Categories of Modality.[47]

TABLE OF CATEGORIES

I *Of Quantity*:	Unity	Plurality	Totality
II *Of Quality*:	Reality	Negation	Limitation
III *Of Relation*:	Of Inherence and Subsistence	Of Causality and Dependence	Of Community (Reciprocity)
IV *Of Modality*:	Possibility-Impossibility	Existence-Nonexistence	Necessity-Contingency

In the considerations concerning the Table of Categories added in the B-Edition, Kant asserts that Modality and Relation belong to the *dynamical* categories, Quality and Quantity to the *mathematical*. The distinction is significant since the latter are concerned with objects of intuition and the former with their *existence*. In all cases, Kant notes, 'the third category in each class always arises from the combination of the second category with the first'. According to the Categories of Modality, then, 'necessity is just the existence which is given through possibility itself'.[48] This reiterates what the *New Elucidation* had already affirmed: that existence is necessary and non-existence impossible.

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[46] Parmenides DK 28 B2: 'the only ways of inquiry to be acknowledged are: one, that <that which is> is, and it is impossible for it not to be [...] another, that It is not, and must needs not be – this, I tell you, is a path that is utterly indiscernible, for you could not know that which is not, for that is impossible, nor utter it'. I follow Cornford's translation and insertion, *Plato and Parmenides* (London: Routledge and Kegan Paul, 1939), 30-31. Importantly, Parmenides' argumentation proceeds by antitheticals, a procedure that Plato's *Parmenides* repeats and of which Kant's dialectic is a direct heir.

[47] CPR: A80/B106.

Descending from the synthetic, while 'all a priori division of concepts must be made by dichotomy',[49] the dynamical categories operate by *dichotomous antitheses* of concepts. On the scale of systems rather than concepts, the principle of identity explicitly sanctions extra-systemic contradictions between those that are affirmatively and those that are negatively grounded, setting up the problem the Transcendental Dialectic examines between antinomic systems. To these formal concerns, the *New Elucidation*'s protocritical yet still dogmatic argumentation adds a material element: In keeping with its Parmenidean source, Kant draws expressly *ontological* consequences from the principle of identity. It is not the identity of any particular content that is established by the principle, but rather the primary differentiation of being from not-being, and therefore the identity of what is as what is. Both principles are self-identical, insofar as their contraries facilitate no derivation: 'Being is not', that is, does not yield any derivables, not even nothing.[50]

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[48] Ibid., B110-111.

[49] Ibid., B110.

[50] Kant expressly disputes that the product of a contradiction is nothing: '"+ A – A = 0", [or i]n other words, affirming and negating the same thing is impossible or [*sive*] nothing' is true iff 'you invest the sign of the negative concept with the power of cancelling [*vim tollat*] the affirmative concept' (*Ak.* I, 390; 1992: 9). This power of cancellation, however, is precisely what the principle of contradiction presupposes, but that the principle of identity denies as active between assertions and negations. With no such power, nothing cannot derive from the combination of something with something that is not. The power of cancellation operates only between identicals, so that Kant rephrases the principle of identity thus: '*whatever is not not, is*', where the two 'nots' cancel each other out (*Ak.* I, 389; 1992: 8). In effect, Kant is arguing that the impossible is not nothing, but is impossible.

Accordingly, 'whatever is *not not*, *is*'[51] avoids the trap of asserting the being of what is not, or of asserting the being of 'not-being' (Parmenides' 'way of opinion').

Ontologically, the important consequence of both this Parmenidean and modal argumentation is that *all predication is of what is* and *no predication can be of what is not*. Being is not therefore a predicate, as the critical Kant will assert,[52] but rather that of which all predicates are predicates, the referent or *Bedeutung* of all predication, regardless of its *Sinn*.[53] In other words, no information is or can be given as to what is: all that is specified concerning being is that it is *impossible* that it is not. This modal account is an important first element of the ontology transcendental philosophy presupposes but cannot own without reverting to dogmatism. The elucidation of this ontology will therefore demonstrate that transcendentalism offers a new species of dogmatism in philosophy.

We are not alone in affirming an ontology underlying the transcendental project. For example, Heidegger notes in his address to 'Kant's Thesis About Being', that the thesis at issue does not affirm that beings or *things* are, and thus does not even inform us as to whether being is comprised solely of beings. All Kant's thesis tells us is that 'being is obviously not a real predicate'. Heidegger identifies this as the 'negative thesis about being'.[54] The 'positive thesis', by contrast, characterises being as

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[51] Kant, *Ak.* I, 389; *Theoretical Philosophy*, op. cit., 8.

[52] CPR: A598/B626.

[53] This elicits a dimension often overlooked in the Fregean account of the *Bedeutungen* of propositions. In 'On *Sinn* and *Bedeutung*' (1892), Frege writes 'all true sentences have the same *Bedeutung*' (in Beaney [ed.] *The Frege Reader* [Oxford: Blackwell, 2000], 159), namely, as the 'Comments' on that essay (1892) make clear, 'the True'. Just as Kant claims all predication is of being, so Frege argues that since all propositions aim at the True, 'thought and Being are the same' (ibid., 174). Finally, in 'Thought' (1919), Frege generalizes this account to the classical Platonic triumvirate: 'Just as "beautiful" points the way for aesthetics and "good" for ethics, so do words like "true" for logic' (ibid., 325).

> the positing of a thing, of certain determinations as existing in themselves. [55]

From this we gain a sense of the dogmatism inherent in ontological determination, while at the same time the properly critical element is foregrounded. In this late analysis of Kant's ontology,[56] Heidegger takes the entirety of the above proposition as constituting the 'positive assertion', despite its containing two distinct – and perhaps antithetical – sub-theses: First, being is identified with *positing*; second, positing is identified not only with determination, but with determinations 'as *existing in themselves*'. That the first sub-thesis fulfils the critical requirements of this ontology is evident from the *positing*: It is not that things are in this or that way that makes the proposition a transcendental one, but the *positing* of things as this or that mode of existence (*agit, facit, operatur, dirigit*).[57] That this is so will become especially evident not only in the *Selbstsetzungslehre* and the 'Ether deductions' of the *Opus postumum*, but also in

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[54] M. Heidegger 'Kant's thesis about being', op. cit.

[55] CPR: A598/B626.

[56] Heidegger's first published examination of Kant's ontology is *Kant and the Problem of Metaphysics* (1929, trans. by R. Taft, Bloomington: Indiana University Press, 1997), an analysis to which he returns in 'Kant's Thesis about Being' (1961) and *What is a Thing?* (1962, trans. by W. B. Barton and V. Deutsch, Chicago: Regnery, 1968).

[57] 'Nature *causes* (*agit*). Man *does* (*facit*). The rational subject acting with consciousness of purpose *operates* (*operatur*). An intelligent cause, not accessible to the senses, *directs* (*dirigit*).' (Kant, *Ak.* XXI,18; *Opus postumum*, 224-5)

Kant's heirs' (especially Fichte's) accounts of the constitutive or determining role of the *act* of positing with regard to the *facts* so posited. Against these Copernican credentials, the second sub-thesis automatically triggers accusations of dogmatism, at least insofar as the term applies to all metaphysics that takes as its object the determination of things 'existing in themselves'.

The question then concerns the relation between the two sub-theses; whether, that is, the first sub-thesis's identification of being with positing is identical with or different from the second sub-thesis's identification of positing and determination. If it is, then being is determinable *in itself* by positing; if not, then the being of the positing is not equivalent to the determination so posited. Note that from the thesis that being is what all predication is of, it follows that all predication must be the determination of being. Meanwhile, positing posits *determinations* as 'existing in themselves'. It does not, that is, determine anything *that* exists in itself, but *makes* determinations exist in themselves. In effect, this is what a second constituent of Kant's modal ontology stipulates: 'I have been reproached', Kant writes,

> for defining the power of desire as the power of being the cause, through one's presentations, of the actuality of the objects of these presentations [*die Definition des Begehrungsvermögens als Vermögens, durch seine Vorstellungen Ursache von der Wirklichkeit der Gegenstände dieser Vorstellungen zu sein*].[58]

Just as the thesis that all predication is of what is critically buttresses the *New Elucidation*'s modal proposition concerning being, viz., that it is impossible that it is not, so the thesis that being is a positing of determinations existing in themselves turns into an account of the determining causes of *actuality*. From this, we derive an initial statement of Kant's ontology:

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[58] Kant, *Ak*. V, 177 n., citing *Ak*.V, 9 n.

Being is necessarily indeterminate if actuality is determinable.

Or, in practical terms:

The necessity of contingency is necessary for the determinability of the actual.

It is precisely at this juncture that a comment Hegel makes in the *Difference Between Fichte's and Schelling's System of Philosophy* with regard to Kant's table of categories acquires significance as regards the investigation of a transcendental dogmatism. The framing of Hegel's comment is, in this regard, especially instructive. In Kant's deduction,

> The identity of subject and object is limited to twelve acts of pure thought [*reine Denkthätigkeiten*] – or rather to nine only, for modality really determines nothing objectively; the nonidentity of subject and object essentially pertains to it.[59]

Firstly, that the categories are to fulfil the 'identity of subject and object', that is, satisfy the speculative proposition, may seem like Hegel's own imposition. Yet it is Kant who stipulates that, although the categories in general constitute 'all original pure concepts of synthesis that the understanding contains within itself *a priori*',[60] the dynamical categories are in addition 'concerned with existence'.[61]

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[59] Hegel, *The Difference Between Fichte's and Schelling's System of Philosophy*, op. cit., 80.

[60] CPR: A80/B104.

[61] Ibid., B110.

With what existence? Categories or acts of thought that had no such effects could satisfy no subject-object or concept-intuition identity. In other words, although the categories cannot determine a priori the existence and specific differentia of particular matters, the categories of modality are nonetheless held to posit 'determinations existing in themselves'. Yet we have seen how the transcendental philosophy demonstrates the necessity attaching to existence as the ground for its determination, which extends, in the form of practical reason, to the determination of actuality (*Wirklichkeit*) as such. Why then does Hegel expressly deny this determination, asserting instead that Kant's categories of modality 'determine nothing objectively' and that 'the nonidentity of subject and object essentially pertain to it'?

The criticism hinges on the claim that the categories of modality, *qua* categories of the understanding, are determining only of forms of thought, and thus provide a merely subjective determination of actuality. Hence it can be denied that anything is thereby determined *objectively*. Further, this is necessarily the case insofar as these categories are premised on the non-identity of subject and object, which the ontology supporting the Copernican revolution presupposes: The determination of reason is simply not the determination of things. In other words, if it is through the *positing* that 'determinations exist in themselves', then these determinations have existence only consequent upon their positing. Since, at the same time, no determinations can be made of things-in-themselves, then the categories of modality, especially those of existence and non-existence, 'determine nothing objectively'.

While possessing no capacity for objective determination, the categories do nevertheless determine the *only possible actions* that speculative reason can perform, *regardless of whether such performances obtain* or are *actualised*. As we have seen, the transition to *actuality* is not an element of speculative reason, but a power only practical reason can effect. To effect is ultimately to determine actuality in accordance with freedom as the only *unconditioned* and *necessary* cause.[62] Accordingly, since it is a necessary presupposition of the Copernican revolution that being is determinable but not determining, being so determined is actuality: Subjectivity remains impotent in being, but powerful in actuality.[63] The reason for this is the Copernican thesis that objects are determinable for reason while reason is not determinable by objects, which entails that objective determination – that is, determination of existents anterior to determination – is impossible. Neither existence nor any of the other categories can therefore be extended to objects as such, but only to actuality, by positing. If being has no 'objective' side, in what then does nature consist? Grasping the implications, it is Fichte who is Kant's true heir, exactly as he claimed, when, in the *Science of Knowledge*, he characterises the object for the subject as the *nicht-Ich*, finally subjectivising all nature. 'Is it true' then, as Georges Cuvier asked his erstwhile professor of comparative anatomy, Carl Friedrich Kielmeyer, 'as the Kantians seem to maintain', that

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[62] Ibid., A418-9/B446-7.

[63] Kant was never as clear as Fichte about this: 'if the Science of Knowledge should be asked, how then, indeed, are things-in-themselves constituted, it could offer no other answer save, as we are to make them. [… H]ence we can never speak of the existence of an object without a subject' (Fichte, *Werke* I: 286; *Science of Knowledge*: 252).

> external nature [...] may be deduced from *a priori* principles, i.e., those that are present prior to all experience [...] – in short, from the nature of our minds [?][64]

The problem is excellently posed: if there are principles prior to all experience, then external nature emerges only *after* its subjective determination. Thus Hegel's intervention clarifies the ontology presupposed by transcendentalism, and articulates its dichotomous structure: Nature cannot be objectively but only subjectively determined; therefore objective nature is of necessity objectively indeterminate in itself. By contrast, Cuvier's problem suggests that it is only if the deduction of external nature is *not* the deduction of external nature that a subject-object dichotomy is conceivable. Rather than the subject-object pair, the Cuvier question (so like Jacobi's challenge to Kant)[65] works out the implications of the priority of thinking over being asserted by transcendental naturalism. Both sets of concerns, however, present an antinomy of transcendental naturalism: The opposability of transcendental to dogmatic naturalism, on the one hand, and the priority of thinking over being, on the other. Since these theses are opposable, transcendental ontology is dogmatic by criterion (1), above. Nevertheless, the core problem of the identity of reason and nature remains open. As for all dogmatisms, therefore, transcendentalism is a naturalism concerned not with the determination of mind by nature, but with that of nature by free causes supported by necessary contingency. We will now examine both the Hegelian and the Cuverian antinomies of transcendental naturalism in turn.

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[64] C. F. Kielmeyer, *Natur und Kraft. Gesammelte Schriften*, ed. F.H. Köhler (Berlin: Kieper, 1938), 236.

[65] 'The transcendental idealist [...] must have the courage to assert the strongest idealism that has ever been taught, and not even to fear the charge of speculative egoism' (F.H. Jacobi, 'Realism and Idealism', in B.Sassen (ed.), *Kant's Early Critics: the Empiricist Critique of the Theoretical Philosophy* (Cambridge: Cambridge University Press, 2000), 175.

3. THE ANTINOMIES OF TRANSCENDENTAL NATURALISM

I. THE HEGELIAN ANTINOMY

Hegel presents an antinomy of transcendental naturalism in *The Difference between Fichte's and Schelling's System of Philosophy*, through Fichte's transcendental deduction of nature. The deduction is transcendental insofar as its starting point is the absolute *Ich*'s oppositing of nature to the empirical *Ich*, or the 'self-limitation of free activity'.[66] In other words, the differential between the absolute and the finite *Ich*s, or the degree to which the latter approximates the absolute identity of the former, provides the necessary conditions for thinking nature in accordance with the programme of the *Science of Knowledge*. Hegel[67] cites Fichte postulating that nature

> is characterised by its antithesis to freedom. 'Nature determines itself' must [accordingly] be translated into 'nature *is* determined by its essence, *formaliter*, to determine itself'; nature can never be indeterminate, as a free being can very well be; and *materialiter* too, nature is determined just in one way and no other; unlike a free being, it does not have the choice between a certain determination and its opposite.[68]

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[66] Hegel, *The Difference Between Fichte's and Schelling's System of Philosophy*, op. cit., 136.

[67] Ibid., 137-8.

[68] Fichte, *Werke* IV, 112-3; *The System of Ethics*, op. cit., 108.

Fichte here makes explicit the necessary indeterminacy of being that is merely implicit in Kant, and applies this to the production of a nature as formal and material *being-determined*. Accordingly, nature *is* formal and material determinability. The determinable is never possibly not-determined, so that the empirical *Ich* can never not be determined in turn by determinacies it posits as its own limits. Empirical or living self-consciousness therefore sets itself as its task an unlimited striving to overcome these limits and increase the indeterminacy of or in being.

Because striving takes *time*, and because it must be *unlimited* if it is a free striving rather than a determined and therefore merely natural drive, Hegel complains that rather than resolving the antithesis of nature and freedom, Fichte replaces it with an antithesis between 'a limited present and an infinity extraneous to it'.[69] Replacing an 'absolute object' with an absolute subject merely produces, notes Hegel, a 'dogmatic idealism';[70] antinomising it by way of a living self-consciousness generates no solution, therefore, to the antithesis of nature and freedom, but transposes the ground of this antithesis outside itself, a subjectivity as objective and absolute as the object of dogmatic materialisms. This is borne out by Fichte's concept of 'drive', drawn from physiological researches into the nature of living beings. Thus, he writes:

> The highest exhibition of intelligence outside itself, in nature, is the drive.[71]

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[69] Hegel, *The Difference Between Fichte's and Schelling's System of Philosophy*, op. cit., 139.

[70] Ibid., 127.

[71] Fichte, *Werke* XI, 363.

Positing the drive as the highest exhibition of intelligence in nature – rather than, for example, the closest nature gets to exhibiting intelligence – therefore clearly exhibits transcendental dogmatism's maintenance of the dichotomy, while at the same time demonstrating the site of the struggle over determinacy versus purpose, between physics and ideality. Fichte reconstructs ethics as the direct conflict of matter and ideality, as the infinitely unresolvable struggle of embodied determinacy for absolute indetermination, and thus posits 'Nature [as] something essentially determined and lifeless'.[72] Nothing demonstrates more concretely this antinomy of transcendental naturalism than the 'shock of the objective world',[73] or nature determined as absolute object.

Hegel's own solution follows from a view of Kant's transcendentalism he shares with Schelling. That is, when reason takes itself as its own object, transcendental philosophy is the investigation of the nature proper to reason. Accordingly, the Hegelian solution to the antinomy concerns the latter's provocation of the need of philosophy to overcome dichotomy. Yet Reason *by its own nature* is driven to maintain the dichotomy in and as its identity with the Absolute. The 'speculative proposition' that satisfies this need always and necessarily asserts identity with the Absolute (Frege's Hegelianism), but never equivalence to it, so that the 'identity of identity and dichotomy' resolves the antinomy of finitude and extrinsic infinity.

Therefore it is a condition of Reason's nature that it is *both* unconditioned by the dichotomy of freedom and nature, *and* maintains it. This is an important solution in three ways. Firstly, Hegel's is a species of *naturalised epistemogenesis* in accordance, as both the Greater *Logic* and the *Phenomenology* show, with living reason. Secondly, it is a largely forgotten solution to a problem that remains unresolved: namely, the relation of reason to nature, on the one hand, given the nature of reason on the other. Speculative idealism, in this regard, shares its concerns with philosophical inquiries regarding naturalised epistemology, neurophilosophy, and dialethism,[74] amongst others. Thirdly, Hegel's proposals do not resolve but amplify antinomy, making his a hyperdogmatism that remains undetermined with regard to nature or reason.

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[72] Hegel, *The Difference Between Fichte's and Schelling's System of Philosophy*, op. cit., 139.

[73] Schelling, *Werke* I, 337.

II. THE CUVERIAN ANTINOMY

Let us then return to the indeterminacy of being thesis common to transcendentalism in general. If what is at stake, for Fichte, is the relative determinability of the *Ich* and its opposited 'nature'; and if, for Hegel, it is the determinability of all dichotomy by Reason's nature that matters, then transcendental philosophy has, in the 'positing' principle considered above, a naturalistic means for accounting for determination. We will first investigate this before pursuing the Cuverian antinomy of transcendental naturalism.

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[74] For naturalised epistemology, see W. V. O. Quine 'Epistemology naturalized' in *Ontological Relativity and Other Essays* (New York: Columbia University Press, 1969). For neurophilosophy, see P. M. Churchland, *Neurophilosophy* (Cambridge: MIT, 1986), 482: 'so it is that the brain investigates the brain, theorizing about what brains do when they theorize'. Graham Priest, in *Beyond the Limits of Thought* (Oxford: Oxford University Press, 2002), defines dialethism as a transcendental investigation into the nature of true contradictions.

Positing is an *act*, the actualisation of a power in the world, subject to resistances and limitations. If nature or being is able to impose resistances and limitations upon subjectivity, philosophy returns to pre-Copernican dogmatic naturalism. Thus the antidogmatic critique of causation consists in a refutation of its capacity to determine reason. To be so capable, a thing or cause (*causa*) would have to be ascribed powers; without a thing-in-itself as their possessor or vehicle, there remains only a set of powers. If a powers ontology is generalised, and if determination is a power of reason, then reason acts in one and the same world as do other powers. As Warnke notes,

> *Actions* are conceived by traditional metaphysics as the *expressions of things.* [Transcendentalism] stands this common view on its head [and] determines *things as expressions of actions, objects* as products of *relations*, *being* as a reified, objectified *doing*, exhausted in its product.[75]

Considered along these lines, the powers or *Vermögen* of the first *Critique*, held responsible as they are for the existence or actuality of determinations, constitute a step towards supplanting bodies with forces in fundamental physics. This, for example, is how the medical scientist Andreas Röschlaub read Fichte, rendering the latter capable of a philosophy of medicine,[76] and how the natural historian Carl Friedrich Kielmeyer reports the substance of Kant's Copernican revolution to Cuvier:

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[75] C. Warnke, 'Schellings Idee und Theorie des Organismus und der Paradigmawechsel der Biologie um die Wende zum 19. Jahrhundert' in *Jarhrbuch für Geschichte und Theorie der Biologie* 5, 1998: 187-234: 200.

[76] Developing the theme of Idealist influences in their contemporaneous sciences, Tsouyopoulos (1978: 90) cites Röschlaub's assessment of transcendental naturalism from the latter's *Magazine for the Improvement of Medicine* vol.8, part 3 (1805): 473: 'The philosophemes of a Kant, a Fichte and a Schelling have given the labours of the physician and the natural scientist a manifest and proper direction in our own day, just as the philosophemes of Empedocles, Democritus, Heraclitus and Aristotle did earlier'.

> This experiment of Kant's is astute, and it recommends itself in that in this way, the necessary, the universal and the certain in our knowledge remains subjective in our mind, while the contingent and the particular will be attributed to objective nature, which is unknown in itself. [77]

As for Kant, then, although he allows no naïve knowledge of nature 'in itself', Kielmeyer's ontology is modal, consisting of what necessarily and what contingently is. Objective nature is not nature-as-objects but as *matter* and, as matter, is subject to further determination by forces. Here Kielmeyer joins Hegel in asserting that Kant does not go far enough (although for different reasons). For to turn matter, as the *Metaphysical Foundations of Natural Science* attempts to, solely into the product of attractive and repulsive forces, would have satisfied naturalistic demands on the first *Critique* without sacrificing transcendentalism. According to Kielmeyer, however,

> Kant neither achieved this, and nor, although he ought to, would he want to; the proof is still wanting that all qualititative differences in matter are simply and immediately differences in the quantitative relations between the attractive and repulsive forces. I would very much like to see this proof undertaken and the qualities of matter explained from these two forces without the intervention of a *tertium*, whether this be God, atoms, or some third force.[78]

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77. Kielmeyer, *Natur und Kraft*, op. cit., 243.

78. Ibid., 245.

So Kielmeyer demands that the powers hypothesis become an objective ontology. What we are left with now, however, are two accounts of transcendental naturalism: in one, the necessary indeterminacy of being is maintained at the cost of anything other than the subjective determination of actuality; in the other, forces supply a unified and speculative ontogenetic account of the material of knowledge, or objectivity. However, to complete this as an account of transcendental naturalism, an additional element must be added to the powers thesis: namely, the ontological thesis regarding the necessary indeterminacy – and therefore determinability – of being. It is with this in mind that we turn finally to the Cuverian Antinomy.

The Cuverian Antinomy is also Schelling's, and concerns priority and posteriority in relations of determination. Where Cuvier asks whether external nature can be deduced according to principles of mind prior to experience, Schelling asserts that being precedes thinking and not the converse. Since the implicit antinomic contrary in Cuvier's question raises precisely this prospect, we will restate the substance of Schelling's account of it:

THESIS	**ANTITHESIS**
Nature precedes the thinking it spawns	Thinking precedes the Nature it thinks

A transcendental naturalism based on powers may be held to supplant the problem of logical and real priority with that of reciprocity – powers are reciprocally, rather than mechanically or efficiently, determined. Since, however, reciprocity is simply a time-cancelling version of Husserl's co-natality thesis, this strand of transcendental naturalism is clearly dogmatic, in that it asserts a perfected equilibrium or static eternity of forces against the time-based antithesis of that view, as stated in the above antinomy.

If being is necessarily indeterminate, then this indeterminacy must precede its determination, since the converse would entail that being is determinate in advance of its determination, thus defeating the transcendental gambit from the outset. From this, once Kielmeyer's Kant-derived powers ontology is added to it, it follows *not* that being is inert and only acted upon by powers-possessors – since this would amount to a dogmatic reversion to things in themselves – but rather, that being itself is determinability in accordance with powers. It is this, then, that gives Schelling his conviction concerning the priority of being over thinking, and Cuvier his scepticism concerning the priority of thinking over nature: Being is therefore potentiality for determinate being, *Seynkönnen*, rather than the object over which transcendental subjects struggle.

The Schelling-Cuvier antinomy thus results, its transcendental condition-giving notwithstanding, in a dogmatic naturalism premised on the multiple determinability of being. Finally, therefore, transcendental naturalism is either a dogmatic naturalism of the Cuvier-Schelling-Kielmeyer type – that is, simply naturalism – or it is not a naturalism at all, like those of Fichte, Heidegger and Husserl. Copernicanism does not eliminate dogmatism, but continues it in new forms – a dogmatism of appearance as opposed to that of essence, as has been recently made crystal clear by Béatrice Longuenesse:

> It is a fact that we live in a world of things. Still, we must understand that these things are our fact, our doing – not in the sense that a philosophy of praxis would give to this statement [...] but in the sense of a metaphysical account of the world as constituted by a process of thinking.[79]

Just as this dogmatism of appearances resulted from Kant's experiment in thought, it remains true of transcendentalism now, and prompts a challenge to those who pursue transcendental philosophy – to demonstrate that theirs is not simply a dogmatic anti-naturalism.

In conclusion, the ontology of powers, with its modal determinations (necessity, contingency, possibility, actuality), can only be regarded as a reducibly metaphysical problem if the physical dimensions of its actuality are ignored. Field ontology entered physics and philosophy at the same time, although its philosophical pedigree is perhaps longer, stretching back at least to Plato's *Sophist* and the topics and interlocutors addressed therein. Accordingly, I will conclude by drawing out some implications of powers ontologies.

Firstly, powers necessarily involve modal concepts. Against Hegel's denial that the Categories of Modality determine anything objective, objectality is nothing other than a set of potentials for actualisation, as Plato insisted. Powers make contingency into an ontology, a metaphysics and a physics.

Secondly, and again emphasising contingency, powers necessarily involve time determination, not as the transcendental form of inner sense, but, as Johann Heinrich Lambert noted, as determining change: 'If changes are real, then time is real [...]. If time is unreal, then no change can be real'.[80] Of course, this does not mean that the *nature* of time is given in advance as linear, as again physicists remind us.

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[79] Béatrice Longuenesse, *Hegel's Critique of Metaphysics* (Cambridge: Cambridge University Press, 2007), 6.

Thirdly, powers do constitute a dogmatically assertible transcendental field insofar as they are both necessary to determination and in and of themselves indeterminate.

Fourthly and finally, the prospects for dogmatism are raised wherever the certainties of transcendental reflection are revealed not as another species of reason, but rather as dogmatism parochialised:

Being is necessarily indeterminate if actuality is determinable.

Or, in practical terms:

The necessity of contingency is necessary for the determinability of the actual.

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[80] Lambert to Kant, October 13th 1770, in Kant *Ak.* X, 107.

A Throw of the Quantum Dice Will Never Abolish the Copernican Revolution[1]

Gabriel Catren

Illustrations by Cristian Turdera

I. THE PTOLEMAIC REDUCTION OF QUANTUM MECHANICS

One of Kant's seminal contributions to modern science is the injunction according to which the Copernican reflection on the spatiotemporal localisation of the subject of science has to be radicalised into an inquiry regarding its transcendental localisation. If the Copernican revolution allowed the development of a rigorous scientific astronomy delivered of the limits imposed by the contingent localisation of the earth, Kant's critique opens up for the first time the possibility of performing a transcendental deanthropomorphisation of science. Instead of imposing juridical limits on science, such a transcendental self-consciousness should allow a progressive emancipation of the scientific comprehension of nature from the limitations imposed by the a priori structures of scientific knowledge (such as human physiology, categories of human understanding, scales accessible to human experience, technological possibilities, imaginary and ideological representations, limitations imposed by the anthropic principle, particular linguistic structures, sociological, political and economical preconditions of research, and so on).

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[1] I would like to thank Damian Veal for his insightful criticisms and comments on a first draft of the manuscript. Of course, I take sole responsibility for the final result.

Alas, instead of exponentiating to a transcendental power the projective dehumanisation of science, most proponents of the critical philosophy instead attempted to stitch up the narcissistic wound opened by the Copernican revolution. Even Kant, far from pushing the transcendental revolution to its ultimate, inhuman denouement, instead used his critique to demonstrate that science would never be able to sublate its humanity. In this way, the required transcendental reflection on the preconditions of scientific experience did not lead to the announced transcendental Copernican revolution. On the contrary, the ultimate sense of the Copernican revolution was, as Meillassoux clearly shows in *After Finitude*,[2] completely distorted. A narcissistic reaction aims to counteract the Copernican decentring of the planet earth – and tries to heal what Freud called the 'cosmological humiliation'– by re-situating human existence on a transcendental 'unmoving *Ur*-earth' (Husserl). In the last instance, it does not matter whether humanity dwells on an orbiting earth; the transcendental ego is the ultimate centred source of the objective consistency that science naïvely believes itself to discover in nature.

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[2] See Chapter Five, 'Ptolemy's Revenge', of Q. Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. R. Brassier (London: Continuum, 2008).

In particular, quantum mechanics is a privileged target of what Meillassoux has notably called the transcendental 'Ptolemaic counter-revolution'. Indeed, many interpretations of quantum mechanics could be translated – to differing extents – in transcendental terms. In what follows, we will use the term 'transcendental' to characterise any interpretation according to which quantum mechanics can be considered a scientific formalisation of certain impassable limits to the knowledge of physical nature. We could say that a transcendental interpretation of quantum mechanics states that the conditions of possibility of scientific experience restrict the amount of accessible information that can be predicted of (or extracted from) physical systems.[3] This transcendental interpretative framework could thus be summarised in the following terms:

> [...] it now proves quite easy to justify transcendentally a large part of the structure of Quantum Mechanics. One can for instance derive a crucial part of the quantum formalism from assumptions about the limits of accessible experimental information; or from assumptions about contextuality of phenomena [...] This means that one is no longer compelled to understand quantum theories as a representation of the 'external', 'independent' world, with all the strangeness and paradoxes that are associated with such a representation. Rather, quantum theories can very naturally be understood

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[3] The forthcoming book *Constituting Objectivity: Transcendental Approaches of Modern Physics,* M. Bitbol, P. Kerszberg and J. Petitot (eds) The Western Ontario Series in the Philosophy of Science, Vol. 74 (Berlin: Springer Verlag, forthcoming February 2009) is entirely devoted to the relationship between transcendental philosophy and modern physics. Some of the most interesting and far-reaching transcendental analysis of the quantum formalism can be found in the works of S. Y. Auyang, M. Bitbol, E. Cassirer, B. Falkenburg, G. Hermann and P. Mittelstaedt. We address the reader to the aforementioned work for all the relevant references.

as expressing the constraints and bounds of (experimental) knowledge. This is very much in the spirit of Kant, if not in the letter of his original texts.[4]

In classical mechanics, the exact position and the exact momentum (roughly speaking, the velocity) of a particle can be simultaneously predicted for all times from a given set of initial conditions. In quantum mechanics, on the contrary, we cannot predict the momentum of a particle characterised by a well-defined position (and vice versa). More generally, Heisenberg's uncertainty principle states that certain pairs of variables can be simultaneously predicted only up to some inversely-correlated uncertainties. It is therefore tempting to try to localise the transcendental a priori structures (instrumental, pragmatic, cognitive, linguistic, etc.) that are at the origin of this supposed limitation. According to this 'Kantian' strategy, quantum mechanics seems to show that it is impossible to go through the 'transcendental' looking-glass towards a hypothetical 'nature-in-itself' inhabited by systems with intrinsic properties. Rather, quantum mechanics seems to provide a mathematical account of the correlations between the 'observed' systems and their (not necessarily human) 'observers'.[5]

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[4] M. Bitbol et al., *Introduction to Constituting Objectivity: Transcendental Approaches of Modern Physics*, op.cit, 17-18.

[5] It is worth remarking that the thesis according to which quantum mechanics only describes correlations between physical systems does not necessarily entail that there exist impassable limits to the knowledge of nature. For example, the so-called 'relational' interpretations of quantum mechanics maintain that the notion of an isolated system with 'absolute' properties is meaningless. We could say that this strategy amounts – in a Hegelian style – to avoiding anthropomorphic interpretations of the quantum 'limitations' by ontologizing the correlations and doing away with any phantomatic 'thing-in-itself'. Hence, relational quantum mechanics cannot be considered a transcendental interpretation of the theory. These relational interpretations could be summarised by means of the following claims:

In this way, physicists seem forced to accept that they cannot abstract from the *constitutive* role that their measuring instruments play in experimental inquiry. This means that quantum systems seem to be inherently *contextual*, that is to say we cannot separate their properties from the experimental contexts that constitute them as systems. The quantum realm that underlies our everyday object-oriented macroscopic experience is a kind of uncanny domain peopled with weird, shadowy entities that assume definite properties only when they are observed, that 'decide' to behave like waves or particles depending on the experimental setup, and so on. In Kantian terms, we could say that quantum systems seem to conform to our faculty of experimental intuition. If classical mechanics is supposed to rely on a classical ontology of observer-independent physical objects endowed with intrinsic objective properties, quantum formalism seems to forbid any ontological extrapolation in terms of decontextualised physical objects. Employing Popper's characterisation of the so-called Copenhagen interpretation of quantum mechanics, we might say 'that quantum mechanics does not represent [physical systems], but rather our knowledge, our observations, or our consciousness, of [physical systems]'.[6] Instead of pushing our comprehension of nature's rational structure further than

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'Properties of quantum systems have no absolute meaning. Rather, they must be always characterised with respect to other physical systems. Correlations between the properties of quantum systems are more basic that the properties themselves.' C. Rovelli, 'Relational quantum mechanics', *International Journal of Theoretical Physics* 35, 1996, 1675. See also F. Laudisa & C. Rovelli, 'Relational Quantum Mechanics', in Edward N. Zalta (ed.) *The Stanford Encyclopedia of Philosophy* (Fall 2008 Edition), at http://plato.stanford.edu/archives/fall2008/entries/qmrelational/.

[6] K. Popper, *Quantum Theory and the Schism in Physics* (Cambridge: Unwin Hyman, 1982), 35. (Popper writes of 'particles' rather than 'physical systems').

classical mechanics, quantum physics forces us to withdraw from noumenal nature and to place ourselves at the centre of a transcendentally-constituted experience. In doing so, quantum mechanics, far from positively extending physical knowledge, only allows us to recognise the transcendental illusions of classical mechanics and to set out the juridical limits of the precritical dream.

In this article, we will argue that in order to construct a satisfactory interpretation of the quantum formalism it might be necessary to advocate what we could call a 'precritical realism', that is to say, to put aside any kind of transcendental considerations. Far from denying the importance and the necessity of a transcendental reflection – and of the consequent transcendental deanthropomorphisation of scientific knowledge – we only mean to suggest that the theoretical scope of quantum mechanics might be strictly physical rather than transcendental. If this were indeed the case, then we would have to accept that, from the point of view of a transcendental critique of scientific knowledge, quantum mechanics is just as 'precritical' as classical mechanics.

When confronted with the paradoxes of quantum mechanics, Einstein adopted what we could call a 'naïve', 'precritical' attitude. Indeed, he was not willing to accept 'transcendental' limits to physical knowledge; he continued to long for a physical theory capable of describing physical reality in *realistic* (i.e. observer-independent) and *complete* terms. Regarding the supposed limitations imposed by Heisenberg's uncertainty principle, Einstein expected the advance of physics to lead to a more complete theory that would describe *all* the 'elements of physical reality' – that is, both the position and the momentum of quantum systems.[7] In this article we claim that Einstein was completely right in demanding, in spite of the critical attempts to interpret quantum mechanics in a 'transcendental' framework, that a physical theory has to be 'realistic' and 'complete'. According to the position that we will advocate, he only failed in not recognizing that quantum mechanics itself provides, *unlike classical mechanics*, a 'realistic' and 'complete' description of physical reality. The main objective of this article is to support this last claim in purely conceptual terms.[8]

II. SPECULATIVE PHYSICS

Before presenting such a 'precritical' interpretation of the quantum formalism, we want to make some remarks concerning the motivations and the methodology of this ongoing project. We could say that the discussion that we shall propose belongs to a particular mode of physical thinking that we shall call, in the wake of Schelling, *speculative physics*. We shall now give a succinct description of what we mean by this term.

In general, the substitution of one physical theory by another one is not a consequence of the mathematical inconsistency of the former. In particular, both classical and quantum mechanics are mathematically-consistent theories.

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[7] A. Einstein, B. Podolsky and N. Rosen, 'Can Quantum-Mechanical Description of Physical Reality be Considered Complete?', *Phys. Rev.* 47, 1935, 777-80.

[8] More technical justifications of the proposed arguments, as well as an extended bibliography, can be found in the following articles: G. Catren, 'On Classical and Quantum Objectivity', *Foundations of Physics* Vol. 38, No. 5, 2008, 470-87 (available from http://philsci-archive.pitt.edu/archive/00004298/); G. Catren, 'Can Classical Description of Physical Reality be Considered Complete?', in M. Bitbol, P. Kerszberg and J. Petitot (eds.), *Constituting Objectivity: Transcendental Approaches of Modern Physics*, op. cit. (available from http://philsciarchive.pitt.edu/archive/00004295/).

Hence, mathematical constraints do not seem to suffice for explaining the a priori necessity of physical theories. The heuristic postulate of speculative physics asserts that physical theories are endowed with a rational necessity that stems *neither* from their mathematical consistency, *nor* from the transcendental preconditions of human experience. If physics formulates laws that describe the consistency of natural phenomena, speculative physics aims to understand why *these* particular laws or theories, instead of others, describe nature. In other words, speculative physics aims to raise what seem to be empirical (or contingent) laws of nature to the status of rational necessities. In order to do so, speculative physics has to establish demarcation lines between mathematical necessity, transcendental structures, and other kinds of a priori principles. Using Kantian rhetoric, we could say that we apply the term 'speculative' to all knowledge that is not so much occupied with discovering the laws of physical nature as with ascertaining their a priori (neither mathematical nor transcendental) rational necessity. In other words, speculative physics aims to reduce as far as possible the contingency of natural laws, that is, to deduce their empirical validity from a priori principles. For the fact that empirical experience provides very important clues for the seeking of more satisfactory physical theories, for their effective construction and for their a posteriori (provisional) corroboration, does not necessarily mean that it is impossible to unveil retrospectively their own rational necessity. As Schelling writes, 'it is *not, therefore*, that WE KNOW Nature as a priori, but Nature *IS* a priori [...] But if Nature *is* a priori, then it must be possible to recognise it as something that is a priori [...]'.[9] Such a recognition is the main task of speculative physics. Even if the hypothetical limits of human understanding prevented scientists from absolving physics of its experimental basis in empirical experience, this fact cannot be used as a proof of the *essentially* contingent character of the laws of nature. As Hegel clearly states, 'the course of a science's origin and the preliminaries of its construction are one thing, while the science itself is another. In the latter, the former can no longer appear as the foundation of the science; here, the foundation must be the necessity of the Notion.'[10] We can thus state that speculative physics tries to consider the laws of nature in their 'own immanent necessity in accordance with the self-determination of the Notion.'[11] If physics depends upon empirical data, speculative physics aims to unveil the inherent rational necessity of physical theories independently of any experimental justification or corroboration. In this way, speculative physics challenges the unquestioned presupposition according to which physics is *de jure* an empirical science. We could thus say about physical theories what Schelling says about the 'judgements of experience', namely that these theories '[...] become a priori [...] when we become conscious of them as necessary [...]'.[12] The very possibility of ascertaining the rational necessity of physical theories stems from the postulate according to which '[...] the distinction between a priori and a posteriori judgements is not at all, as many people may have imagined, one originally cleaving to the judgements themselves, but is a distinction made solely with respect to our knowing, and the kind of our knowledge of these judgements, so that every judgement which is merely historical for me – i.e., a judgement of experience – becomes, notwithstanding, an a priori principle as soon as I arrive, whether directly or indirectly, at insight into its internal necessity.'[13]

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[9] F. W. J. Schelling, *First Outline of a System of the Philosophy of Nature*, trans. K.R. Peterson (Albany: State University of New York Press, 2004), 198-9.

[10] G. W. F. Hegel, *Hegel's Philosophy of Nature. Part two of the Encyclopaedia of the Philosophical Sciences* (1830), trans. A.V. Miller (New York: Oxford University Press, 2004), § 246, 6.

[11] Ibid., 6.

[12] Schelling, op.cit., 198-9.

The very terms of this project go against the main claim of Meillassoux's *After Finitude*, namely that it is possible to demonstrate the necessary contingency of physical laws. The essential point for the present discussion is that Meillassoux simply disqualifies the possibility of *deducing* the laws of nature. Following Hume, he assumes that ('unless we are Hegel')[14] we are unable to discover such a necessity. Consequently, he says, we can only *describe* the *contingent* structural order that we *empirically* find in nature. To justify these claims, Meillassoux identifies natural laws with inductive inferences, obviating in this way the fact that inductive reasoning does not play any role in contemporary physics. The lack of any logical justification for inductive inferences leads Meillassoux to conclude that the nomological constancy of nature is not grounded on any a priori necessity. We might say that Meillassoux elicits the implicit 'metaphysical' content of the standard thesis according to which the undecidability between two mathematically consistent theories can only be settled by appealing to empirical experience. The physicist's job would be to choose the most accurate mathematical model for describing a completely contingent empirical order. If for Rutherford 'all science is either physics or stamp collecting', according to Meillassoux we must accept that even physics is mere (mathematised) stamp collecting.

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[13] Ibid., 198-9.

[14] Q. Meillassoux (with R. Brassier, I. H. Grant and G. Harman), 'Speculative Realism' in R. Mackay (ed.), **COLLAPSE III** (Falmouth: Urbanomic, 2007), 441.

The only argument that Meillassoux seems to give, besides the simplistic reduction of physics to inductive inferences, is that the project of demonstrating the necessity of natural laws supposes an infinite regress of reasons that could only be interrupted by a 'metaphysical ' first cause capable of positing itself in virtue of its mere notion (an 'ontological argument'). In other words, since the project of (absolute) knowledge seems to be either an 'infinite task' (Husserl) or a 'metaphysical ' project (Hegel), we must accept the absolute validity of the 'abstract negation' according to which it is simply not possible to understand why nature is regulated by certain laws instead of others. With regard to this second argument, it is worth noting that Meillassoux seems to conflate the formal ontology of possible worlds with the problem of understanding the hypothetical necessity (or contingency) of existence, that is to say of the effective *givenness* of ontic reality. But even if we rejected the possibility of an ontological argument capable of deducing existence from the concept, this would not prevent us from tackling the problem of understanding the rational necessity of physical theories. We could say that a physical theory provides a particular provisional solution to a certain problem. For instance, quantum mechanics is, as we shall argue below, the best solution that we have at the moment to the problem of explaining the objective consistency of nature. In order to understand the rational necessity of quantum mechanics, speculative physics must (among other things) evaluate the unicity of this solution. Are there other possible solutions to the problem of constructing a theory of generic physical objects besides quantum mechanics? To what extent could the physics of a possible world differ from the physics of our world? Even if we could prove the impossibility of an ontological argument, this 'no-go theorem' would not entail that we cannot analyse in rational terms the physical constraints of a possible world and their range of variability. It is also worth remarking that the project of understanding the rational necessity of physical theories defines local problems of scientific knowledge like any other. The answers that speculative physics can provide are of course – as is always the case in science – conditional and partial answers that will evolve within the rhythm of physics and mathematics. It is difficult, then, to understand why the supposed impossibility of providing a satisfactory rational global model for the 'topology' of absolute knowledge (an infinite regress of reasons, an 'axiomatic' well-founded system, a Hegelian suspended circle, etc.) would imply the futility of such a local project.

Far from providing stronger arguments for showing that natural laws do *in fact* lack any rational necessity, Meillassoux's addresses his efforts to the demonstration that this supposed contingency cannot be an epistemological limitation of human understanding, but must rather be an absolute principle. Therefore, Meillassoux's attempt to demonstrate the *absolute* (i.e. non-epistemological) contingency of physical laws relies on the unquestioned presupposition that *in fact* it is not possible to discover any rational necessity. Even if we can decide legitimately to explore the consequences of the *hypothesis* according to which the laws of nature lack any rational a priori necessity, we cannot pretend that we are rationally forced to accept the validity of such an hypothesis, nor that the principle of reason must be abandoned.

Moreover, even if it were true that we are unable to determine the rational necessity of natural laws, this supposed *empirical* fact could not be used as proof of their absolute contingency. If we assume that we cannot discover any rational necessity in physical laws, we have to decide whether this incapability results from the limits of human understanding or from the fact that physical laws are intrinsically contingent. We shall call this alternative Dilemma I. Nevertheless, instead of addressing this dilemma, Meillassoux tries to decide whether the contingency of physical laws is a correlate of human thought or rather an absolute contingency. We shall call this alternative Dilemma II. In order to solve this second dilemma, he argues that facticity cannot be consistently considered a correlate of thought. In this way, he concludes that facticity could only be an 'absolute' facticity. However, the crucial step for passing from the pertinent Dilemma I to the fictive Dilemma II is the deliberate confusion between epistemological criticism (according to which we cannot discover any rational necessity in natural laws because we are not clever enough) and ontological idealism (according to which facticity is a correlate of thought). But the hypothetical existence of impassable limits of human understanding cannot be legitimately identified with the thesis according to which 'to be is to be a correlate of human thought'. In short, to say that an ant will never be able to understand general relativity does not mean that one believes that nature is nothing but a correlate of the ant's 'thought'. If we restore this essential difference between Kant and Berkeley, the inference that leads from our alleged inability to discover any natural necessity to the absolutisation of facticity remains groundless. Indeed, the first step for pushing further the Copernican deanthropomorphisation of science is to reduce the narcissistic illusion of converting a conjectural limit into an absolute principle. We must avoid at all costs being like a congenitally deaf person trying to demonstrate the absolute impossibility of music. Indeed, Hume and Kant were perfectly right to reject any kind of ontological extrapolation of epistemological limitations. Just as Hegel, in turn, was right to deny the unavoidable character of these limitations.

To summarise, we can say that Meillassoux's 'proof' ('for it is indeed a proof', as Badiou tells us)[15] begins with an unquestioned (and probably false) presupposition (namely, that physics cannot discover any rational necessity in physical laws), and proceeds by means of an illegitimate 'deductive' inference (namely, that of absolutising a supposed limitation). Far from defending science from the Ptolemaic counter-revolution that Meillassoux describes so admirably, this narcissistic absolutisation of an inexistent limitation bolsters a certain form of philosophical contempt for scientific rationality. Indeed, the shift from a gnoseological statement to a speculative one only serves to absolutise the critical reduction of science. Meillassoux rehearses a paradigmatic gesture of 'Kantian' critique, namely that of 'proving', in purely philosophical terms, what physicists will never be able to do – in this case, understand the rational necessity (or the corresponding ranges of variability) of their own theories. Moreover, this is consistently done without any consideration of physics itself – after all, why should the philosopher consider in detail scientific (ontical) descriptions lacking any rational necessity if he can produce philosophical (ontological) demonstrations? Why would he analyse in accurate terms that of which he speaks – namely, physical theories – if he knows in advance that physics is only a collection of contingent laws that can change without any reason? Why should he try to understand the rational structure of particular physical theories, if the latter will surely be superseded by other theories, as has always been the case in the history of science … ?

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[15] A. Badiou, 'Preface' in Q. Meillassoux, *After Finitude*, op. cit., vii.

It is worth noting that, if speculative physics aims to force as far as possible the conversion of physics into an a priori discipline, the progressive comprehension of the rational necessity of natural laws is already a constitutive part of theoretical physics itself. For example, we could say that, at least to a certain extent, Einstein 'deduced' general relativity by means of purely theoretical reasoning lacking any empirical motivation. Moreover, we can now provide a priori arguments that show why general relativity is a more satisfactory theory than the Newtonian theory of gravity. Indeed, we could say that one of the great lessons of general relativity is that it is necessary to absolve physics from the presupposition of any kind of metaphysical or transcendental (back)ground. More precisely, general relativity permitted scientists to free the description of gravitational phenomena from some of the geometrical 'absolute objects' (as Anderson calls them) presupposed by the Newtonian theory.[16] The replacement of a *metaphysical 'God-given' ground* – the spatiotemporal background – by new physical degrees of freedom – the gravitational field – produced what we could call a *suspended (cor)relational nature*. As a result, the relativity of motion could be generalised beyond uniform motion: Accelerated motion, far from being defined with respect to a presupposed fixed geometrical stage-set, is 'relative' to the gravitational field (which defines the geodesics of space-time). Hence, the dynamics of the resulting extended set of interacting degrees of freedom is relative to nothing but itself. In this sense, general relativity established from within physics a 'speculative' disjunction between the correlational *absolute* and the metaphysical (or transcendental) *ground*. In Hegelian terms, we could say that the absolute absolves itself from any ultimate ground, that is to say from any last unmoving instance subtracted from the immanent mediation conveyed by physical interactions. It is then necessary to establish a sheer distinction between the *principle of reason* and the *principle of the ground* (*Der Satz vom Grund*). The history of physics clearly shows that the principle of reason – that is to say, the practical imperative of pushing the rational comprehension of the real as far as possible – requires us to abandon the metaphysical principle of the ground. Science does not progress by trying to found itself on a last self-posited metaphysical or transcendental reason, but rather by trying to absolve itself from any kind of presupposed background. At the antipodes of Meillassoux's stance concerning the metaphysical scope of 'correlationism', we can say that general relativity taught us that an absolution with respect to any metaphysical background whatsoever requires us to understand nature in (non-anthropomorphic) correlational terms.

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[16] See J. L. Anderson, *Principles of Relativity Physics* (New York: Academic Press Inc., 1967); M. Friedman, *Foundations of Space-Time Theories. Relativistic Physics and Philosophy of Science* (Princeton: Princeton University Press, 1983); C. Rovelli, *Quantum Gravity* (Cambridge: Cambridge University Press, 2004); and G. Catren, 'Geometric foundations of classical Yang-Mills Theory', *Studies in History and Philosophy of Modern Physics* 39, 2008, 511-31.

To summarise, let us admit that we now understand the intrinsic theoretical limitations of the Newtonian theory of gravity for explaining gravitational phenomena. This means that it is not contingent that nature is better described by general relativity than by Newtonian mechanics, nor that general relativity has the particular formal structure that it has. This comprehension of the rational necessity of general relativity is not incompatible with the fact that this theory will surely be superseded by a more satisfactory one, in this case a quantum theory of gravity. Such a substitution will probably not be a 'scientific revolution' that will condemn general relativity to death, but rather a kind of dialectical overcoming that will deepen the main lesson of general relativity; namely, that physics has to absolve itself from any kind of metaphysically or transcendentally presupposed background. More generally, we could say that the main task of speculative physics is to elicit the conceptual continuity and the rational necessity that bridges the historical discontinuities opened up by so-called 'scientific revolutions'.

If Meillassoux is right in asserting that the attempt to demonstrate the necessity of laws of nature is basically the Hegelian project, he presupposes dogmatically that such a project cannot be legitimately reactivated. Hegel's (as well as Schelling's) philosophy of nature depends on a *heuristic* (not dogmatic) raising of the principle of reason to a higher power: If physics explains the nomological consistency of nature, we should try to explain in purely rational terms why physical laws have the particular form they have. Such a task cannot be effectively developed by trying to demonstrate general statements about the global validity of the principle of reason, but only by trying to apply it locally to particular scientific theories. If in the end such a project could not be effectively accomplished, it would at least permit us to localise and characterise in rigorous and precise terms the corresponding kernels of irreducible facticity. Hence, we could say that speculative physics aims to discriminate between what is *essentially* contingent and what stems from an a priori necessity. In other words, the speculative conversion of empirical determinations into a priori principles should permit us to identify what is essentially empirical. Indeed, the effective possible obstructions to the principle of reason can only be identified by remaining faithful to this principle as far as possible. As is usually the case in mathematics, the most interesting theoretical configurations emerge as obstacles to the realisation of a certain programme. In other words, it is necessary to be programmatically ambitious in order to fail in a productive way. On the contrary, the a priori general 'proof' that the program is condemned to failure is simply unfruitful. In our particular case, this means that we shouldn't give up on our desire to understand the a priori principles that guarantee the rational consistency of nature. Paraphrasing Badiou, we could adopt the following methodological prescription: 'Méfions-nous des gens trop pressés de consentir [à l'irraison]. [...] J'aime qu'on abdique [le principe de raison] seulement contraint et forcé.'[17]

The proposed definition of speculative physics entails the following methodological consequence: in order to understand the rational necessity of a physical theory it is necessary to comprehend 1) the inherent theoretical deadlock of the preceding theory and 2) how the new theory bypasses this impasse. In other words, the *speculative deduction* of a physical theory aims to identify what we could call its *theoretical surplus value*. This means that speculative physics does not try to demonstrate the *unconditional* rational necessity of a physical theory, but rather to localise its *differential* theoretical superiority. In particular, even if – undoubtedly – quantum mechanics is not the final satisfactory formulation of mechanics, it should be possible to understand *in purely conceptual terms* why it is a more satisfactory theory than classical mechanics. This apparently banal prescription has important consequences. In particular, it challenges the prevailing idea that the difficulties in understanding quantum mechanics contrast with our satisfactory comprehension of classical mechanics. Indeed, our definition of speculative physics implies that our lack of a conceptual understanding of quantum mechanics is a direct consequence of our unsatisfactory comprehension of classical mechanics. More precisely, we have not yet understood precisely what internal theoretical deadlocks in classical mechanics make its quantum sublation necessary. In other words, we do not understand why it is not a contingent empirical fact that the objective consistency of nature is better formalised by quantum mechanics than by classical mechanics. Hence, in order to comprehend the rational necessity of quantum mechanics we must go back to classical mechanics and try to identify its theoretical flaws. According to this perspective, quantum mechanics, instead of inaugurating a radically new non-classical 'paradigm', should be understood as deepening a programme initiated by classical mechanics. In other words, the astonishing success of quantum mechanics shows retrospectively that Newton, Galileo and Kepler were in fact on the right path.

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[17] In the original quotation Badiou writes 'mi-dit ' (literally 'half-said', but the sense is 'half-hearted' or 'half-measure') and 'Tout' ('Whole') instead of 'irraison' and 'principe de raison' respectively. See A. Badiou, *Théorie du sujet*, (Paris: Editions du Seuil, 1982), 138. ('Let us be wary of those too keen to consent [to 'unreason']. I would rather one abjure [the principle of reason] only when constrained and forced to do so'. *Theory of the Subject*, trans. B. Bosteels [London: Continuum, forthcoming 2009]. Translation modified).

This is the effective methodological prescription we have followed in arriving at the conclusions described below. That is to say, we tried to localise the intrinsic deadlocks of classical mechanics and the corresponding theoretical surplus value of quantum mechanics. Very briefly, in classical mechanics there exists a certain correspondence between each physical quantity of physical systems (such as the position, the momentum or the energy) and the so-called *classical operators*.[18] The important point is that this classical correspondence between physical quantities and classical operators is not entirely satisfactory because it does not associate *distinct* physical quantities with distinct classical operators (i.e. the classical correspondence is not an isomorphism).[19] It is possible to show that the mathematical formalism of quantum mechanics emerges when one forces this isomorphism. To do so, it is necessary to substitute quantum operators for the classical operators.[20] Hence, the heuristic questions of speculative physics, in the case of quantum mechanics, are the following: Why do operators play such a fundamental role in mechanics? What is the conceptual content of the correspondence between physical quantities and operators? And why should this correspondence be isomorphic?

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[18] Roughly speaking, an operator is a mathematical entity that generates transformations of other mathematical entities. For example, a derivative is a mathematical operator that transforms functions into other functions.

In order to answer these questions we have to take into account that physics could be defined as a *theory of objects*. Such a theory consists of two parts. In the first place, physics depends on a general formalism, called *mechanics*, for treating any kind of physical objects, that is to say for studying their properties, their symmetries, their temporal evolution, and so on. Secondly, there are different particular kinds of objects (particles, fields, molecules, waves, astrophysical systems, etc.) that can be treated by means of this general formalism. The different branches of physics result from the application of the general formalism to the study of these different particular systems. If mechanics is a general formalism that can be used to study *any* kind of physical system, it could be tempting to define mechanics as a formal ontology of generic physical objects. By *formal ontology* we mean the study of generic determinations that do not depend on the particular properties of any particular (kind of) object. In Kantian terms, we could say that mechanics is a formalisation of the structure of the (non-transcendental) generic object = X. The important point is that, contrary to a widespread idea, classical mechanics does not provide a satisfactory definition of physical objects. It is then possible to show that quantum mechanics permits an overcoming of the classical obstacles to the formulation of such a definition. As we shall see, the definition of physical objects depends essentially on the correspondence between physical quantities and operators. Therefore, the complete claim is that quantum mechanics, *unlike classical mechanics*, is a consistent formal ontology of generic physical objects. Indeed, and as we shall see, quantum mechanics seems to provide a possible physical solution to a transcendental problem, namely the problem of understanding the constitution of physical objects by means of a synthesis of the manifold of sensible (or experimental) intuition. As opposed to Kant's or Husserl's solution, quantum mechanics shows that the intrinsic consistency of physical objects does not require any transcendental – i.e. (inter) subjective – constitution. As we shall see, this solution pushes the Copernican deanthropomorphisation of physics to a further limit: rather than the transcendental subject, it is the object itself that generates the synthetic operations which unify the phenomenological manifold of its aspects or profiles. In Kantian terms, one might say that quantum mechanics demonstrates how to make physics conform to the quantum nature of self-constituted objects, and not the objects to our (all too human) faculty of classical intuition.

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[19] In technical terms, physical quantities are given by functions on the phase space, whereas classical operators are given by so-called Hamiltonian vector fields: See R. Abraham and J. E. Marsden, *Foundations of Mechanics*, Second Ed., (Cambridge: Addison-Wesley Publishing Company, 1978).

[20] It is worth noting that this characterisation of the relationship between classical and quantum mechanics is not the usual one. In fact the proposed interpretation of quantum mechanics stems from an analysis of the so-called geometric quantisation formalism, due mainly to the seminal works of J.-M. Souriau and B. Kostant in the early seventies (see J.-M. Souriau, *Structure of Dynamical Systems. A Symplectic View of Physics* [Cambridge: Birkhäuser Boston, 1997] and J.-L. Brylinski, *Loop Spaces, Characteristic Classes and Geometric Quantisation*, *Progr. Math.* 107 [Boston: Birkhäuser Boston Inc., 1993]).

III. PHENOMENOLOGY OF A QUANTUM ELEPHANT

Physical experience is not a chaotic swarm of disconnected empirical data. As Whitehead cleverly observed: 'Sometimes we see an elephant, and sometimes we do not'.[21] In other words, physical reality decomposes itself in different objective configurations that can be identified and recognised. We should add that properly speaking we can only see particular phases, aspects or profiles of the elephant. As Lacan says, 'l'être se présente, se présente toujours, de par-être'.[22] By turning the elephant around an axis (or, equivalently, by moving around the elephant ourselves) we can observe *different* phases of the *same* elephant. This means that there is a defining kernel (that we could call the elephant's *quiddity*) that remains invariant through the modifications of its modes of phenomenological presentation. We can thus define an object as a physical configuration characterised by a certain set of *objective properties* that allow virtual observers to recognise the object in spite of the variations of its phases. As Badiou says: '[...] par «objet» il faut entendre ce qui compte pour un dans l'apparaître, ou ce qui autorise à parler de cet être-là comme étant inflexiblement «lui-même».'[23] This means that the objective properties that define the object cannot change under the transformations that permit observation of its different phases (for instance, turning the elephant around an axis). Henceforth we shall call such transformations *phase transformations* of the object. Hence, we can assert that objective properties must be *invariant* under phase transformations. We can thus redefine an object as a set of invariant objective properties that manifests itself through a phenomenological multiplicity of phases. This means that there is no entity without identity (Quine), nor without different phases (Husserl). In Frege's terms, we could say that the same reference (*Bedeutung*) can have different senses (*Sinn*), that is to say different modes of presentation. For example, the morning star and the evening star are nothing but different modes of presentation of the same object.

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[21] A. N. Whitehead, *Process and Reality* (New York: The Free Press, 1978), 4.

[22] J. Lacan, *Le Séminaire*, livre XX (Paris: Editions du Seuil, 1975), 44 ('being presents itself, always presents itself, by para-being.' J. Lacan, J.-A. Miller (ed.), *On Feminine Sexuality, The Limits of Love and Knowledge, 1972-3*, trans. B. Fink [New York: Norton, 1998], 45. Note that the English translation does not preserve Lacan's play on words 'par-être'/'paraître' ['para-being'/'to appear']).

In this way, the manifold of sensible intuition decomposes itself in sheaves of aspects orbiting around sets of invariant objective properties. As Kant and Husserl noted, the objective consistency of nature requires an operational function capable of synthesizing the multiplicity of phases of a given object. Therefore, a satisfactory theory of physical objects should be able to explain the relationships between the *invariant objective properties* that define the *quiddity* of the object, the *phenomenological multiplicity of its phases*, and the *synthetic operations* that guarantee its objective unity. According to the transcendental tradition, the unifying synthesis is performed by the subjective faculties. In Husserl's terms, the 'hyletic' multiplicity of sensible intuition becomes a 'noematic' objective unity thanks to the 'noetic' functions of synthesis carried out by the transcendental ego. In other words, the subjective functions of synthesis posit, on the basis of bundles of sense data lacking any intrinsic consistency, the ideal objective unities that compose human experience.

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[23] A. Badiou, *Logiques des mondes*. (Paris: Seuil, 2006), 205 (' [...] by "object" we must understand that which counts as one within appearing, or that which authorises us to speak of this being-there as inflexibly being "itself"'.', A. Badiou, *Logics of Worlds*, trans. A. Toscano [London/New York: Continuum, forthcoming 2009], 193).

The main task of what we could call a speculative theory of physical objects is to explain the objective consistency of nature without appealing to a transcendental synthesis. As Whitehead says: 'We are concerned only with Nature [...] and not with the synthesis of the knower with the known. [...] Accordingly none of our perplexities as to Nature will be solved by having recourse to the consideration that there is a mind knowing it. Our theme is the coherence of the known [...]'.[24] Our main claim is that, according to quantum mechanics, it is the object itself that generates the synthetic operations that unify its different phases. In other words, we shall transfer the constitutive capabilities from the subject to the object. As we shall see, the utilisation of operators in mechanics is a direct consequence of the necessity of (self-)synthesizing the multiplicity of the object's phases. Hence, operators play a central role in mechanics because mechanics is nothing but a formal theory of generic physical objects, that is to say a theory that explains how the multiple phases of an object are mutually related by means of certain synthetic operations that leave its objective properties invariant. The important point is that a satisfactory interpretation of mechanics as a theory of generic physical objects is only possible within the framework of quantum mechanics. The theoretical surplus value of quantum mechanics relies on the fact that the classical definition of operators does not permit a satisfactory definition of physical objects.

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[24] A. N. Whitehead, *An Enquiry Concerning the Principles of Natural Knowledge* (New York: Dover, 1919), vii.

We shall now present in conceptual terms the ontology of generic physical objects that can be extracted from the formalism of quantum mechanics. As we said before, an object is a kind of 'projector' (or 'radiator') of phases, aspects or profiles whose essential *quiddity* is given by a persisting kernel of invariant objective properties. The set of invariant objective properties of an object will be called from now on the *eidos* ε of the object. In general, it is possible to perform different kinds of phase transformations in order to observe the multiple phases of an object. Borrowing Husserl's terminology, we could also call the phase transformations 'eidetic variations'. A set of phases connected by means of a given kind of phase transformation (such as, for instance, rotations around a given axis) will be called an *orbit of phases*. In Figure 1, the different lateral phases of the elephant (whose name is Colin) can be observed by rotating Colin around a vertical axis. By definition, these different lateral phases belong to the same orbit of phases. Equivalently, let's suppose that the phenomenological observer Jean-Sol Partre is orbiting around Colin in a plane perpendicular to the vertical axis. By doing so, Jean-Sol Partre will observe the phases of Colin that belong to the orbit of lateral phases.

Phase transformations are 'phantasmatic' acts that do not produce any *objective* effect. Therefore, phase transformations

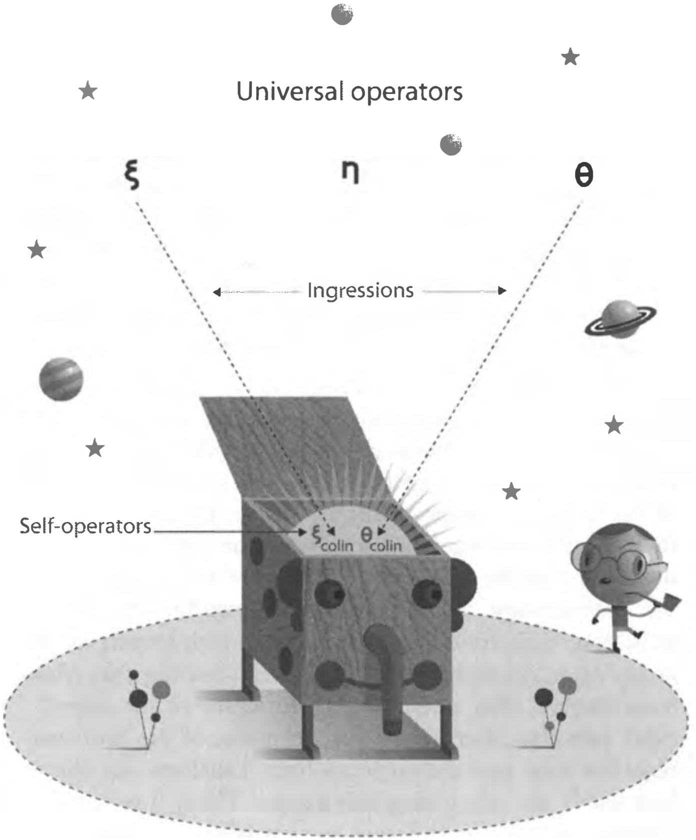
Universal operators
ξ
η
θ
Ingressions
Self-operators
ξ_{colin}
θ_{colin}

Figure 1. Jean-Sol Partre observes elephant

have to be distinguished from transformations that change the object *objectively*, that is to say that change the object into *another* object. For instance, the transformation that breaks an object into two objects is not a phase transformation of the former. These kinds of transformation will be called *objective transformations*. In this way, there are two kinds of transformations that can be performed on an object, namely the *objective transformations* that objectively transform the object into another object, and the *phase transformations* (or 'eidetic variations') that interchange the different phases of the object without modifying it objectively.

Since phase transformations only interchange the different phases of an object, the objective properties that define the object are necessarily invariant under phase transformations. In Husserl's terms, the object's *eidos* is composed of the invariants under eidetic variations. In order to stress that phase transformations transform the object into itself, they will also be called *automorphisms* of the object. With this terminology, we recover Weyl's well-known characterisation: 'objectivity means invariance with respect to the group of automorphisms.'[25] It is worth stressing that *phase transformations* (that interchange the phases of the object), *eidetic variations* (that permit the definition of the invariant objective *eidos*) and *automorphisms* (that transform the object into itself) are interchangeable terms. These three terms, however, emphasise different aspects of the same notion. The fundamental distinction is the distinction between phase transformations on the one hand and objective transformations on the other.

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[25] H. Weyl, *Symmetry* (Princeton: Princeton University Press, 1952), 132. An analysis of the relationship between group theory and perception can be found in E. Cassirer, 'The Concept of Group and the Theory of Perception', *Philosophy and Phenomenological Research* Vol. 5, No. 1 (1944), 1-36.

It is now necessary to specify more precisely what we understand by objective properties. To do so, we have to take into account that the characterisation of objective properties as *invariants* under eidetic variations does not suffice for providing a satisfactory definition of objective properties. The problem has been clearly stated by Nozick in the following terms: 'The notion of invariance under transformations cannot (without further supplementation) be a complete criterion of the objectivity of facts, for its application depends upon a selection of *which* transformations something is to be invariant under.'[26] In other words, there is no general prescription for determining which transformations are needed in order to define the invariant objective properties of a physical object. Therefore, the eidetic invariants depend on the election of a certain group of eidetic variations.[27] If we consider too many transformations as eidetic variations, the 'object' will have no eidetic invariants. Every property of the object will be nothing but a phase with no objective value. Hence, the 'object' will be a phenomenological set of phases without any invariant identity. If, on the contrary, we consider too few transformations as eidetic variations, the object will have no phases. This means that every property of the object will be an objective invariant. Hence, the 'object' will be an identity without phases.

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[26] R. Nozick, 'Invariance and Objectivity', *Proceedings and Addresses of the American Philosophical Association* Vol. 72, No. 2 (1998), 21-48. In Weyl's terms, 'Reality may not always give a clear answer to the question what the actual group of automorphisms is [...]', H. Weyl, op.cit., 132.

[27] Evidently, we cannot solve this problem in a circular way by stating that the automorphisms of an object are the transformations that leave the objective properties invariant.

In fact, quantum mechanics provides a very elegant solution to this indetermination. As we shall see, the quantum definition of physical objects furnishes the required 'further supplementation' by stating that the object's automorphisms are induced by the very objective properties of the object. In other words, each objective property defines a particular kind of phase transformation. Hence, not only is an objective property invariant under all of the object's automorphisms; it also induces a particular kind of automorphism. Far from being a circular characterisation, we shall show that Heisenberg's uncertainty principle is a direct consequence of this definition.

In order to formalise this idea, we shall propose a definition of physical objects by means of two fundamental postulates. But first we must introduce some terminology. In Platonic terms, we shall say that a physical object realises (or participates in) a certain number of universal operators (or 'ideas') in a way that depends on the object. Or we may alternatively say, in Whiteheadian terms, that a universal operator (or 'eternal object') makes *ingression* into the object in an *object-dependent way*. The ingression of a universal operator into an object defines what we shall call a *self-operator* of the object.[28] As we shall see below, the self-operators of an object perform the self-synthesis of its phenomenological multiplicity of phases. In Figure 1, Colin participates in the universal operators ξ and θ. The ingressions of these universal operators define the self-operators ξ_{colin} and θ_{colin}. On the contrary, Colin does not participate in the 'idea' η. By means of this Platonic terminology, we want to convey the idea that an object can be characterised by the way in which it participates in a certain number of universal ideas. Hence, in order to define the *quiddity* of an object we have to specify (1) which are the universal ideas realised by the object and (2) how these ideas make ingression into the object. The important point is that two different objects can realise different universal ideas and/or realise differently the same universal idea. In figurative terms, we could say that an elephant and a giraffe are different because they realise different ideas, and that two elephants are different because they realise differently the same idea. For example, in Figure 2, Colin and the giraffe (whose name is Chloé) participate differently in the same universal operator ξ. This means that the self-operators ξ_{colin} and ξ_{chloe} that result from the corresponding ingressions are different. On the other hand, Colin realises a universal operator that is not realised by Chloé, namely the operator θ. In turn, Chloé realises a universal operator that is not realised by Colin, namely the operator η.

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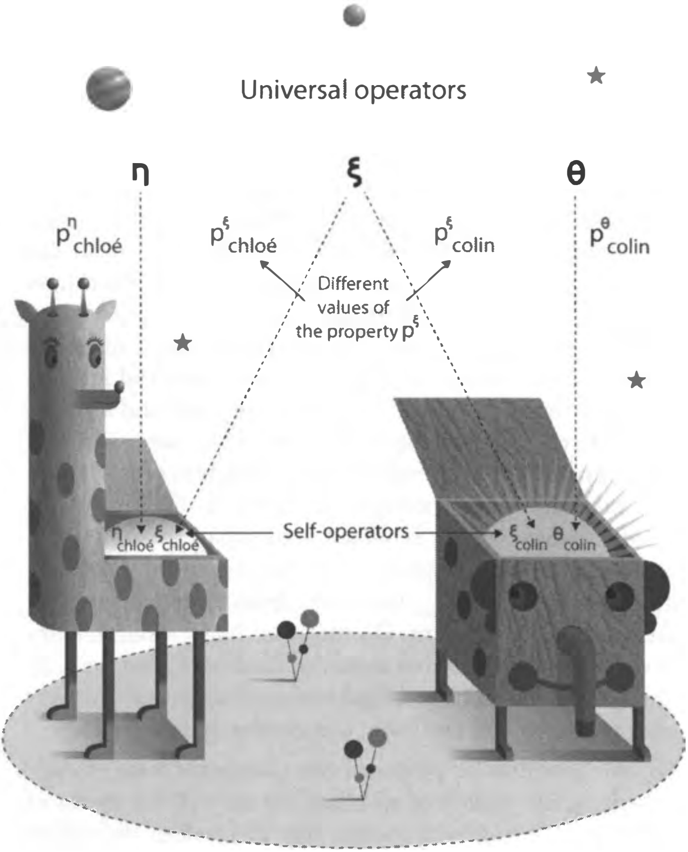
[28] It is worth noting that the language of universal entities (and their multiple possible ingressions) is borrowed from category theory (see S. Mac Lane, *Categories for the Working Mathematician* [New York: Springer-Verlag, 1997]). For example, an element a of a set M can be redefined in terms of the so-called *characteristic function* χa from the singleton {*} (which is a terminal object of the category of sets) to the set M. By definition, the characteristic function χa sends the singleton {*} to the element a (i.e. $\chi \mathrm{a} : \{*\} \rightarrow a$). In other words, any element x of M can be defined by means of a particular 'ingression' χx of the 'universal element' {*}. In our case, the universal operators are given by elements of a Lie algebra, whereas the self-operators that result from their ingression are the so-called quantum operators.

We have thus far proposed two alternative ways of characterizing the *quiddity* of an object, namely (1) by means of its invariant objective properties (the 'Husserlian' definition) and (2) by specifying how the object participates in a certain number of universal 'ideas" (the 'Platonic' definition). The first postulate of the quantum theory of physical objects unifies these two ways of defining the *quiddity* of an object:



Universal operators
η
ξ
θ
$p^{\eta}_{chloé}$
$p^{\xi}_{chloé}$
p^{ξ}_{colin}
p^{θ}_{colin}
Different values of the property p^{ξ}
$\eta_{chloé}$ $\xi_{chloé}$
Self-operators
ξ_{colin} θ_{colin}

Figure 2. Elephant meets giraffe

Postulate ♠: an objective property of an object is a particular numerical value that specifies how the object realises a certain universal operator.

For example, two objects that differ in the value of their energy realise differently the same universal operator. In Figure 2, Colin and Chloé realise differently the idea ξ. According to postulate ♠, there exists a property p^{ξ} such that each possible numerical value of p^{ξ} defines a different ingression of the universal operator ξ. In turn, these different ingressions define different self-operators. Since both Colin and Chloé realise the universal operator ξ, the quantity p^{ξ} defines objective properties of both of them. Since Colin and Chloé realise differently the universal operator ξ, they are characterised by different values of the quantity p^{ξ} (namely p^{ξ}_{colin} and p^{ξ}_{chloe} respectively).

We could say that postulate ♠ articulates and formalises the relationship between the 'Platonic' universal *ideas* and the 'Husserlian' *eidos* of particular objects. Indeed, the object's *eidos* (i.e. the set of numerical values of its objective properties) specifies how the object participates in a certain number of universal 'ideas'. Reciprocally, the ingression of certain universal ideas defines the *eidos* of the object. More precisely, the ingression of the universal ideas (ξ, θ, ...) into an object like Colin defines a set of particular numerical values (p^{ξ}_{colin}, p^{θ}_{colin}, ...) of the quantities (p^{ξ}, p^{θ}, ...). These particular values constitute the objective properties of Colin. Hence, the set of these values defines Colin's *eidos*, that is to say the essential *quiddity* that allows us to identify and to recognise Colin through its different modes of presentation.

According to our terminology, the ingression of an universal operator ξ into Colin defines a self-operator ξ_{colin} of Colin. By definition, an operator is a mathematical entity that generates transformations. In particular, the self-operator ξ_{colin} generates transformations of Colin. The second postulate of the quantum theory of physical objects specifies the nature of these transformations:

Postulate ♣: The transformations generated by a self-operator of an object are phase transformations (or automorphisms) of the object.

In other words, a transformation generated by one of the object's self-operators is not an *objective* transformation of the object into another object, but rather a phase transformation that does not modify the object's *quiddity*. This means that the self-operators of an object generate all the possible phantasmatic transformations of the object into itself, that is to say all the different non-trivial declinations of its identity. The self-operators unfold the transformations which, without modifying the object's *quiddity*, permit the observation of its different phases. We could thus say that the self-operators of an object are the generators of its phenomenological presentation.

In order to fix ideas, let's consider again the case of Colin. Let's suppose that, as in Figure 1, Colin participates in the universal operator ξ. According to postulate ♠, there exists a quantity p^{ξ} whose particular numerical value p^{ξ}_{colin} specifies how the universal operator ξ makes ingression into Colin. This ingression defines the self-operator ξ_{colin}. Let's suppose now that the self-operator ξ_{colin} generates rotations around the vertical axis. According to postulate ♣, these virtual rotations around the vertical axis are nothing but phase transformations of Colin. This means that the self-operator ξ_{colin} generates the sequence of Colin's phases that Jean-Sol Partre will observe if he orbits around Colin as in Figure 1. In other words, the phase transformations generated by the self-operator ξ_{colin} unfold the orbit of *lateral* phases of Colin. In this way, the numerical value $p^{\xi}{}_{colin}$ of the objective property p^{ξ} defines the self-operator ξ_{colin} (postulate ♠), this self-operator being the generator of one kind of phase transformation of Colin (postulate ♣). We shall sometimes summarise these two postulates by saying that the objective property $p^{\xi}{}_{colin}$ induces a certain kind of phase transformations of Colin. In particular, the objective property $p^{\xi}{}_{colin}$ specifies how Colin will appear when he rotates around the vertical axis (or when Jean-Sol Partre rotates around him). In this way, each objective property induces an orbit of phases corresponding to a particular mode of presentation of Colin (such as, for instance, rotations around an axis, translations along an axis, temporal evolutions, etc.).

We can now summarise the two proposed postulates by means of the following definition of physical objects:

Definition: An object is a physical configuration that can be completely characterised by specifying the numerical values of the objective properties that induce all the object's automorphisms.

According to this definition, the object's *eidos* (i.e. the set of its objective properties) plays a twofold role, namely it defines the invariant *quiddity* of the object and it induces the object's automorphisms. These automorphisms unfold the different orbits of phases of the object, that is to say the multiple sets of aspects that the object offers to all possible virtual observers. Hence, the imbrication between these two roles can be summarised by stating that *the object's invariant* quiddity *generates its phenomenalisation.* We can also describe this sort of 'speculative theorem' in the following terms: On the one hand, the identification of an object requires an invariant eidetic kernel. On the other hand, the phenomenalisation of an object requires phantasmatic acts, that is to say phase transformations that permit the observation of its different phases without producing any objective effect. Quantum mechanics establishes a link between the 'essence' and the 'appearance' by stating that the *eidos* of an object is the inducer of its phantasmatic acts.

In order to provide an imaginary schematisation of the relationship between the invariant *eidos* and the object's phenomenalisation, we could also appeal to Brion Gysin's *dream machine.* For, in fact, the following stroboscopic experience is at the origin of Partre's persisting hallucinations. Let's consider for instance the orbit of Colin's lateral phases. As we said before, this orbit of phases is generated by the self-operator ξ_{colin}. Let's represent this self-operator as an inner source of yellow light. Let's suppose now that each lateral phase is translucent and that ξ_{colin} is the unique source of light. Thanks to this 'eidetic' generator of light, Jean-Sol Partre can observe the markings on Colin's skin. If Jean-Sol Partre orbits around Colin, he will observe the different patterns of markings of each lateral phase. However, the light that passes through each translucent phase will always be yellow. Hence, the colour of the eidetic radiator that allows Jean-Sol Partre to observe the orbit of lateral phases is invariant under the corresponding eidetic variations. In other words, the colour of the eidetic source that generates the lateral phenomenalisation of Colin is an invariant objective property.

Auyang has already remarked that the 'representation-transformation-invariance structure' that allows the definition of objective properties as invariants under transformations between different representations of a physical system is still valid in quantum mechanics.[29] Nevertheless, the proposed definition of physical objects goes further than the usual characterisation of objective properties as group invariants. Indeed, this definition states *also* that the automorphisms that define the objective invariants are induced by the objective properties themselves. Therefore, we could say that quantum mechanics completes the usual characterisation of objectivity and provides for the first time a satisfactory definition of physical objects.

IV. PACHYDERMAL NOMADOLOGY

> '[...] comment l'objet qui se meut serait-il en un point de son trajet?'
>
> H. Bergson, *La pensée et le mouvant*[30]

We shall now try to establish more explicitly the relationship between the previous definition of physical objects and quantum mechanics. In fact, it is possible to show that none of the proposed postulates can be implemented in the framework of classical mechanics;[31] whereas, on the contrary, quantum mechanics can be considered a satisfactory formal implementation of the proposed definition of physical objects. In particular, we shall now show that Heisenberg's uncertainty principle is a direct consequence of this definition. Roughly speaking, we could say that Heisenberg's uncertainty principle is a formalisation of the virtuous circle that results from the intertwining of objective and non-objective properties.

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[29] See S.Y. Auyang, *How is Quantum Field Theory Possible?* (New York: Oxford University Press, 1995), Chapter Five.

[30] Paris: PUF, 1938, 158 ('How could the moving object be in a point of its trajectory passage?', H. Bergson, *The Creative Mind: An Introduction to Metaphysics*, trans. M.L. Andison [New York: Dover, 2007], 143).

According to the proposed definition, an objective property is an invariant quantity that induces a particular kind of phase transformation of the object. In turn, a property is objective (i.e. invariant) if it does not change when the object is acted upon by a phase transformation. Hence, objective properties satisfy two conditions, namely (1) they are invariant under all the phase transformations of the object and (2) they induce a particular kind of phase transformations of the object. We can thus conclude that an objective property of an object has to be invariant under the phase transformations *induced by all the objective properties of the same object.* If a property is invariant under the phase transformations induced by another property, we shall say that these properties are *commensurable.* Let's consider for example an object defined by the *eidos* $\varepsilon = \{p, l\}$, where by definition p and l are objective properties of the object. This means that the numerical values p and l characterise completely the object's invariant *quiddity.* The standard definition of objectivity requires that the value of each objective property be invariant under a certain group of eidetic variations. Nevertheless – as we have explained above – this standard definition does not specify *which* group of transformations are to be used for defining the objective invariants. The proposed definition of physical objects bypasses this flaw by stating that the eidetic variations are induced by the objective properties themselves. Therefore, each objective property has to be invariant under the eidetic variations induced by the other objective properties of the same object. The phase transformations induced by an objective property p will be denoted δ_p. In particular, if p and l are objective properties of an object, then they have to satisfy $\delta_p l = 0$ (i.e. l has to be invariant under the phase transformations induced by p) and $\delta_l p = 0$ (i.e. p has to be invariant under the phase transformations induced by l).[32] In general, the phase transformations induced by an objective property of an object cannot modify the other objective properties of the same object. This fact imposes a restrictive condition on the *eidos* of an object. Indeed, the *eidos* cannot be an arbitrary collection of objective properties. Each objective property has to satisfy the condition of being invariant under the phase transformations induced by all the others. This requirement constitutes what we shall call the *clause of self-consistency of the eidos*. This clause states that the *eidos* of an object can only be composed of commensurable properties.

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[31] A technical presentation can be found in G. Catren, 'On Classical and Quantum Objectivity', *Foundations of Physics* 38, 5, 2008 470-87.

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[32] Of course, the objective properties p and l have to be also invariant under the phase transformations induced by themselves. In other terms, they have to satisfy $\delta_p p = 0$ and $\delta_l l = 0$. Nevertheless, it can be shown that these conditions are trivially satisfied by any property. The non-trivial conditions stem from the invariance of an objective property under the phase transformations induced by the other objective properties of the same object.

In particular, if a certain property is modified by the phase transformations induced by an objective property belonging to the object's *eidos*, then the former cannot also be an objective property of the same object. This statement can be considered the conceptual translation of Heisenberg's uncertainty principle. In particular, it is possible to show that the momentum p is a property that induces transformations in the position q (and vice versa). Hence, if the momentum p is an objective property in the object's *eidos*, then the position q cannot also be an objective property of the same object. The position q is rather a phase of the object that changes when the object is acted upon by the phase transformations induced by p. In other words, since the position q and the momentum p are incommensurable, they cannot be both objective properties of the same object.[33]

We could say that Einstein was literally right in thinking about quantum objects in terms of dice. Indeed, what God would obtain if he threw a die is not an objective property of the die, but rather one of its faces. And the important point is that a die's face is a die's *phase*. Asking after the objective position q of a quantum elephant with an objective momentum p is as nonsensical as looking for the objective (or privileged) face of a die. Nevertheless, even if a die has no objective face, it will show a particular face when thrown. Obviously, this does not mean that the result obtained was the objective but unknown face of the die. Analogously, even if a quantum elephant with an objective momentum p has no objective position q, it will appear in a particular position q_1 if a measurement of the position is performed. This does not mean that q_1 was the objective but unknown position of the elephant. Neither does it mean that the garden where Colin carelessly wanders splits in parallel paths, such that in each path Colin is in a well-defined position. In any case, a stampede of elephants in a quantum casino will never crush the Copernican revolution: Colin's delocalisation is intrinsic. It cannot be bypassed by appealing to the supposed limitations stemming from a transcendental constitution of objectivity, nor by forking the paths of his garden. Like the faces of a die, the different possible positions q_i of Colin are mere phases with no objective value. In this way, even a single quantum elephant has '[...] une onde [or a die – GC] associée comme flux qui définit l'espace coexistant de ses présences.'[34] We might say that Colin is a deterritorialized quantum elephant with no objective position. Dispersed across the garden, Colin's 'method of resistance [is] always just to keep moving – seeking, not a place to hide out, secure and fixed, but a state of dynamic ambiguity about where [he] might be any given moment, along the lines of Heisenberg's uncertainty principle.'[35]

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[33] For the sake of simplicity we have only considered the case of an object with a well-defined momentum p and a completely undetermined position q. The reciprocal case – a well-defined position with an undetermined momentum– is completely analogous. In the general case, both the position and the momentum are subject to certain indeterminacies. In fact, the flexibility of quantum mechanics' formalism makes it possible to define physical objects characterised by properties which are neither objective properties nor phases, but rather a mixture of both. In these cases, both q and p are unsharp objective properties of the object. The resulting subtle equilibrium between unsharp objective properties and unsharp non-objective phases is formally governed by Heisenberg's uncertainty principle.

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34. G. Deleuze and F. Guattari, *L'Anti-Œdipe (Capitalisme et schizophrénie 1)* (Paris: Minuit, 1972), 333 ('[...] an associated wave as a flow that defines the coexisting space of its presences.', G. Deleuze and F. Guattari, *Anti-Oedipus*, trans. R. Hurley, M. Seem and H.R.Lane [Minneapolis: Minnesota University Press, 1983], 280).

35. T. Pynchon, Introduction to Jim Dodge's *Stone Junction* (New York: Grove Press, 1998).

V. QUANTUM CASINO

According to the proposed definition of physical objects, the measurement of a quantum object can be understood as a throw of a die. This means that in general the obtained result will not be an objective property of the object, but rather one of its non-objective phases. Nevertheless, there is a crucial difference between quantum objects and ordinary dice, namely that the former can be superposed.[36] According to our interpretational framework, quantum superposition stems from the intuitive fact that an object is a superposition of phases, aspects or profiles. The important difference is that in quantum mechanics the superposed phases of an object are in turn quantum objects. As in set theory, where a set is a collection of sets, a quantum object is a superposition of phases that are in turn quantum objects. Hence, the superposition of quantum objects produces a new quantum object such that each term of the superposition is one of its phases.

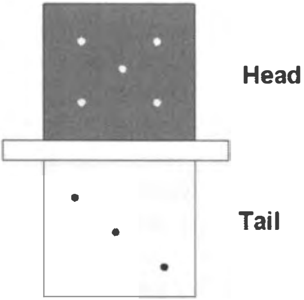

Figure 3. Quantum coin

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[36] Another significant difference is that the only phenomenological access to a quantum object is by 'throwing' it. In other terms, a quantum object is like a die whose phases can only be observed if one throws the die.

This difference between ordinary dice and quantum objects opens new phenomenological (or experimental) possibilities. For example, we could schematise a particular quantum object as a coin ❍ such that each of its two phases is in turn a die (see Figure 3). Let's denote these two dice as the die-head $■_{\text{head}}$ and the die-tail $❑_{\text{tail}}$. The object ❍, then, is a superposition of the objects $■_{\text{head}}$ and $❑_{\text{tail}}$. Let's write this superposition as $❍ = ■_{\text{head}} + ❑_{\text{tail}}$.

Let's suppose now that in our casino there are two tables, namely a table for playing with coins and a table for playing with dice. So, what can we do with the object $❍ = ■_{\text{head}} + ❑_{\text{tail}}$ in such a casino? First, we can play heads or tails in the table for coins. Let's suppose that, by doing so, we obtain the phase $■_{\text{head}}$. Since the obtained phase is in turn a die, we can go on playing and throw the die $■_{\text{head}}$ on the table for dice. By doing so, we will obtain a number between 1 and 6. The important question is now the following: Can we play with the object $❍ = ■_{\text{head}} + ❑_{\text{tail}}$ *directly* on the table for dice, that is to say without having initially played heads or tails? The formalism of quantum mechanics shows that this is in fact possible. In order to visualise such a possibility, we have to modify the imaginary representation of the object ❍. Instead of considering it as a coin with a die in each phase, we can represent it as a sort of 'hyperdie': We can literally superpose the two dice by putting the die $■_{\text{head}}$ within the die $❑_{\text{tail}}$, such that their vertices are rigidly linked (see Figure 4). If we now throw the hyperdie ❍ directly onto the table for dice, the quantum formalism shows that the probability for obtaining a given number between 1 and 6 depends on the relative orientation (or 'relative phase') between the two dice. For example, the two phases with the

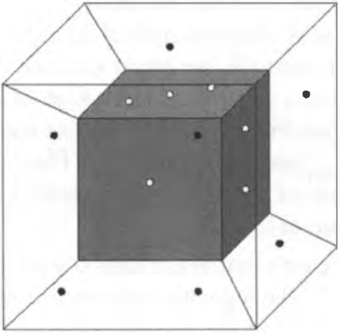

Figure 4. Hyperdie

number 1 might be (among other possibilities) 'in phase' (i.e. aligned) or 'out of phase' (i.e. opposed). If they are in phase, then the number 1 is a possible result of the throw of the hyperdie ('constructive interference'). If they are out of phase, then the number 1 is not a possible result of the throw of the hyperdie ('destructive interference'). In any case, it is meaningless to ask from which die the obtained number comes from.

It is worth noting that a rotation of the hyperdie as a whole (i.e. without modifying the relative orientation between the two dice) is a phase transformation of the hyperdie. Whereas if we modify the relative orientation between the two dice that compose the hyperdie, we will obtain a new hyperdie characterised by another probability distribution. For example, phases that were out of phase might be in phase after the transformation. Hence, a change in the 'relative phase' is not a phase transformation, but rather an objective transformation.

We have only considered thus far the superposition of quantum objects. Nevertheless, in *quantum design*, the construction of objects depends on two fundamental operations, namely the superposition '+' and the tensor product '⊗'. As we have explained above, the superposition '+' permits the construction of a new object by superposing different phases (which are in turn quantum objects). Hence, the terms of the superposition constitute the different 'phenomenological' profiles of the new object. On the other hand, the tensor product '⊗' permits the construction of a single phase by 'pasting' different objects. Whereas the superposition '+' combines two objects as different phases of another object, the tensor product '⊗' combines them as different parts of the same phase.[37]

VI. THE QUANTUM ESSENCE OF MANIFESTATION

This quantum theory of physical objects allows us to resist to the Ptolemaic counter-revolution on two different fronts: First, it shows that quantum mechanics provides a *realistic* and *complete* description of physical objects. The fact that the position q and the momentum p cannot be both objective properties of the same object does not mean that the very *quiddity* of the object depends on the observing subject, on the measurement device or on the experimental context. This means that it is no longer necessary to appeal to a 'transcendental' argument to explain why it is not possible to gain access to all the objective information that defines an object. Hence, quantum mechanics cannot be considered an intra-scientific formalisation of a transcendental limitation of physical knowledge. As Žižek says, the uncertainty principle 'is thus profoundly "Hegelian": what first appeared to be an epistemological obstacle turns out to be a property of the thing itself.'[38] Indeed, the uncertainty principle is nothing but a signature of the intertwining between the invariant *eidos* that defines an object and its experimental phenomenalisation. If the momentum p is an objective property of an object, then the position q is necessarily, like the face of a die, a phase with no objective value. In consequence, the classical description of physical objects, which includes both q and p, is overdetermined. This means that in classical mechanics non-objective properties are wrongly considered objective. We can thus conclude that, *unlike classical mechanics*, quantum mechanics describes all the intrinsic objective properties of observer-independent objects.[39]

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[37] The mixing of these two operations is at the origin of so-called quantum entanglement. For example, the object $\psi = \alpha \otimes \phi + \beta \otimes \varphi$ results from the superposition of two phases, namely $\alpha \otimes \phi$ and $\beta \otimes \varphi$. These phases are obtained by 'pasting' the objects α and ϕ on the one hand and β and φ on the other one.

But not only does this interpretation allow us to contest the Ptolemaic reductions of quantum mechanics, but also suggests, secondly, a possible intra-physical solution to a transcendental problem, namely the problem of explaining the constitution of physical objects from the manifold of sensible (i.e. experimental) intuition. In Kantian terms, we can say that the unification in the representations of a physical object no longer requires the unity of transcendental apperception in the synthesis of these representations. The quantum theory of objects shows that the 'counting-as-one' of the phenomenological multiplicity of the object's phases is provided by the very *eidos* of the object. Thus the function of synthesis is anchored in the eidetic kernel that defines the *quiddity* of the object. More precisely, the self-synthesis of an object is performed by its self-operators. Each self-operator generates one kind of automorphisms of the object, that is to say a particular sequence of non-trivial 'phantasmatic' transformations of the object into itself. Each sequence of automorphisms connects the different phases belonging to the same orbit of phases. In turn, the self-operators are defined by the objective properties that constitute the object's *eidos*. In this way, the *eidos* that defines the invariant 'essence' of the object induces at the same time the synthetic functions that guarantee the objective consistency of its phenomenological manifold of aspects. In Hegelian terms, we could say that it is the essence of the essence to generate the manifestation of the object. The *essence* of the object is the projector of its *appearance*. Thus the objective consistency of the manifold of experimental intuition is not noetically constituted by the transcendental subject (or the experimental context), but rather induced by the 'eternal objects' that make ingression into nature.

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[38] S. Žižek, *The Indivisible Remainder* (London: Verso, 1996), 211.

[39] It is worth remarking that this point was recognised by Deleuze and Guattari in very accurate terms: '[...] even in quantum physics, Heisenberg's demon does not express the impossibility of measuring both the speed and the position of a particle on the grounds of a subjective interference of the measure with the measured, but it measures exactly an objective state of affairs [...] Subjectivist interpretations of thermodynamics, relativity, and quantum physics manifest the same inadequacies. Perspectivism, or scientific relativism, is never relative to a subject: it constitutes not a relativity of truth, but, on the contrary, a truth of the relative [...] Of course, a well-defined observer extracts everything that it can, everything that can be extracted in the corresponding system.', G. Deleuze and F. Guattari, *What is Philosophy?*, trans. G. Burchell and H. Tomlinson [London: Verso, 1994], 129-30.

Errancies of the Human: French Philosophies of Nature and the Overturning of the Copernican Revolution

Alberto Gualandi

1. THE 'FRENCH ANOMALY' AND THE RADICALISATION OF THE COPERNICAN REVOLUTION

It is customarily maintained that the Copernican revolution dealt a sort of originary blow to the narcissistic human self-image that had endured for two thousand years. According to Freud, after Copernicus man would have ceased to position himself at the centre of the universe; after Darwin, to position himself at the centre of living nature; and after the psychoanalytic revolution, to position himself at the centre of himself.[1] Within the horizon of contemporary philosophy, it is perhaps the French philosophies of the sixties which radicalised, in a materialist direction, this critique of the anthropocentrism cosubstantial with the Western metaphysical tradition, supplementing Freud's interpretation of the Copernican revolution with the lessons drawn from the other 'masters of suspicion', Marx and Nietzsche.

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[1] 'A Difficulty in the Path of Psychoanalysis' in *Introductory Lectures on Psychoanalysis* (London: Penguin Books, 1991), 325-6.

The radicality of this critique surpassed that of other national traditions of thought, for it did not stop at recognising the marginal position of the 'human' in the cosmos, living nature and the unconscious psychic system. Rather, it sought to weed out everything that still remained anthropocentric in the Western tradition after Copernicus; beginning with Cartesian dualism, which reserved for the human spirit alone the characteristics of finality and liberty, in an infinite Galilean cosmos, albeit one reduced to a mechanical system (endowed with movement and extension); and reaching as far as the transcendental forms and principles of Kant, who had continued to place the consciousness of man at the centre of the system of knowledge, morality and art.

This radical attitude on the part of French philosophers was not gratuitous, however. For it could be claimed that a number of philosophies which, in the second half of the twentieth century, claimed to draw the consequences of the lessons of Darwin, Marx, Freud, or of the great scientific revolutions of the past century, continued nonetheless to construct their systems upon some form of methodological dualism or linguistic transcendentalism which ended up reserving a privileged place in the system of knowledge for critical reflection on the human – its actions and cognitions, its possibilities and conditions. The French philosophers of the sixties attempted something more audacious: According to them, man and his thought would be but finite forms among others, all engendered on the basis of an obscure and infinite ground that one might call Being or Nature. The most extreme consequence of the Copernican revolution would therefore not be the death of God, but rather the disappearance of Man and of his 'face'.[2]

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[2] M. Foucault, *The Order of Things* (NY: Vintage Books, 1973), 387.

Now, although the radical character of this enterprise placed French philosophy in an anomalous and solitary position in relation to other traditions of thought, today it must be noted that it anticipated a tendency internal to many contemporary philosophical and scientific approaches whose stated goal is the naturalisation of the human and cognitive sciences. Comparing it with this contemporary tendency, at work in a number of disciplines – from neuroscience to human ethology, via cybernetics and evolutionary psychology – one might even affirm that the French anomaly harboured something more profound. Although the developments of modern science represented a privileged source of inspiration for them, the French philosophies of the sixties believed themselves capable of refusing those determinist and mechanist presuppositions that they attributed, above all, to their predecessor Descartes. For according to them, determinism and mechanism would be but anthropomorphic residues, models of thought that were still too humanist – the result of projecting human schemata of action upon an external nature deprived of its depth[3] – and which every properly materialist thought must rid itself of, if it would think the whole of Life and of Nature. As I shall try to demonstrate in what follows, the pertinence and the richness of this critical attitude, singularly characteristic of French philosophies of nature of the sixties, finds itself confirmed by the epistemological debate, presently in progress in the contemporary life sciences, which turns around problems of ontogenesis and 'actualisation'.

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[3] G. Canguilhem, *La connaissance de la vie* (Paris: Vrin, 1965), 182; Eng. trans. S. Geroulanos, D. Ginsburg as 'Knowledge of Life' (New York: Fordham University Press, forthcoming 2008); G. Deleuze, *Différence et répétition*, (Paris: Minuit, 1968), 360; Eng. trans. P. Patton as *Difference and Repetition* (London: Athlone, 1994); *Spinoza et le problème de l'expression* (Paris: Minuit, 1968) 207; Eng. trans. M. Joughin as *Expressionism in Philosophy: Spinoza* (New York: Zone Books, 1992).

However, my objective in the following pages will not be to sketch an apologia for an intellectual movement which tried to liquidate its Cartesian heritage by pushing to the maximum the materialist and anti-anthropocentric stance that had animated Western reflexion from Copernicus onward. What I shall try to show is only that this tendency, although legitimate, cannot succeed. It cannot succeed because the critical question raised by the *other* Copernican revolution that shook Western thought – *Kant's Copernican revolution* – continues to represent its unabsolved debt to thought. In the light of this second revolution, anthropomorphism can never be completely liquidated, since the question of the human is always ready to resurge qua transcendental question rooted not in immutable and eternal *a priori* forms and principles, but in the incontrovertible fact that man is indeed the being that interrogates nature, poses its questions to nature.[4]

How to escape this epochal dilemma which tears Western thought in two? Must one follow to the very end the direction indicated by Copernicus' scientific revolution, and end up dissolving the face of man in the 'waves' of an infinite nature?[5] Or must one instead follow the opposite tendency and, radicalising Kant's Copernican revolution, end up affirming, with Husserl, that 'the earth does not move'?[6] In other words, how are we to reconcile the equally legitimate stances of what appear today as the most opposed 'factions': That of philosophers (and scientists) of nature, and that of phenomenologists? And more generally, how are we to articulate the relation between science and philosophy in an epoch where everything seems to point to their mutual and radical exclusion?

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[4] E. Straus, 'Der Mensch als ein fragendes Wesen', in *Jahrbuch für Psychologie und Psychotherapie* 1, 1953: 139-153.

[5] Foucault, *The Order of Things*, op. cit.

[6] E. Husserl, 'Umsturz der kopernikanischen Lehre in der gewöhnlichen

Even if it must be brief, our analysis of the 'French anomaly', represented emblematically by the philosophies of nature of the sixties (an analysis to be developed further in part 2, below), and the reconstruction of the ways in which the question of the human resurges in them (and despite them) – at their very heart, in their (analogical) theories of individuation (part 3) – will allow us to foresee a solution which I shall outline in the final part of this text (parts 4 and 5). To place oneself at the centre of the cosmos and from there 'to pose questions to it'; or to displace oneself from this centre, to occupy, through an *eccentric* thought, the point of view of galaxies, of quarks or of neurons; returning to occupy once again the centre of one's own animal body, sensible and self-developing: These are activities accessible exclusively to a rather singular living being. A being which – beyond all suspicion of anthropocentrism or finalism, and in line with the most recent findings of evolutionism – one might also define as that being 'capable of error. A human error which is probably as one with errancy […]

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weltanschaulichen Interpretation', in M. Faber (ed.), *Philosophical Essays in Memory of Edmund Husserl* (Cambridge, Mass.: Harvard University Press, 1940), 307-25. Eng. trans. Fred Kersten as 'Foundational Investigations of the Phenomenological Origin of the Spatiality of Nature' in P. McCormick and F. Elliston (eds), *Husserl: Shorter Works* (Notre Dame, Indiana: University of Notre Dame Press, 1981): 222-237; revised trans. Leonard Lawlor in L. Lawlor (ed.), *Husserl at the Limits of Phenomenology* (Evanston: Northwestern University Press, 2002), 117-131.

and dissatisfaction'.[7] To try to understand more clearly the quasi-biological conditions of possibility of this characteristically human *errancy* – an errancy which, through the proxies of our senses and our bodies (and not despite them, as has often been said) leads us from the earth to the sun and from the sun to our brain – such is the task with which this text ultimately engages.

2. The World 'is' an Egg: Philosophies of Nature, Biological Ontogenesis and Human Individuation

I would like to begin this journey through what I have called the 'French anomaly' with a provisional response to the following question: At the level of philosophical reflection on the natural and life sciences, what happened in France in the sixties that was novel in relation to what had been going on in the preceding decades? I would say that the most apparent change was as follows: In the sixties, epistemological reflection on science gave way to a renaissance of *philosophies of nature*. This renaissance is a new and significant fact, for reasons that I will try briefly to enumerate.

Above all, for reasons internal to the French tradition of reflection on science: In the epistemological tradition of the preceding decades, philosophies of nature had been considered as the lowest degree of reflection on science. Brunschvicg, for example, identified philosophies of nature with the romantic and idealist philosophies of Schelling and Hegel. According to Brunschvicg, the latter took a dangerous step backwards in relation to Kantian epistemology, because not only did their post-Kantian philosophies of nature aim to grasp, in atemporal fashion, the *a priori* principles at work in the science of their time, they claimed to step beyond the methods and results of the different scientific disciplines by identifying ontological laws presiding over the historical genesis of scientific reason.[8]

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[7] G. Canguilhem, *Etudes d'histoire et de philosophie des sciences* (Paris: Vrin, 1970), 364.

A second notable reason: In my view, this movement of the renaissance of philosophies of nature relates to a tendency that belongs exclusively to French philosophy and which, during this epoch, is absent from other traditions of thought. Outside France, philosophical reflection on science is dominated by critical revisions of the neo-positivist paradigm put forward by authors such as Popper, Kuhn and Lakatos; or, on the German side, by authors such as Habermas. Reflection on science is above all a reflection on the *language* of science, and the Wittgensteinian distinction between the causal domain and the rational domain, the Popperian demarcation between context of discovery and context of justification, or the hermeneutic distinction between explanation and reconstruction, seem to prohibit any contamination between the object of science and the subject of reason, between the human mind and the nature of the objects and bodies studied by physics or biology. In short, outside France, epistemological reflection remains fundamentally Kantian, because it remains a reflection on the logical and discursive structures of the mind and of scientific reason. It is only in the last two decades that things have begun to change, in both England and the United States (and this in spite of the resistance of certain analytic philosophers, who tried to reterritorialize the Kantian transcendental problematic upon language). This change of direction is usually referred to as the programme of the *naturalisation* of the sciences of man and of culture. Everyone today has some idea of what this programme means and what it entails. The only thing I would like to note here is that this programme of naturalisation surely presupposes a certain philosophy of nature and of life, but the authors who put forward the programme do not consider that this conception of nature and of life has anything whatsoever to do with metaphysics, because they believe it possible to draw their conceptual tools from science itself, and in particular from the Darwinian conception of evolution. With the aid of several examples, I would like to show that the current partisans of this programme of naturalisation nevertheless find themselves confronted by problems fairly similar to those posed by the French thinkers who gave life to this renaissance of philosophies of nature.

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[8] L. Brunschvicg, *L'expérience humaine et la causalité physique* (Paris: Alcan, 1922).

Who are these French authors? I would like to name three: Gilbert Simondon, Gilles Deleuze, and Michel Serres. Which are the works to which I would attribute this turn toward philosophies of nature? *The Individual and its Physico-Biological Genesis*, written at the end of the fifties but published in 1964; *Difference and Repetition*; and *The System of Leibniz* and the two first volumes of *Hermes*. As far as Serres is concerned, I shall limit myself to a few citations through which I believe one can confirm the above claims about the rupture that took place between philosophies of nature in the sixties and Brunschvicg and Bachelard's historical epistemology. From Serres: 'The term "cut" is the mathe-mateme of discontinuity', but it is also the sign of a 'history that is normalised', 'ideal', 'based on a mathematical model', which rests in turn 'on an ethics': the ethics ‘of reform’ and of ‘the founders of the University’.[9] ‘Now, there exists no cut between science and philosophy. […] epistemology is more the *sign* of divorce than the possibility of an agreement, it designates the dehiscence, in trying to reduce it.’[10] This dehiscence can only be surpassed by a ‘new scientific spirit’ which decrees the ‘end of idealist theories of knowledge’ and of historical epistemologies,[11] and which ‘leads us towards a philosophy of nature’, where the information-structure is ‘inscribed’ in ‘the thing itself’, and where one could affirm that ‘there does indeed exist an objective transcendental’.[12]

As for Simondon, I shall limit myself to certain notions that are essential for understanding the rest of my argument. The central notion in Simondon’s system of nature is certainly that which gives the title to his masterwork: The notion of the process of individuation. Simondon’s philosophy of nature is without any doubt a philosophy of ‘univocal being’, since for Simondon a crystal, a drosophila fruitfly, a pig, or a philosopher, are all ‘individuals’. What makes a human being more individual than any other, however, is the fact that the process of actualisation through which a human individual is determined as such does not end at the moment of his death. I shall come back directly to this Simondonian way of posing the question of the human.

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[9] M. Serres, *Hermès II. L’interférence* (Paris: Minuit, 1972), 15, 213-4.

[10] M. Serres, *Le système de Leibniz et ses modèles mathématiques* (Paris: PUF, 1968), 64-5.

[11] M. Serres, *Hermès I. La communication* (Paris: Minuit, 1968), 66-7.

[12] M. Serres, *La naissance de la physique dans le texte de Lucrèce* (Paris: Minuit, 1972).

Let us turn now to Deleuze. In a certain sense, Deleuze's philosophy of nature seems the most distant from any possible epistemological interpretation.[13] However, I myself believe that every philosophy must demonstrate a certain comportment in relation to science, and I believe that Deleuze's philosophy of nature is capable of doing so – even that it was capable of doing something more. I said above that, for Brunschvicg, the major failing of philosophies of nature lay in their pretention to overstep science, in a deductive and *a priori* fashion. I am not sure that Deleuze actually made such a claim (extravagant for any historical epistemology). But his philosophy of nature was able to sketch out, according to a method that was neither deductive nor inductive, neither *a priori* nor *a posteriori*, the lines of the evolution or development of science, which were only virtually prefigured in the science of his times, but around which the science of our times is in the process of constructing a new scientific paradigm. To show this, I would like to take the example of biology and, in particular, to return to a celebrated page where Deleuze proposes to us an ontological model of the egg; or, better, the egg as model of the world:

> The world is an egg. Moreover, the egg, in effect, provides us with a model for the order of reasons: differentiation-individuation-dramatisation-(specific and organic) differenciation. We

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[13] In the Introduction of *Difference and Repetition*, Deleuze puts us on guard against any over-strict epistemological interpretation of his 'metaphysics'. 'A book of philosophy', Deleuze maintains, 'must be in part a very particular type of detective novel'; and 'on the other hand a type of science fiction', whose author knows very well that the usage he makes of science 'is not scientific' (ibid., xx-xxi). Twenty years later, in *Negotiations*, he recalls explicitly that epistemology was never his thing, and that he never considered it necessary to pass through epistemology in order to do philosophy.

> think that difference in intensity, such as it is implicated in the egg, expresses first the differential relations as virtual matter to be actualised. This intensive field of individuation determines the relations that it expresses to be incarnated in spatio-temporal dynamisms […] Individuation always governs actualisation […] Notions such as 'morphogenetic potential', 'field-gradient-threshold', put forward by Dalcq […] take account of this complex ensemble. This is why the question of the comparative role of the nucleus and the cytoplasm, in the egg as in the world, is not easily solved. The nucleus and the genes designate only the differentiated matter – in other words, the differential relations which constitute the pre-individual field to be actualised; but their actualisation is determined only by the cytoplasm, with its gradients and fields of individuation.[14]

This page is most significant, for many reasons. First of all, because it sums up the Deleuzian conception of structuralism, the problem of the relation between structure and genesis, ideal and real, virtual and actual; but also because of its reinterpration of the Kantian problem of the schematism and the transcendental. Secondly, it allows us to bring to light Deleuze's discursive strategies, his way of working with the science of his times, of putting into communication different theories and authors: in this case Simondon's theory of individuation and Dalcq's morphogenetic embryology. Re-read in the light of the great tradition of the philosophies of nature of Spinoza, Leibniz, Nietzsche and Bergson, the Simondonian theory of individuation allows us to see *in the egg a great metaphor of the world*.[15] Here is our provisional hypothesis: Deleuze's philosophy of nature, like every great philosophy of nature, allowed us to go beyond science because it succeeded in identifying the metaphors which underly the conceptualisations of science, its paradigmatic changes, its epistemic ruptures.[16] In what follows, I shall try to clarify further what should be understood by *metaphor*. For now let us try to confirm this hypothesis by returning to the example of the egg.

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[14] Deleuze, *Difference and Repetition*, op. cit., 323 (translation modified).

[15] According to Canguilhem, one can in fact maintain that the vitalist is someone driven to reflect on the problems of life through the contemplation of an egg rather

What problem is Deleuze coming to grips with by means of this complex set of concepts, in which Simondon's concept of individuation plays an important role? Deleuze, as we know, is an anti-Platonist. As such, he holds that what exists in the immanence of the world is not a copy of a model that would constitute the ideal mould of real individuals. What is real is not *the one* or *the transcendent*, but rather singularities and differences. Now, which concepts in contemporary biology fulfill the function of the transcendent model? Quite obviously, the concepts of biological code and of the gene. For an extremist geneticist such as Richard Dawkins, for example, we are nothing other than the vehicle of our genes, the corporeal envelopes of an information-model which exploits us as much as possible so as to transmit itself from generation to generation. For this ultra-geneticist conception, 'all the various complex aspects of being an organism, being a person, are merely ways in

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than through the use of a capstan and bellows (Canguilhem, *La connaissance de la vie*, Paris : Vrin, 1965).

[16] In discussing the relations between mechanism and vitalism, Canguilhem reminds us, among other things, that, paradoxically, philosophy can also indicate to science a position which the latter should still occupy, rather than occupy tardily, as Bachelard would have it, an already outdated position (Canguilhem *La Connaissance de la vie*, op. cit.,149).

which our selfish genes program the lumbering robots which constitute us, to serve their, that is the genes', interest.'[17] The most apt and high-performing are those which pass the test of selection. In this model, as can be imagined, there is not a great deal of room for differences. Differences are produced at the source, thanks to the copying mechanisms which Jacques Monod compared to a roulette wheel or a lottery. But once differences are produced, they are selected or eliminated as a function of the unique imperative of the survival of the fittest and best-adapted. In which case, the good news of the 'eternal return of the different' would afford us little hope. In other words, where there is nothing but chance and necessity, there is no longer any space for the virtual and for creation: Everything depends on the matrix, that is to say on the code in which the great book of the world is written.

But in that case, in the light of current biology, what validity can we grant the ontological model put forward by Deleuze in *Difference and Repetition*? I would like to respond to this question with the following citation:

> Living organisms exist in four dimensions, the three of space and one of time, and cannot be 'read off' from the single dimension that constitutes the strand of DNA. Organisms are not empty phenotypes, related one-to-one to particular patterns of genes. Our lives form a developmental trajectory, or lifeline, stabilized by the operation of homeodynamic principles. This trajectory is not determined by our genes nor partitioned into neatly dichotomous categories called nature and nurture.

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[17] S. Pinker, S. Rose, 'Pinker vs Rose: A Debate', at http://www.edge.org/3rd_culture/pinker_rose/pinker_rose_p4.html

> Rather, it is an autopoietic process, shaped by the interplay of specificity and plasticity. In so far as any aspect of life can be said to be 'in the genes', our genes provide the capacity for both specificity – a lifeline relatively impervious to developmental and environmental buffeting – and plasticity – the ability to respond appropriately to unpredictable environmental contingency, that is, to experience.[18]

I believe this citation suggests a perspective very close to that proposed by the metaphor of the egg. Above all, it tells us that the genotype is not a mould which univocally determines the individual. Between the genotype and the phenotype there intervenes a process of epigenetic development in which the role of the temporal variable is as important as that of the topologico-spatial. Structure is actualised by a process of development which introduces factors of stochastic and temporal variability that singularise the individual phenotype. In other words, organisms 'create themselves through the dynamic interplay of DNA and the cellular orchestra in which it's embedded, and the cells, with their external environment'.[19]

The above citations are not from Deleuze; they are taken from the books and articles of contemporary neurobiologist Steven Rose. They allow us to understand that the problems raised by Deleuze in the sixties are once more at the centre of the contemporary biological discussion. For they touch on the problems, today known as 'evo-devo', concerning the relation between development and evolution, epigenesis and the genetic code, neurobiological plasticity and cerebral modularity. But they touch also on larger questions concerning philosophies of nature and of life, ontology and gnoseology. According to Rose, the rigidly geneticist conception of a theorist such as Dawkins or Pinker – a conception Rose calls 'ultra-Darwinist' – is too static and mechanical, incapable of giving an account of the true becomings of nature. It freezes life and loses its becoming. It transforms 'processes into reified objects'. According to such a conception, true organisms, individual phenotypes, are simply copies of ideal models, which need expend no effort in order to actualise themselves in the concrete world, in the *here* and *now* of natural becoming:

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[18] S. Rose, *Lifelines: Life Beyond the Gene* (NY: Oxford University Press, 2003), 306.

[19] Pinker and Rose, 'Pinker vs Rose: A Debate', op. cit.

> The crucial thing is this. All living organisms have simultaneously both to be and to become. [...] And it's that dynamic, that self-construction, which is completely lost in the abstract understanding of genes and the behaviors they control.[20]

So as to deepen this comparison and to show that the relation between the Deleuzian concepts and those of contemporary biology is not a vague and pseudo-poetic one, we could construct an argument which, starting with Deleuze's proposed genetic reactualisation of Geoffroy de Saint Hilaire's concept of the plane of organisation,[21] sought to demonstrate that Deleuze attempts to *mathematicise* either the architechtonico-spatial components of genetic structure, or the temporal becomings through which they are actualised. In fact, it seems to me that the Deleuzian enterprise of employing both differential analysis and the topological mathematics of algebraic transformations to think genetic structure and its process of actualisation is close to that of contemporary biology, becoming concrete in the concepts of development genes – concerned with the architectonic structure, the organic *Bauplan* – and regulative genes, which determine the rhythms of its actualisation.[22] For with these two concepts, contemporary biologists try to describe the play of interaction between the spatial and temporal components of genetic structure in the domain of ontogenetic development as well as in that of macro-evolution.[23] As we shall see, these two concepts also have very important implications in relation to the individuative deceleration which characterises the human species as compared to that twin-species with which we share 98.6 percent of our genes – that is, the chimpanzee. Having insufficient space to enter into the details of this somewhat technical argument, I must come straight away to my conclusions.

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[20] Ibid.

[21] Deleuze *Difference and Repetition*, op.cit.,185.

Deleuze's philosophy of nature is not a vague metaphor in the sense that someone like Alain Sokal might suppose it to be. If it is a metaphor, it is so in a more noble sense, perhaps even in the sense that it grasps theoretical problems of science – problems which even the latter has itself not yet clearly perceived – and systematises them. It is a metaphor in the sense that one could say that every creative intellectual procedure proceeds via metaphor and analogy. For, following Lakoff and Johnson, metaphors and analogies can be defined not as mere rhetorical figures, but as heuristic strategies which allow the conceptualisation of new domains of being and of experience, by transposing structures, schemata or models from one domain of knowledge to another, from a well-known domain to a lesser-known one.[24] Once again, I would like to use some citations to express this idea more effectively. The first is drawn from Stephen Jay Gould who, in posing the problem of the authentically creative method of science, and in particular the method which led Darwin to the formulation of the theory of evolution by selection, states that he has often been impressed by the fact that the theoretical contributions most decisive for the elaboration of the Darwinian theory did not come from biology, but rather from sociology (Comte), from economics (Smith) and from population statistics (Malthus). From this fact, Gould concludes as follows:

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[22] A. Prochiantz, *Les anatomies de la pensée* (Paris: Odile Jacob, 1997); G. Marcus, *The Birth of the Mind* (NY: Basic Books, 2004).

[23] S. J. Gould, *The Structure of Evolutionary Theory* (Cambridge, Mass.: The Belknap Press of Harvard University Press, 2002), 1322ff.

> If, on this basis, I might advance an hypothesis on what constitutes the common denominator of genius, I would conclude that it is characterised by vast interests and by the capacity to construct fruitful analogies between different domains of knowledge.[25]

According to Gould, in other words, the inventive method of science is 'neither deduction', 'nor induction', but 'what is given in the middle': that is to say, *analogy*. If this is so for science, one might well think that it is even more so for philosophy. And I would say that it is qua faculty of grasping reflexively the metaphors and analogies common to different domains of knowledge that philosophy, even today, can boast of an advantage in relation to science. I also think that it is to the systematic employment of this faculty of tracing passages and analogies[26] that we owe a good part of the theoretical charm exerted by that crafty genius who was Gilles Deleuze. But let us try to be more precise, and to redefine metaphors and analogies through the medium of a more technical concept, that of *transduction* – a metaphorical term itself (originally drawn from bacteriology), which allows us to displace these concepts into the context of the theory of individuation. Simondon writes:

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[24] G. Lakoff and M. Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 1980).

[25] S. J. Gould, *The Panda's Thumb* (London: Penguin, 1980), 57.

> Transduction can be a vital operation; in particular, it expresses the sense of organic individuation; it can be a psychic operation and an effective logical procedure, even if it is in no way limited to logical thought. In the domain of knowledge, it defines the very nature of invention, which is neither inductive nor deductive, but transductive, that is to say corresponding to a discovery of dimensions according to which a problematic can be defined; it is that which is valid in the analogical operation. This notion can be employed to think the different domains of individuation [...] Objectively, it allows us to understand the systematic conditions of individuation, internal resonance, the physical problematic. Logically it can be employed as the foundation of a new type of analogical paradigm, to pass from physical to organic individuation, from organic individuation to psychic individuation, and from psychic individuation to subjective and objective transindividuation, a passage which defines the plan of this research.[27]

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[26] The faculty of tracing passages and analogies to arrive at models and structures which remain invariant in different domains of knowledge, for example from the mathematical and physical domain to the biological and socio-economic (Deleuze, *Difference and Repetition*, op. cit., 184-6).

[27] G. Simondon, *L'individuation psychique et collective* (Paris : Aubier, 1989), 25-6.

The only objection I would put to Simondon is that this research plan can only be carried to completion in bringing to light the singular place and the crucial communicative role played by that domain of being through which analogical transduction effectively becomes a logical procedure and an heuristic method. In other words, the project that animates philosophies of nature can only succeed on condition of recognising in the human the source and the condition of all metaphorical transduction.

3. ERRANCIES OF THE ULTRA-NEOTENIC ANIMAL

I thus come to the central part of my argument concerning the place which the question of the human holds in the French philosophies of nature. To avoid all sterile polemic on the question of the humanism or anti-humanism of the philosophy of the sixties, I would like to tackle the question from a biological point of view: What place do the philosophies of nature of the sixties reserve for the human animal, within their system of nature or of life? I say the human *animal*, since all the authors I am speaking of would probably agree 'that one cannot remove man from the vital' and that 'the notion of anthropology already includes the implicit affirmation of the specificity of Man, separated from the vital'.[28]

Man, however, is a symbolic animal, and one must therefore take account of the way in which symbolic structures of sense and signification, whether linguistic or pre-linguistic, are rooted in the living body. For the ambition of every philosophy of nature is to retrace a genesis of thought, by retracing the path of the emergence of thought and culture on the basis of nature. The question that must be asked is this: Do these authors succeed in identifying the precise place where the symbolic is rooted in the biological nature of the human animal? Have they not, rather, simply juxtaposed or superposed, in a sort of onto-epistemological parallelism, the question of the symbolic onto that of the living and of animality? And does not this superposition lead these authors to treat the great problems of the sciences and of culture – language, history, society – as simple structural effects, like the products of a spatio-temporal process of individuation that follows the same morphogenetic laws, or the same mathemes, as are in play in the production of nature? And because of this, don't they end up seeing in language, history and society the effects of a machinic calculus that subtracts from human symbolic acts what I would like to call their metaphoric and communicative intentionality?

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[28] Ibid., 181.

In posing these questions I do not want to maintain a dualist position according to which culture and thought would be the effect of an irreducible irruption. Just as biologists and palaeo-anthropologists such as Gould, Tattersall or Corballis have recently shown, I hold that language, culture and history take to their extreme consequences a logic of restructuring *exaptation* already at work everywhere in the living world. For this logic of *exaptation* or, as Lévy-Strauss and Jacob called it, this strategy of *bricolage*, represents a process of functional displacement or cognitive *transduction* by virtue of which an anatomical, perceptive, symbolic or institutional structure comes to be used for ends different to those which it had at its origin.[29]

However, what remains to be explained is the reason why the *exaptive* bricolage assumes in man a far more important cognitive and heuristic role than in every other animal. Now, the sole response I know to this question is the following: This cognitive transfer is motivated by the fact that man is an animal which, to live, is obliged to establish between itself and the world an analogical and communicative relation. It is because of this originary communicative relation that a symbolic structure must not be considered as the simple result of a 'connectionist calculation'.[30] I am of the view that every symbolic structure, in fact, attempts to resolve a typically human problem, the problem posed by the fact that every process of symbolic individuation can only be accomplished in man in an indirect fashion, that is to say by virtue of the mediation of the *Other*. We might underline the philosophical consequences of this thesis in familiar terms, in the following way: Every process of cognitive individuation of external reality is metaphorised by a process of subjective individuation, just as every process of individuation of the structures of reason and of mind is mediatised[31] by processes of individuation taking place in external reality. Simondon once more: 'The individuation of the real external to the subject is grasped by the subject by virtue of the analogical individuation of knowledge in the subject […] This grasp is therefore […] an analogy between two operations, which amounts to a certain mode of communication'.[32] Now, to what is owed this analogical mode of communication which is at the basis of all animist and anthropomorphic, totemistic, religious and transcendent phenomena,[33] but which is also at the foundation of the fact that man is the only living thing that has a need to identify itself metaphorically with the Other – another animal, a machine or even a God – to know what he is and how he should act in the world?

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[29] According to a neurobiologist such as Vilayanur Ramachandran, or a cognitive linguist such as George Lakoff, the basis of this heuristic transfer is to be found in the diffused hyper-connectivity of the human brain which permits the establishment, in the course of the process of human ontogenesis and phylogenesis, of synaesthetic and symbolic relations between the different sensori-motor modalities, between cerebral regions which preside over the elaboration of the data of hearing and sight, and those which preside over the control of the hand and voice. The hypothesis that the process of anthropogenesis could have passed by way of the liberation of the hand and the restructuring exaptation of the phono-auditive apparatus would find here a neurobiological confirmation.

[30] P. Maniglier 'Il calcolo delle culture. Lo "strutturalismo" nella storia dell'intelligenza artificiale' in *Discipline filosofiche*, XII, 1, 2007.

To respond to this question, we must once more turn to biology, reformulating the question as follows: If we remove from man the faculty of understanding and elaborating that group of more or less abstract and conventional information which are symbols and signs, must we then consider man an animal like all the others? For ultra-Darwinist biologists and psychologists such as Dawkins and Pinker, man is very simply an overendowed ape, to which a surplus of 900 cubic centimetres of cerebral matter furnishes cognitive modules, genetically predetermined, which allow it to accede to the dimension of language and other cultural significations. For a biologist such as Gould, but also for neurobiologists such as Ramachandran, Gary Marcus or Alain

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[31] See for example Simondon's critique of the hylomorphic model of Aristotle and Kant, and Serres's metaphorological analyses.

[32] Simondon, *L'individuation psychique et collective*, op.cit., 30.

[33] Serres, *La naissance de la physique dans le texte de Lucrèce*, op. cit.,150-1.

Prochiantz, however, this response risks attributing to man *too many* qualities, in making him the contrary of what he is.[34] Man is not a hyperadapted animal, but rather a *neotenic ape*, with a delayed ontogenetic development, which natural selection favoured at a time of great climatic change[35] because of its maladapted and 'infantile' character, because of its quasi-fœtal cerebral plasticity, which permitted it to specialise in (territorial) non-specialisation, in communication and in sociality.[36]

It may be noted that this neotenic conception of man is close to the Simondonian conception of individuative retardation which opens the human being onto the transindividual, psychic and social dimension of the symbolic. But it also comes close to the Deleuzian conception of man as the essentially deterritorialized being, and Canguilhem's thesis according to which man is distinguished from every other living thing by that anxious errancy which pushes him continually to modify his conceptual *a prioris*. For, let us recall in passing, this conception had already been known in France since the beginning of the thirties, above all thanks to Gawin de Beer's work *Embryologie et évolution*. In his major work, Simondon also cites Lodewijk Bolk, as well as the concept of neoteny,[37] and one of the categorial couples used by De Beer's embryology is that of virtual and actual, later to be reprised by Simondon and Deleuze. In reprising the thesis formulated by Bolk in 1926, De Beer, in this little book, proposes a heterochronic conception of development and evolution, emphasising the concept of human individuative retardation or neoteny.[38] This conception would later be taken up again by Gould, who would show (after Portmann), how human temporality must in reality be characterised by a double heterochronic phase, defined by certain authors as ultraneoteny.[39] In human ontogenesis, the individuative retardation – expressed above all in the almost disproportionate prolongation of the condition of neonatal and infantile dependence (and then in adolescence and in a period of post-reproductive old age), but also, at the morphological level, by the conservation of fœtal characteristics (concerning the reduced size of the mandible and the ocular cavities, or the advanced position of the *foramen magnum* and the vagina) – is preceded by a phase of intra-uterine acceleration.[40] This phase of intra-uterine acceleration is characterised by an increased rate of brain growth whose consequence is a premature birth (around ten months early).[41] This birth is rendered necessary by the form of the pelvis in the female biped, but also by the cognitive and behavioural advantages that the human species received from the fact of its possessing a quasi-fœtal brain which is exposed to the conditioning of the familial and natural milieu in a premature and still very plastic state. This brain, which comes into the world 23 percent developed – as opposed to the roughly 40.5 percent of the chimpanzee[42] – would however be completely inapt to face the world, and to make sense of the profusion of *meaningless stimuli* to which it finds itself exposed, if it was not in a position to transpose into all sensorial modalities the communicative structure which links the infant to its mother and which the auditory modality had already begun to exercise in the darkness of the uterine night.[43] This communicative structure is what allows different sensory modalities to maintain synaesthetic and metaphorical relationships which distinguish the brain of the human animal from that of every other animal. In conclusion, *man is a symbolic animal because its ultra-neotenic condition imposes upon it the maintenance of a communicative relation with the Other in order that it might begin, and pursue in a sufficiently successful fashion, its process of cognitive, emotional, social and linguistic individuation.*

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[34] A. Prochiantz, *La construction du cerveau* (Paris: Hachette, 1989); G. Marcus, *The Birth of the Mind* (NY: Basic Books, 2004); V. Ramachandran, *The Emerging Mind* (London: Profile Books, 2004).

[35] S.M. Stanley, *Children of the Ice Age* (NY: Freeman, 1996); J. Gribbin and J. Cherfas, *The First Chimpanzee* (London: Penguin, 2001).

[36] S. J. Gould, *Ontogeny and Phylogeny* (Cambridge, Mass.: The Belknap Press of Harvard University Press), 402; *Ever Since Darwin* (London: Penguin, 1978); A. Prochiantz, *La philosophie dans le boudoir* (Paris : Odile Jacob, 1995), 143.

[37] G. Simondon, *L'individu et sa genèse physico-biologique* (Paris : PUF, 1964), 280.

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[38] G. De Beer, *Embriologie et évolution* (Paris: Amédée Legrand 1930), Ch. VIII.

[39] M. Mazzeo, 'Il tempo del tatto' in Contessi, Mazzeo, Russo (eds.), *Linguaggio e percezione* (Rome: Carocci, 2002), 67; *Tatto e linguaggio* (Rome: Laterza, 2005); *Storia naturale della sinestesia. Dalla questione Molyneux a Jakobson* (Macerata: Quodlibet, 2005).

[40] A. Gehlen, *Man: His Nature and Place in the World*, trans C. McMillan and K. Pillemer (NY: Columbia University Press, 1988); Gould, *Ontogeny and Phylogeny*, 369-370.

[41] Considered in terms of the relation between the neonatal and adult size in other species.

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[42] Gould, *Ontogeny and Phylogeny*, op. cit., 366-7, 371-2; *Ever Since Darwin*, op. cit., 59-60.

[43] Gehlen, *Man*; A. Tomatis, *L'oreille et le langage* (Paris: Seuil, 51); D. Meltzer, *Explorations in Autism* (London: The Ronald Harris Educational Trust, 1975); M. C. Corballis, *The Lopsided Ape* (Oxford: Oxford University Press, 1991), 213; T.J. Crow, 'Auditory hallucinations as primary disorders of syntax: An evolutionary theory of the origins of language' in S. Spence and A. David (eds) *Voices in the Brain: The Cognitive Neuropsychiatry of Auditory Verbal Hallucinations* (Hove, East Sussex: Psychology Press, 2004), 124-46.

Now, I believe that this neotenic conception of the human animal has most significant consequences for philosophy – or, better, for the relation between the natural and biological sciences and the human sciences, such as cultural anthropology, psychoanalysis, linguistics and sociology. On the other hand, I believe that this problem allows us to identify a true difficulty with structuralism, because if one does not take account of this communicative structure which orients human anthropogenesis, then the onto-epistemological isomorphism or parallelism between natural structures and psychic, social and cultural processes of individuation becomes merely what Aristotle would call a *metabasis eis allo genos*, that is to say a categorial transgression or 'category mistake' which, to cite Serres or Simondon once more, could also be defined as a 'bad analogy'.[44] It is an analogy behind which one might also recognise the transcendental illusion which leads to the presumption of a new absolute knowledge and to the scientistic suppression of that effort of critical reflection concerning human knowledge and its history, which – beyond every legitimate aspiration to a rebirth of (anti-finalist) metaphysics of nature and of life – is also philosophy.

4. THE MÖBIUS BAND OF BEING AND THOUGHT

Let us try now to systematise the analyses presented above in a critical fashion. At the heart of these analyses we saw emerge forcefully the 'fundamental thesis, without which human experience in general would remain incomprehensible: the thesis of the *communicative character* of this experience'.[45] In its most general signification this thesis denotes a set of dynamics singularly characteristic of human experience: metaphorical and synaesthetic translations, functional restructurings and 'cognitive mappings', sensori-motoric exaptations and inferential invariances which permit a circulation among different domains of experience. These dynamics are essentially characteristic of human experience because it is thanks to them that a communicative and circular relation is established between the internal and external world, between individual consciousness and the social milieu, between the human world and natural reality.[46] Although propositional language represents the principal vector of this experiential dynamic, the roots of the communicative structure of experience go deep into a sensory and pre-linguistic dimension, a dimension which furnishes the 'embodied' foundation of the syntactic, semantic and pragmatic structures of 'audio-vocal' language. This thesis has a crucial importance for the horizon of contemporary philosophy. In fact, to describe this set of communicative dynamics means, on one hand, to stay close to the task which phenomenology assigned to philosophy.[47] On the other hand, this task is perhaps also compatible with that proper to an epistemology which, in transgressing the indications of phenomenology, refuses to resign itself to accepting the antinomies which our epoch imposes upon philosophy: The antinomy between sensory experience and propositional language (and, consequently, mathematical symbolism); the antinomy between Kant's 'Copernican revolution' and Copernicus' own. In what way might these antinomies be surpassed?

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[44] Simondon, *L'individu et sa genèse physico-biologique*, op. cit., 280.

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[45] Gehlen, *Man.* op. cit.

[46] Gehlen, *Man*, op. cit.; J. Jayne, *The Origin of Consciousness in the Breakdown of the Bicameral Mind* (Boston: Houghton Mifflin, 1990); G. Lakoff and N.E. Núñez, *Where Mathematics Comes From. How the Embodied Mind Brings Mathematics into Being* (NY: Basic Books, 2000); V. Ramachandran 'Hearing Colors, Tasting Shapes', in *Scientific American* 288, 5, 2003: 42-9.

[47] This task might be described effectively as follows: 'To explore human experience, revealing its depth and wealth, instead of reducing it, [...] and to resist the temptation to take [the data of experience] for coded signs which reveal their true meaning only after an intricate process of deciphering' (E. Straus, in H. Spiegelberg, *Phenomenology in Psychology and Psychiatry* (Evanston: Northwestern University Press, 1972), 263, 267.

If we are today to sketch out an adequate image of the human being and its singular mode of experience, we must try to construct a sort of *theoretical interface* capable of establishing a *circular* and *communicative* relationship between science and philosophy. It is firstly a question of avoiding the imprisonment of theory between the aprioristic schemata of philosophy, but also one of avoiding forcing it into a scientific empiricism insufficiently elucidated in terms of a comprehension of its own conceptual foundations. The word 'theory' should therefore not be understood here uniquely as 'a *static* set of propositions in accord with the facts', but also as an interpretative *dynamic* in a state of circulation 'from below to above'; and, inversely, from 'above to below': from concepts to experience, and vice versa. It is a question here of putting into communication the customarily separated dimensions of 'subjective intentional sense' and 'objective empirical facts', without falling back into the rigid separation between *Naturwissenschaften* and *Geisteswissenschaften.* This rigid distinction is inapplicable in the present context, since the object and the subject of investigation are 'the same':[48] man in his unity and his corporeal and spiritual determinations. In other words, it is a question of giving an account of human experience in the duplicity of its *natural* and *cultural* determinations. On one hand, an experience rooted in a *biological, natural body*, in its singular physiology and sensoriality; on the other, an intentional experience which is constructed and developed in a communicative relation with the *Other*, which is structured and stabilised by virtue of the institutionalised forms of *cultural* intersubjectivity.

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[48] E. Husserl, *Crisis of European Sciences and Transcendental Phenomenology* (Evanston: Northwestern University Press, 1970), §53.

In the light of these methodological presuppositions, the central thesis animating this new image of the human could well be reformulated in the following way: Since the human body is an ultra-neotenic body – organically non-specialised and cognitively speaking not 'pre-wired' for any specific determinate milieu – human experience is coordinated and structured in a communicative relation with the Other, compensating for its extra-specific instinctive deficit through communicative, intra-specific and quasi-instinctive 'circuits', which 'from our origins' (phylogenetic and ontogenetic) have favoured in a determinative fashion the survival of the species. In other words, the alterity towards which the *erfahrende Bewusstsein* intentionally transcends is not originarily that of the object or of the external world (the *Allon*), but rather that of other human beings: the *Heteros*.[49] Or, in still other words, the relation with the object is 'intentioned' in a metaphorical and mediated fashion by the relation with the *Other*. To affirm this does not mean, however, rushing headlong into an 'intersubjective idealism', denying that the 'external object' possesses an 'ontological' existence 'already', or that it has a (physical, chemical, biological) structure *in itself*. It means, rather, affirming that this object is not yet endowed with a sense *for us* and *for itself*. The fundamental theoretical kernels of the two antithetical conceptions of the movement of auto-constitution of the human spirit – phenomenology in its Hegelian and Husserlian guises – are thus superposed, their features now agreeing.

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[49] E. Straus, 'Psychiatrie und Philosophie', in H.W. Gruhle, R. Jung, (eds), *Psychiatrie der Gegenwart*, Band I/2, (Berlin: Springer, 1963), 969.

What there is of truth in transcendental philosophy and in phenomenology – that is to say, in the fact that human consciousness is self-constituted in the course of an historical and intersubjective genesis whose sense is not predetermined in advance and which, opening onto the future, is thus always exposed to the risk of falling back into the past – must not, however, make us forget that the foundations of this genesis project their roots back into *Nature*. As was shown by the French philosophers of the sixties, along with the contemporary biologists which we have met along our way, man is only one living form amongst others: A form which has detached itself, during an infinitely short time, and 'by way of an hereditary error', from the obscure and chaotic ground of a nature which ceaselessly actualises itself by bricolaging '*a priori*' structures and forms (which we share with all the other animals), and upon which are founded our cognitive strategies for the capture of information which, in large part, is already inscribed in things.[50] In this sense, human 'knowledge' cannot be anything other than the 'anxious search for the greatest quantity and the greatest variety of information. Consequently, to be a [human] subject of knowledge, if the *a priori* is within things, if the concept is in life, is only to be unsatisfied with the sense that is found. Subjectivity is thus nothing but dissatisfaction. But perhaps this is life itself.'[51] From this point of view, contemporary biology thus harbours a 'philosophy of life'[52] whose aspirations would be no less totalising than those (opposed to it) advanced by the philosophies of history and of consciousness. But, after all that we have said about the neotenic nature of man – and the interactive (stochastic and temporal) play between information and milieu, between structure and actualisation, strongly amplified by the human brain – can we stop there? To accept in their ultimate consequences the stances taken by these philosophies of nature and life seems to project us into a profoundly contradictory situation, where the specific pertinence of 'human errancy' in the 'metaphorico-transductive' process of knowledge – a pertinence which we have tried to bring to light throughout the above – becomes 'erased' by the great current of life. Can we be satisfied with this dazzling short-circuit between being and thought; or, in other words, with this unsurpassable antinomy between philosophies of being or nature and philosophies of consciousness or culture?

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[50] Canguilhem, *Etudes d'histoire et de philosophie des sciences*, op. cit., 364.

Let us try first of all to take the measure of this apparently contradictory situation by conceptualising it symbolically, which means assuming this situation in all seriousness by pushing to the maximum the circular dynamic which it ceaselessly engages. The appropriate symbol is that of the Möbius band, where it is always possible to reverse the relation of foundation between 'that which founds and that which is founded': between subject and object, theory and experience, intentions and causes, science and philosophy. This possibility of reversal is owed in the last instance to a fact that is at once banal and paradoxical, and whose meaning we have not yet completely grasped. On the one hand, man is an infinitely small part, an infinitesimal element, of a nature which surpasses him spatio-temporally on every side and which envelopes him as an All; on the other, this idea of 'Nature', just like the Kantian idea of the 'world', 'is neither object nor concept'. For it is founded and constituted by virtue of a mental activity which is necessarily rooted in a body and which is necessarily 'centred' on sensory and cognitive structures which belong inalienably to it. Its mental activity – including scientific activity – can never be emancipated or completely abstracted from these structures. This is why all those who, from Bachelard onwards, considered that the Copernican revolution, just like every other scientific revolution after it, determined a complete and definitive rupture with the body and its sensory modality of knowledge, are seriously mistaken. In my view, the whole problem is rather to comprehend how there can exist an animal that is capable of causing its thought to 'get out' of its body, and from the relation that every animal maintains with its milieu,[53] so as to install this thought in the place of God, of the sun, of the proton, the neuron, and from this point of view – errant and anxious, taken up in an unsatisfied and incessant movement – to watch itself live, know, and think.

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[51] Ibid.

[52] Ibid.

Returning for now to the Möbius band and to this unsurpassable circularity: If, from the point of view of science, it is natural causes and processes that produce an individual body and engender consciousness, from the point of view of modern philosophy, the causal concepts of science are but theoretical abstractions progressively constructed in the course of a genesis whose point of departure must be the 'intuitions' of sense and the *a priori* structures of consciousness. Let us represent the first 'side' of the band as a sort of *eccentric* dimension in relation to the human, to its body and its consciousness, a sort of *Copernican vector* typical of modern science (and paradoxically, of ancient science).[54] From this point of view, Kant's Copernican revolution – the continuation and deepening of Descartes' 'subjectivist' revolution, and the anticipation of Husserl's 'phenomenological revolution' – is not completely symmetrical, in the domain of philosophy, with the scientific revolution unleashed by Copernicus, but rather precisely its *reversal*. This gives the impression of a complete opposition, a radical divergence between science (centred on the category of causality) and philosophy (centred on the category of intentionality). For, whereas science identifies in finalist anthropocentrism the insupportable evil of philosophy,[55] philosophy accuses science of objectifying man and of dehumanising the world and the life upon which all scientific enterprise is founded.[56] Whereas science tries to mobilise our reflection ever more by pushing it to adopt the point of view of the solar system, the universe, the subatomic particle or the neuron, modern philosophical consciousness arrives at the scientifically scandalous affirmation according to which the Earth, qua originary soil of all quotidian and scientific knowledge, 'does not move'.[57] Hence the exigency of defining a new circular and communicative relation between science and philosophy, fit to take account of the necessary complementarity between the *critical* and *eccentric* dimension of man[58] and his singular place in the All of Being or of Nature.[59] This exigency nevertheless finds in our perspective, a collocation different from that which philosophy usually assigns it: The pivot of this communicative relation is not represented by the 'transcendental ego', a self-evident object or a self-conscious subject of thought, but rather by a body that senses and develops in relation to its milieu according to intentional modalities of a particular type. An ultra-neotenic body that, in the course of the anthropogenic process, has discovered strategies that have permitted it not only to see, touch and move in a singular fashion, but also to speak of the Other and, ultimately, to *hear* itself *think*.

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[53] A. Prochiantz, *Machine-Esprit* (Paris : Odile Jacob, 2001), 154.

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[54] E. Straus, 'The Expression of Thinking' in J.M. Edie (ed.), *An Invitation to Phenomenology* (Chicago: Quadrangle, 1965).

[55] J. Monod, *Chance and Necessity* (London: Fontana, 1974).

[56] Husserl, *Crisis*, op. cit., §2.

5. EMBODIED TRANSCENDENTAL PHILOSOPHY

The methodological hypothesis orienting our research is that the 'eye' and the 'ear', the 'hand' and the 'voice' represent corporeal-mental structures around which pivot the communicative relation between the 'eccentric' vector of science and the ‘centric’ vector of philosophy. Organs and functions of objective and biological bodies and, at the same time, *a priori* structures of phenomenological consciousness, the human senses can only be described in their function as ‘interfaces’ between mind and world by reconciling an objective ‘third-person’ description with a subjective ‘first-person’ modality. If no-one can know what seeing, touching or hearing means without being afforded the possibility to accede directly and in the ‘first person’ to the different modalities of sensory feeling; no-one can say what effect proves one is a ‘human being’ without situating oneself at the ‘centre’ of a singular body that, even before it ‘thinks’ in objective fashion, must be lived, in the first person and subjectively, according to the synaesthetic and metaphorical modalities unavailable to any other animal. Although for man, as for other animals, the senses represent those *material a prioris* that function as ‘categorial axes’ around which turn the relation of mutual implication between consciousness and milieu, human beings seem capable of constructing a scaffold of intrasensorial schemata, ever more exempt and abstracted from the corporeal *hic et nunc*, and which find their highest expression in audio-vocal language.[60] My suggestion is that our experience of our own ‘mute thought’ or interior dialogue – an experience upon which, in large part, our feeling of self-consciousness and self-determination is founded – is in reality closely linked to the function of silent self-hearing which the ear gradually assumes in the course of the phylogenetic process of anthropogenesis (*hominisation*). If we must therefore maintain – just as the partisans of the ‘linguistic turn’ do – that it is in language that the question introduced by the 'what' ('What is man?') changes sign, being transformed into the question concerning the 'who' ('Who is man?') of he who asks the question; it is also true that the mute and silent thought which we identify with our interior 'I' is rooted in the terrain of a sensory activity already endowed with its own intentionality.

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[57] Husserl, 'Umsturz der kopernikanischen Lehre in der gewöhnlichen weltanschaulichen Interpretation', op. cit.

[58] H. Plessner, *Die Stufen des Organischen und der Mensch*, in *Gesammelte Schriften* (Frankfurt: Suhrkamp, 1980-1985); *Die Frage nach der Conditio Humana*, in *Propyläen-Weltgeschichte* (Frankfurt/Berlin: Verlag Ullstein, 1961).

[59] M. Scheler, *Die Stellung des Menschen im Kosmos* (Darmstadt: Otto Reichl-Verlag 1928); H. Jonas, *The Phenomenon of Life. Toward a Philosophical Biology* (NY: Harper and Row, 1966).

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[60] A. Clark, *Being There* (Cambridge, Mass.: The MIT Press, 1997).

As Helmuth Plessner and Erwin Straus have shown, this originary sensory intentionality can only be grasped by carrying out a reversal of direction in every objective description – physiological, neurobiological, behavioural – of sensory activity, a reversal which results in replacing the third person with the first. And so it is that, at the precise point where this replacement happens, the fundamental philosophical question concerning the conditions of possibility of experience is reintroduced, through a sort of reversal or epistemological *Umkehrung* internal to the eccentric and objective descriptions of science and the philosophies of Nature. In a certain sense, this reversal of perspective, which is also a reversal of the Copernican revolution, is not new. Plessner calls it 'critique of sense' or 'aesthesiology', and maintains that every biological science or philosophy of nature and of life which claims to assign man his place in the order ('vertical' and of growing complexity) of living nature, absolutely cannot pass from this ('horizontal') dimension which, in their 'heterogeneous unity', the senses half-open to the 'transcendental I' of consciousness. This aesthesiological reversal was then radicalised by Straus in a phenomenological direction, by showing, on one hand, that only the activity of sensing allows us to accede in the first person to that which is *real*; and on the other, that the aesthesiological analysis of diverse sensory modalities allows us to avoid all recourse to an intentional consciousness which – as is still the case in certain analyses of contemporary neurobiologists who wish to explain in purely causal and objective fashion the engendering of consciousness on the basis of bodies and emotions – *contemplates* sensory contents from without, like a spectator who *watches* a 'film' that passes before the mental *eye* of *its* consciousness.[61] In conclusion, according to our hypothesis the paradigm of the ear and the voice would allow us to surpass the tactile and ocular dichotomies which are still at the basis of contemporary science, as well as transcendental philosophy.

Qua sensing and self-developing organism, the living body is already endowed with an intentionality in relation to its milieu. In being incarnated, however, in a multiplicity of sensory modalities, this intentional structure is split into a plurality of *a priori* forms concerning space and time, the possible and the real, the extensive and the intensive, distance and direction, passive and active character, pleasure and pain.[62] These categorial structures, incarnated in different sensory modalities, pose the problem of their order and their integration into a unitary structure, of which the 'transcendental I' is a *result* rather than a *condition.* In Straus, Plessner and Gehlen's aesthesiological perspective, the 'Mind's I' is the product of intrasensorial schemata capable of surmounting this modal difference by transcending the dimension of the corporeal *hic et nunc* through contents of experience ever more abstracted from direct sensory contact with reality. Visual data are thus allowed to symbolically take the place of tactile data, the phono-auditive gesture to replace visual data, and ultimately the ear comes to relieve the voice, by becoming silent discourse or mute thought. This aesthesiological redefinition of the Kantian problem of the schematism of the imagination plays a crucial role in our attempt to establish a communicative relation between contemporary science and philosophy. On the neurobiological side, this aesthesiological hypothesis today finds corroboration in those theories that try to explain the emergence of consciousness without reference to any central instance assigned in advance the task of integrating information coming from different cortical regions. On the palaeo-anthropological side, it finds confirmation in those theories of cultural phylogenesis which identify in the processes of anatomical and cerebral exaptation, in the strategies of motor and sensory exemption, and in the synaesthetics and the metaphors between different cortical regions, the very vector of the process of anthropogenesis (*hominisation*). In light of these theories, internal self-consciousness now appears as a sort of 'refolding' or 'circumvolution' of a 'phenomic surface' – deprived of all topological distinction between interior and exterior, since it lacks all 'thickness' – which is incarnated in the aesthesiological structures of sense and perception. It is this absolute phenomenological surface[63] which might be considered as the veritable matrix of sense, the Möbius band of which we spoke above.

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[61] A. Damasio, *The Feeling of What Happens. Body and Emotion in the Making of Consciousness* (NY: Vintage, 2000), 24. For a deconstruction of this ocular metaphor employed by Damasio, see J.-P. Petit's general introduction in J.-P. Petit (ed.), *Les neurosciences et la philosophie de l'action* (Paris : Vrin, 1997), and J.-P. Changeaux and P. Ricoeur, *Ce qui nous fait penser: La nature et la règle* (Paris: Odile Jacob, 1998), Eng. trans. M. B. DeBevoise, *What Makes us Think?* (Princeton and Oxford: Princeton University Press, 2000).

[62] E. Straus, 'Aesthesiology and Hallucinations' in R. May, E. Angel, H.F. Ellenberger (eds), *Existence* (New York: Simon & Schuster, 1958).

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[63] E. Melandri, *La linea e il circolo* (Bologna: Il Mulino, 2004).

But the model of the Möbius band can also be developed in the other direction, that is to say in the direction of a 'critique' of the structure of experience which science presupposes as ontologically already given at the foundation of its action of knowing. If everything that is determined by language, by science, or by any other type of theoretical abstraction, presupposes the originary and uncircumventable ground of 'sensing',[64] aesthesiology might then assume the role formerly occupied by transcendental epistemology. In other works, we have, for example, tried to indicate the consequences that might be drawn from this transcendental aesthesiology at the level of mathematical philosophy.[65] The problem of the relation between the finite and the infinite, the continuous and the discrete, can only be conceived dynamically by a living being for which it is necessary, from its birth, to harmonise the fundamental phenomenological difference which separates the aesthesiological structure of haptic touch (an active, discrete, repetitive and algorithmically finite structure) from the heterogeneous and nuanced structure of vision (a passive, continual and virtually infinite structure) through invariant relational structures constructed in large part through analogy.[66] Similar consequences could also be drawn at the level of the epistemology of physics; in demonstrating, for example, that the concepts of cause and of natural law necessarily contain metaphorical elements derived from the feeling of necessity that humans feel when faced with the 'conventions' of language and other laws which regulate their social action;[67] and, more profoundly, from the feeling of vital auto-affirmation which we derive from our intentional movements and acts.[68] These analyses might, however, also be deepened in relation to that ontological terrain, common to scientific knowledge and traditional philosophy, which is constituted at the crossroads of a well-determined intrasensorial schematism: The objective properties or primary qualities of the real, upon which Western science has founded its ontology since Galileo and Descartes, up to the great rupture of quantum physics; for what are they if not the product of a common tactile-ocular sense of which humanity had already had a first intuition beginning from Aristotle and Democritus? And how to explain the 'substance-accident' syntax of experience which, from Aristotle onward, has been recognised as lending its basis to propositional language, without reference to the tactile-ocular schematism from which the linguistic imaginary of scientific knowledge still struggles to free itself today?

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[64] E. Straus, *Vom Sinn der Sinne* (Berlin: Springer, 1935, second expanded edition 1956).

[65] A. Gualandi 'Brunschvicg, Kant e le metafore del giudizio matematico' in *Discipline filosofiche* XVI (2), 2006.

[66] A project very close to the present one, critically analysing the 'embodied' transcendental foundations which underly mathematical construction, is that of F. Bailly and G. Longo, *Mathématiques et sciences de la nature. La singularité physique du vivant*, Paris : Hermann, 2006 – see esp. 41-3. Longo and Bailly's approach shows us, amongst other things, that in contemporary French philosophy the question of the human is far from having been definitively liquidated.

These are only a few examples which cannot, in the present text, be translated into an sufficiently articulated epistemological analysis. To acquire a sufficient theoretical coherence, these examples would have also to integrate the question of the conceptual foundations of contemporary biological knowledge, from which this article has drawn many of its arguments. This question is not, however, no stranger to our approach, since the critique of the 'machine' model, which serves as the foundation for the classic cognitivist theories of the elaboration of information, and which even governs the functioning of a number of contemporary theories of the genetic code and its informational structure, represents a prime example of it.[69]

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[67] Lakoff and Núñez, *Where Mathematics Comes From*, op. cit.

[68] H. Jonas, *The Phenomenon of Life*, op. cit.

In order for the Möbius band to successfully develop in the right direction, we must however return once more to the analysis of the modalities through which the living being incarnates in itself the forms which serve to interpret the real for it.[70] The theory of spatial structures incorporated in the genetic *Bauplan* of an organism, as in the aesthesiological structures which permit a living body to relate itself to its milieu, surely furnish us with a powerful model of description.[71] From this point of view, human experience might distinguish itself from that of other animals by its capacity to translate the aesthesiological structures of different sensory modalities one into another according to plastic and flexible dynamisms that contrast with the strongly hierarchised organisation of other animals.[72] This strongly metaphorico-analogical modality of intrasensorial translation[73] – a modality that is not rigidly predetermined by the species (nor determined *a priori* by a univocally digital code, as Artificial Intelligence would have it) – leads us once more to the fundamental anthropobiological condition which makes it possible: The ultra-neoteny of the human body and brain. In thus elevating ourselves to the anthropobiological condition of possibility for our specific modality of making experience from reality, the status of this ultra-neotenic character of human nature is thus transformed from a scientific hypothesis into an uncircumventable phenomenological fact; into a sort of *material a priori* whose signs can be seen in the way, the errant and anxious way, in which our experience unfolds in every domain of its expression – beginning with that centrico-eccentric dynamic of experience that is at the base of Kant's Copernican revolution, but also that of Copernicus himself.

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[69] This epistemological critique which, with philosophical intelligence, contemporary biology addresses to its supposed precedents, is today confirmed also by mathematicians who work on the *incorporated* foundations of their discipline (see, for example, Bailly and Longo, *Mathématiques et sciences de la nature*. op. cit.).

[70] Canguilhem, *Etudes d'histoire et de philosophie des sciences*. op. cit.

[71] Prochiantz, *Les anatomies de la pensée*, op. cit.

[72] Ramachandran, *The Emerging Mind*; M. Mazzeo, *Storia naturale della sinestesia. Dalla questione Molyneux a Jakobson* (Macerata: Quodlibet, 2005).

6. THE REVERSAL OF THE COPERNICAN REVOLUTION AND THE METAPHORICAL ERRANCIES OF THOUGHT

Let us return now to Copernicus, so as to draw a philosophical conclusion appropriate to his scientific revolution. According to a now canonical interpretation, the revolutionary character of Copernicus' system determined a clear and definitive rupture between sensory experience and scientific reason, and imposed a drastic reduction of philosophical anthropocentrism. I would like briefly to try to show that this interpretation is false, or at least only partly true. As far as the question of meaning is concerned, we must first of all note that the contrast between sensory experience and Copernicus' theory 'is much more radical than the difference between a correct and an erroneous judgement'.[74] Following Straus and Husserl, in fact, it can be maintained that Copernicus did not simply replace a false sensory judgment ('the earth does not move') with a true judgment ('the earth moves'), but that he left the primary dimension of sensory experience so as to accede to a conceptual dimension, abstract and exempt, by virtue of which scientific thought apparently disengaged itself from all anchorage to our earth and to every living, sensing and self-moving body alike. Scientific thought thus *imagines* seeing the earth, the sun and the stars from an 'excarnate' and eccentric point of view which had not been possible for any human being before Copernicus: an 'intellectual vision' so powerful that it could be compared to the vision of God.[75] But is this scientific vision as *absolute* as we would like to believe it is?

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[73] A. Berthoz *Le sens du mouvement* (Paris: Odile Jacob, 1997); G. Longo, *Mouvement, espace et géométrie*, in *Intellectica*, n. 25., 1997; Bailly and Longo, *Mathématiques et sciences de la nature*.

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[74] Straus. 'The Expression of Thinking', op. cit., 281.

[75] 'When Copernicus conceived and elaborated the heliocentric system, he did not watch the skies; neither did he wait for the night to observe Jupiter, Mars and Venus; nor for the day to see the sun rising and setting. He thought about cycles and epicycles. While in his thoughts he was concerned with the constellation of the stars in their continually changing positions, he was not bound to any particular place or time in his thinking. He used, of course, all the observations made on this globe by astronomers before him. But the heliocentric system deals with the relation of sun and star, envisioned as if it were from a point outside of the solar system and certainly from a position removed – in thought – from the earth, which Copernicus had cut loose from its moorings and enlisted in the company of the other planets. The Copernican system discussing the revolutions of the celestial bodies comprehends, in one view as partners in one relation, the sun and the stars, which are actually never seen together by a terrestrial observer. In this and in many other aspects, Copernicus' thoughts firmly contradict, or at least seem to contradict, the testimony of the senses. Western man knows that the sun is at rest; nevertheless, all of us – the astronomers not excepted – see that the sun moves, rises and sets. But this is not sufficient reason to condemn sensory experience as deceptive, for the contrast between seeing and thinking is much more radical than the difference between a correct and an erroneous judgement.' (Ibid., 280-1).

In the first place, it must be noted that this powerful theoretical vision bequeathed us by Copernicus does not furnish a sufficient reason 'to condemn sensory experience'.[76] As Straus and Husserl remind us, the construction of the mathematical imagination which a scientific theory is, must above all be in a position to rediscover the way that permits it to 'come back down', more or less mediately, to the level of 'centric' experience as delivered by the senses and the body.[77] If this were not to happen (neither today, nor tomorrow) the theory could be judged neither true nor false, but only as incapable of entertaining any relation whatsoever with the *reality* of this world.

Secondly, we must consider as one of the great lessons of the relativist and quantum revolutions of the twentieth century, as of the 'embodied' reflections on the foundations of mathematics and physics, that contemporary science is less excarnated and 'absolute' than its classic image claimed to be. In fact it does not seem able to progress along the generalising path of theoretical abstraction without enveloping in its mathematical symbolism the reference system or the concrete 'point of view' from which the subject of knowledge localises, measures, and marks out the reality of the world. But if, on one hand, this fact demonstrates the theoretical power and the philosophical profundity of contemporary science; it also shows, on the other, that at the heart of this science is implicated a metatheoretical Möbius band – analogous to that which we identified above – which can only be neutralised by returning to the absolute 'Earth as ground' and to 'my body as centre' of all experience.[78]

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[76] Ibid.

[77] 'Whether I walk or I stop, I have my body [*Leib*] as centre and around me bodies [*Körper*] at rest or in movement, and a ground without mobility' (Husserl, *Umsturz der kopernikanischen Lehre*, op.cit, 7).

As far as the question of anthropocentrism is concerned, it must first be noted that the eccentric dimension of experience conquered by Copernicus' revolution surely subtracts from the earth its privileged place within the cosmos, but that this effort is not sufficient to eliminate all anthropomorphism, the latter simply being pushed back to the confines of the universe in a sort of imaginary *absolute*, 'of the human body and face'. The Newtonian conception of absolute space as *sensorium dei* furnishes a proof of this marginal and phantasmatic persistence of the human form.[79] The most furious enemy of all anthropomorphism, Spinoza, offers another when he claims to ontologise an historical product of human reason – the deductive system of Euclidean geometry – in the eternal substance of divine Nature. Laplace's omniscient demon, who foresees the behaviour of the universe as if it were a Turing machine pre-programmed by a great evil engineer, represents a third.[80] In sum, it is as if anthropocentrism was only progressively eliminated from the contents of knowledge – or, more precisely, from the topologico-spatial structure of the universe – whereas it is reborn in a reinforced fashion in the specific form of the act of knowing. Why?

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[78] 'If I now think of the Earth as of a body in motion, in order to so think it or, more generally, in order to think it as a body […] I need a ground to which to refer every experience of the body and thus also all experience of the being which remains at rest or in movement' (Husserl, *Umsturz der kopernikanischen Lehre,* op. cit., 6-7). But since science can never rejoin this new absolute ground – because every new ground will be but an extension of that originary ground which is, for humanity, the Earth: 'the Earth can just as little lose its sense of *primordial enduring*, the arche of the world, as my body [*Leib*] can lose its most singular sense of being a proper primordial body [*Urleib*] from which every body derives a part of its sense of being.' (Ibid., 15).

[79] This phenomena could be explained as follows: Since every relative movement comes to be seen as such in relation to an absolute – that is to say, in relation 'to a "body-ground", perceived as in a state of rest, a "body-ground" with which my corporeal soma is as one' (Husserl, *Umsturz der kopernikanischen Lehre*, op.cit., 5-6) – the (Copernican) subtraction of that originary ground which is the Earth provokes the theoretical production of new absolutes which necessarily function as phantasmatic 'body-grounds'.

To understand this point, we must first of all recall that the eccentric dimension of experience marks a radical rupture between the human modality of human experience and that of every other animal. The sensory experience of the sun which moves against an immobile terrestrial background is shared by human and animal alike.[81] On the contrary, what remains inaccessible to every other animal is the capacity to *transfer* its thought of the sensory and corporeal here-and-now into a time and a space which have not 'taken place'. In other words, qua exaptive and metaphorical being, obliged to pass through a series of

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[80] This metaphorical displacement of the originary 'body-ground' might also be produced in a purely 'subjective' dimension. Kant's transcendental I – which claims to *unify* a shattered universe, which has lost its objective centre and which refuses all interference of God in science – might offer an example. The difficulties which contemporary neurobiological theories encounter in elaborating a theory of consciousness which presupposes no preconstituted identitary instance – cerebral homunculus or central processing unit – represent another. In short, once that absolute that is the human body, perceiving and acting against the background of the Earth, has been expelled from the system of reason and knowledge, it reappears in a sublimated and metaphorised form as a central instance of consciousness, or as a (quasi-intentional) sensor for information that is already inscribed – objectively as metaphorically – in nature.

[81] 'The gift of sensory experience is available only to motile creatures which, in rising from the ground, establish a position opposite to the ground and thereby gain a relation to objects qua objects within the open horizon of the world. In this truly fundamental situation, the senses serve men and animals first of all in their basic task of orienting them toward their environment. The primary frame of reference for our moto-sensorium is the earth and the firmament, resting in their own weight. Against this background, we actually see the sun, the moon, and the stars moving, and I daresay we see it correctly as far as seeing is concerned.' (Straus, 'The Expression of Thinking', op. cit., 282)

(intrasensorial) schemata and (linguistic) mediations ever more exempt from direct sensory contact with reality, man is in essence the eccentric animal; and it is indeed this eccentric dimension of experience which was conquered in systematic fashion by the Copernican revolution and the science that followed it.[82] Qua product of a specifically human modality of knowledge, science thus does not pursue a deanthropomorphisation of reality, but rather a process of progressive humanisation, one whose price is a kind of ontological loss of the world. The price we pay for the eccentric character of our experience is, in fact, according to some, the effective loss of that originary dimension of experience which we share with all other animals; loss of the world to which we accede through our senses and our bodies.[83]

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[82] 'The Copernican system does not correct erroneous sensorial impressions; it transcends the realm of sensory experience. Though contemplated on earth, it is not visualized from the earth. The observer is transferred to Erehwon, to nowhere; he is removed from his terrestrial point of view and freed from its limitations. In sensory observation, bound to the actual situation, we are also limited by it; we see fragments only. The heliocentric system, however, puts together all the fragments. It considers not only sun, planets, and earth in one view of imagination; it comprehends the whole of their circuits. It comprises in one geometrical figure all the possible positions of the earth on its path around the sun, passed in the course of one full year. With the aid of a mathematical model, indifferent in its proportions to the natural conditions of place and time, size and weight, we break through the barriers of sensory experience.' (Ibid.)

[83] 'In sensory experience we are in direct contact with things; they stand before us and we before them. In thinking the relation is an indirect one; the noema mediates between the thinker and the target of his imagination. Conceptual thinking requires a radical *ekbasis* from any particular position. We may as well say that because man can perform such an *ekbasis* from the social and the physical environment, and finally from his own corporeal existence, he is able to think. The characteristic attitude of the thinker expresses this 'excarnation' – the price man must pay for his intellectual and spiritual achievements' (Ibid., 282-3)

The objective of this text, however, was to show that there exists a path which leads from the human body to the eccentric thinking of science (passing through the hand, the eye, the voice, right up to the linguistic and mathematical schemata, exempt from any sensorial *hic et nunc*); and indeed, also an inverse path which leads back from eccentric thought to an animal body, to a singular ontogenetic development, a path which we discover in the necessity of transferring into the world its communicative structure, whose traces science will continue to carry up to the very (hypothetical) 'end' of its journey. As opposed to Straus and the other thinkers who conceive this path as a sort of leap, rupture or originary loss of infantile or animal paradise, I hope to have shown that the modality of experience that is at the foundation of the Copernican revolution and of all of modern science does not produce any void or irreversible loss, but only an anxious errancy which finds in a singular type of animal body its quasi-transcendental biological condition of possibility. An errancy which, from this point onward, cannot be infinitely diluted, but which does possess limits which coincide with the contours traced by an incessant oscillation between our body and its Other, imaginary or real; between our thought and a Nature from which thought emerged and detached itself as if it found itself faced with an alterity; between our nature and that of a reality with which we are obliged ceaselessly to conduct a dialogue. In conclusion, in this way human errancy could also be a metaphor for a singular animal condition to which Nature would oblige us, so as to both distance us from and bring us closer to it.

Thinking Outside the Brain

Paul Humphreys

Philosophy is a naturally sceptical discipline. Limits on what can be known, constant doubts about our most cherished beliefs, impossibility theorems – such is the gloomy lot of a philosopher. Fortunately for those of us with a more constructive outlook, not all philosophical results are so pessimistic. Were John Stuart Mill alive today, he may well have questioned our political wisdom, but he would surely be envious of the growth in our scientific epistemology. Yet there is a group of constraints on knowledge that has seemed insurmountable. This group contains the *egocentric predicament*, the Ralph Barton Perry claim that each human can experience and know the world only from his or her individual psychological and perceptual perspective; its generalization, which we can call *the anthropocentric predicament*, the apparent fact that we can only experience and know the world from a specifically human perspective, one that is fixed in part by our peculiar evolutionary history; and the *linguistic determinism* position, the idea that the limits of language are the limits of thought. All of this pessimism is natural, most of it is well argued, and a great deal of it will be rendered irrelevant by developments in science. This essay will explain why.

THE GREAT HALL OF MIRRORS

Perhaps because of these constraints, contemporary epistemology continues to be saturated with anthropocentric views. Its subject matter, almost without exception, is human epistemology, based on a tradition stretching from the pre-Socratics, on through Descartes, and affecting even the philosophy of artificial intelligence, within which human cognition still serves as the most significant reference point. Consider just a few famous titles: John Locke's *Essay Concerning Human Understanding,* George Berkeley's *A Treatise Concerning the Principles of Human Knowledge*, David Hume's *A Treatise of Human Knowledge*, Thomas Reid's *Essays on the Intellectual Powers of Man*, and Bertrand Russell's *Human Knowledge: Its Scope and Limits.* Despite their respect for science, the logical positivists emphasized the centrality of human sensory experiences, Thomas Kuhn's paradigms were rooted in communities of human scientists, and Willard Quine's pragmatism leans heavily on the choices made by human language users. We humans do like to admire ourselves in the mirror of nature.

Variations on these constraints place limits on knowledge whether one is a realist or an anti-realist, a human or another species altogether. Were you to be a solipsist, the boundaries of your lonely little existence would be set by the modes of thought peculiar to you as a self-conceived human. Chimps, extra-terrestrials, cognitively-aware computers; all have their own versions of the three predicaments just mentioned. Or so we are told.

Empiricism – the position that all legitimate knowledge must ultimately be justified in terms of evidence gained through human sensory experience – is one version of the anthropocentric predicament, for if empiricism is true, what we can know is essentially limited to what is accessible through a set of biologically contingent devices. Indeed, the supposed conflict between realism and empiricism makes sense only from the perspective of humans, simply because for an empiricist the limits of knowable reality are set by the cognitive limitations of humans. Realism thus acquires an anthropocentric taint in claiming that there are things lying beyond the reach of the human senses and that there exists a mind-independent reality, if only because the senses and the minds involved are those of humans. From the perspective of different kinds of knowledge producers, such as scientific instruments and computers, the division between what is accessible to the human senses or to the human mind, and what is not, is, ironically, an artificial division. It is for reasons such as this that traditional empiricism passed its expiration date long ago.

A famous version of the anthropocentric predicament is Kant's view that we are doomed to represent the world using fixed conceptual frameworks that form a part of the human cognitive apparatus. Kant's own choices for the frameworks – such as Euclidean spatial representations and deterministic cause-effect relations – turned out to be ill-advised, but the basic insight is striking.

Advances in science and mathematics, especially the development of formalism in the mid to late nineteenth century and the accompanying construction of non-Euclidean geometries, led to a liberalization of Kant's original position. Many non-Euclidean geometries are far more difficult, if not impossible, to imagine visually than is Euclidean geometry, but they can be developed and understood through the use of formal mathematical theories. This use of formal theories to generate new concepts shows that intuitionism as a philosophy of mathematics, with its emphasis on the human mind, is too confining, and that formal theories offer the possibility of taking an objective stand about mathematics without committing oneself to Platonism.

In fact, a formalist outlook has been present in some areas of science almost from the outset. Whatever the real motions of the planets are, for Ptolemy they were understandable only through their representations in mathematical astronomy;[1] for Galileo, the book of Nature was written in mathematics; and the struggle to understand inertia and gravitation in the seventeenth century was resolved only by conceding that one had to grasp those concepts through the role they played in mathematical physics. We should not forget that the modern idea of inertia, the idea that a body could continue to move forever without a force to maintain its motion, is deeply counterintuitive to a species that requires water and air to survive. Scientists who were born and thrived in a viscosity-free space would find inertial motion perfectly natural.

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[1] Although it must be said that Ptolemaic representations were driven primarily by Platonic concerns rather than by the attractions of formalism.

And so fixed psychological frameworks have been replaced by flexible theoretical frameworks. Yet humans still have to understand the concepts, such as sets, points, energy, and information, that are involved in these formal languages, and the ability to develop physical and mathematical intuitions about these concepts is highly prized. Moreover, sophisticated and profound as these theoretical frameworks are, the formal mathematical manipulations continued to be constrained by the a priori reasoning abilities of human mathematicians and scientists. It is within this context that linguistic determinism came to be seen as the new, inescapable, constraint. The languages remained languages of, by, and for the people.

THE INTERFACE PROBLEM

There are two things wrong with linguistic determinism. The first is that it is false. A famously pithy, *ex cathedra* statement of linguistic determinism is Wittgenstein's aphorism '*The limits of my language* mean the limits of my world'.[2] Empirical research has been cited both for and against linguistic determinism, but a recent study of two groups of Australian children speaking aboriginal languages shows that they can perform basic counting operations just as competently as English-speaking children, despite the indigenous languages lacking words for cardinal numbers.[3] For example, the children speaking only an aboriginal language were able, as effectively as English speaking children, to select the correct number of beads matching the number of taps made by two wooden blocks. The most plausible explanation for this success is that the aboriginal children possess the mental concept of a one-to-one correspondence, even though they cannot express that idea, or the associated number concepts, in their languages. Results such as these are important because, even if lacking the appropriate vocabulary is an insurmountable barrier in some areas, the fact that it is not so in others shows that humans can develop terms for mental concepts for which they have no current vocabulary.

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[2] *Tractatus Logico-Philosophicus*, trans. D. F. Pears & B.F. McGuinness (London: Routledge and Kegan Paul, 1961), §5.6.

[3] B. Butterworth, R. Reeve, F. Reynolds, & D. Lloyd, 'Numerical thought with and without words: Evidence from indigenous Australian children', *Proceedings of the National Academy of Sciences* 105, 2008: 13179-13184.

In the light of this, here is a little thought experiment: Much emphasis has been placed on computational accounts of the mind. Instead, imagine that non-computational biologically-based cognitive devices have been developed, perhaps modeled on human brains, perhaps on a different basis. It is entirely possible that such devices would possess innate concepts, just as human brains have developed such concepts through evolution, with the difference that the artifacts' concepts would probably be radically different from ours. The task would then be to have the artificial cognitive devices communicate their conceptual frameworks, firstly to each other, and secondly to us. The first goal is easily achieved by ensuring that the new devices have identical biological structures. The second goal is considerably more difficult – and not just because human brains and the newer devices would have different structures.

We can call the general problem of inventing effective intermediaries between artifacts and human cognition the *interface problem.* The interface problem is a generalization of the issues that underlie the difficulties in reconciling empiricism and realism and it is always present when we access the humanly unobservable realm using scientific instruments. It has two aspects – the interface between the instrument and its target, and the interface between the instrument and humans. Solutions to both aspects have been developed for traditional scientific instruments but we now have to develop interfaces for an even more powerful set of tools: those of a purely automated computational science.

THE SUBURBS OF THE SENSES

Precisely when humans first extended the range of their native perceptual abilities is not known. The first recorded mention of magnifying glasses is by the Arabic scientist Alhazen in 1021, although naturally occurring magnifiers such as rock crystal have been used for at least three thousand years. Microscopes were developed in Europe in the late sixteenth century, closely followed by refracting telescopes. Those early instruments have led to an astonishing array of devices that includes scanning tunnelling microscopes, nuclear magnetic resonance imaging devices, automated gene sequencing machines and many, many others. Until recently we required the output of these devices to be directly accessible to us in the form of visual images, numerical data arrays, and so on. But no longer. The computational revolution that began in the 1940s has led to an extension of our a priori representational abilities that is even more profound than the perceptual extension afforded by scientific instruments because it fosters the automation of knowledge. Computer assisted mathematics, computer simulations, the automated processing of data by computers – each of these has the ability to construct knowledge encoded in categories and processes that we cannot currently understand. The trick is to see whether, by extending our conceptual resources, we can appreciate what the science developed by such automata would be like – and, in turn, to gain access to realms of reality unimaginable by humans.

A PAIR OF DISTINCTIONS

I begin with two distinctions. Call the current situation within which humans have to understand science that is carried out in part by machines, in part by humans, the *hybrid scenario*. Call the more extreme situation of a completely automated science the *automated scenario*. The distinction is important because, in the hybrid scenario, we cannot completely abstract from human cognitive abilities when we discuss representational and computational issues. In the automated scenario human capabilities are irrelevant. The second distinction concerns shifts in scientific methods. Thomas Kuhn famously described as 'scientific revolutions' the discontinuities in concepts and methods that occur as a result of a change in scientific paradigms, such as the replacement of classical mechanics by modern quantum theory. We can usefully draw a distinction between *replacement revolutions* and *emplacement revolutions*. Replacement revolutions are then the familiar Kuhnian variety in which an established way of doing science is overthrown and a different set of methods takes over. Emplacement revolutions occur when a new way of doing science is introduced which largely leaves in place the existing scientific framework and supplements it with distinctively new methods. The introduction of laboratory experimentation was an emplacement revolution in the sense that it did not lead to the demise of theory or of observation. So too was the explicit development of statistics in the late nineteenth and early twentieth centuries.

In that sense, the rise and permanent establishment of computational science in the last half-century constitutes an emplacement revolution. This is not to say that theory and experiment remain unaffected by computational approaches, because certain theoretical methods that used to be carried out 'by hand' have now been taken over by computational methods and many experiments are now computer assisted, but theory and experiment have not been abandoned. They are not considered scientifically unacceptable in the way that the replacement revolutions of Copernican theory over Ptolemaic theory, Newtonian theory over Cartesian theory, or Darwinian theory over gradualism resulted in the previous approaches becoming untenable.

It is because we are currently in the hybrid scenario that computational science constitutes an emplacement revolution. If the automated scenario comes about, it is an open question whether we shall then have a replacement revolution. The question is open because we do not yet know whether a radically new non-representational apparatus will be used by the automated methods and existing methods of pursuing science will be abandoned by humans. My prediction is that automated experiments will continue but that automated theory and simulations will take on currently unrecognizable forms. Fortunately, in the hybrid scenario we can partially grasp a computer's world view. So let us start with that.

THE VIEW FROM INSIDE THE CAR

Thomas Nagel's famous article 'What Is It Like To Be a Bat?' argued that there was something that it was like to be a bat, but that we, as humans, could never know what that experience was like.[4] Nagel deliberately chose a species that was so different from humans in the way that it experienced and represented the world that we cannot analogically infer from our own experiences to what the bat's world is like.[5] Contemporary computers have no phenomenological experiences, so there is no phenomenology to account for, but there is such a thing as what it is like to represent the world in the way that a computer does. So let us see if we can imagine what it would be like to gather information about the world from the perspective of a computational device. One important feature is that such devices will often have only a local and not a global perspective on a situation. You can easily appreciate such local perspectives by imagining that you are sitting in a car in rush-hour traffic. You can see the car in front, the car behind, and the cars on either side, but no further. There are simple rules you obey, such as not colliding with another car, moving when and only when there is space in front or to the side, not reversing, and so on. The perspective you have on the traffic is purely local – you have no global understanding of the traffic jam as a whole. That's why drivers in traffic jams are always asking

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[4] See T. Nagel, 'What Is It Like to Be a Bat?', *Philosophical Review* 83 (1974), 435-50.

[5] It is also possible that bats do not represent anything to themselves; they just do batty things without using representations of the world.

'What on earth is going on up there?' And indeed, this local perspective is exactly the perspective that an artificial agent has in a computer simulation of a traffic jam.

Contrast this with one of the most significant abilities that we humans possess, the ability to take an external, global perspective on many situations.[6] A helicopter pilot flying over a traffic jam has, of course, taken advantage of a third spatial dimension to view the jam, but the pilot also has the essential ability to conceptualize the traffic jam as a whole – here's a two mile clogged segment, there's a slowly moving segment near the on-ramp, and so on. Developing this global cognitive ability is one of the most important human intellectual achievements and one that computers often lack. Playing the board game of *Go* requires a global perspective, more so even than playing chess, in part because *Go* is a territorial game, in part because no human can consider the consequences of all possible moves at any given stage of a game – nor, for that matter, can any existing computer. In a different way, mathematical proofs require a global strategy as well as an understanding of the local rules governing individual steps in the proof. That is why someone can understand each step in a proof and not understand the proof as a whole.

We can catch another glimpse of what it is like to be a computer by using the device of a cellular automaton. This is a particular kind of computer which in its two-dimensional form consists in a square array of cells, each cell being coloured either black or white. Time-steps between states of the automaton are discrete and at the next time-step, the colour of any given cell depends on just two things, the current colour of that cell and the current colours of the neighbouring cells. Once a rule for the transition between the current state and the next state has been specified, the cellular automaton has been completely specified. For example, one cellular automaton runs on the rule 'If the current state of the cell is black, three of its neighbours are black and the rest white, then turn the cell white; otherwise the cell is black at the next time step'. It is possible to represent the behaviour of many important systems in physics using cellular automata, but our example will be philosophical. A traditional metaphysical problem has concerned whether the principle called the identity of indiscernibles has any possible exceptions. The principle states that if the names 'a' and 'b' pick out entities with *exactly* the same properties, then 'a' and 'b' are just different names for the same thing. Put another way, the principle says that there cannot be two things with exactly the same properties. Various clever or exotic counter-examples to this principle have been considered, going back at least as far as Kant. Indeed, the entire subject matter of quantum statistics is based on the violation of this principle by quantum entities such as electrons and photons. Many of these examples are difficult to imagine, but here is one that needs no fancy physics. Note that the rule defining a given cellular automaton does not mention which of the neighbours are in a given state, only how many of them are in that state. So imagine yourself as a black cell within a cellular automaton, equipped with our exemplary rule. As such, you do not have the ability to distinguish neighbouring cells by their location. All you know is that three otherwise indistinguishable cells are black and five indistinguishable cells are white and each falls into the class of things you need to consider. So you need to dutifully change your state from black to white.[7] In such ways we can imaginatively project ourselves out of our familiar spatial world in which position distinguishes otherwise identical objects such as two mint copies of *Harry Potter and the Deathly Hallows* and project ourselves into a non-spatial, cellular automaton world within which there are indistinguishable 'things'. So, at least to some extent, we can project ourselves into the conceptual frame of a computer. The point of these examples is to show that, with the help of imagination – sometimes a little, sometimes a great deal – humans can come to understand alien modes of thought.

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[6] From here on I shall use 'global' as a synonym for 'non-local'.

A different issue is whether a locally-situated observer can have evidence for the global state of a system. This move from a local to a global perspective is a special sort of inductive inference, and an agent located on a cell of a cellular automaton could not necessarily make that inference. There are at least two reasons for this. First, his cell may exhibit a limited variety of behaviour that does not permit the inference of the global state of the automaton. For example, his own cell and its neighbours may simply alternate between two states, thereby not providing enough information to infer how other cells are behaving. He would also not have access to the global initial state, and knowledge of this state is ordinarily required to predict future states of the entire cellular automaton. The second reason is that new predicates that apply to the global states, and that cannot be defined in terms of individual states, may have to be invented in order to make effective predictions. Aggregate properties such as averages are no problem, but to reclassify the shape of a hanging chain as a catenary requires creative judgment. Just as we sometimes cannot understand the local perspective of computers, so they often cannot understand our global perspectives.

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[7] I am taking the neighbourhood to be the von Neumann neighbourhood, which consists in the eight vertical, horizontal, and diagonal neighbours of a given cell.

LIVING WITH INCOMPLETENESS

We have seen that humans can overcome the anthropocentric predicament. There is also evidence that we are not trapped inside a web of words. Freed of these constraints, we can gain glimpses of what kind of realism is tenable. Mathematical models extend our conceptual reach but neither Platonism nor formalism entails that humans should be able to grasp all of mathematics. There is precedent for that view in other areas: medieval discussions of the Ontological Argument held that claims to have a full understanding of God were necessarily false in addition to being blasphemous. So it is hardly news that formally identifiable concepts exist that lie forever beyond the reach of humans. Despite Gödel's famous insistence that the truth of certain mathematical results is directly accessible to humans even though not amenable to proof, the epistemology of Platonism has always been mysterious, and it requires a commitment to supernaturalism because abstract objects, in the sense in which Platonists take abstract objects, are not a part of the natural world. This is in contrast to the epistemology of formalism within which, even if humans cannot fully or even partially understand certain formal concepts, we can understand how a computer can construct those concepts and effectively use them to interact with an external world.

Clear-thinking realists recognize that knowledge of the external world will always be incomplete and that Kant bequeathed to us a chimera, an unattainable because unintelligible goal, that of knowing a thing-in-itself. The challenge that modern science presents to us is a different one, it is to develop methods by means of which we can grasp the extended realm of reality to which instrumentally based, computationally augmented science provides access.

BEYOND THE HUMAN PALE

Let me now put the principal philosophical novelty of these new scientific methods in the starkest possible way: Computational science introduces new issues into the philosophy of science because it uses methods that push humans away from the centre of the epistemological enterprise. In doing this, it is continuing a historical development that began with the use of clocks and compasses, as well as the optical telescope and microscope; but it is distinctively different in that it divorces reasoning, rather than perceptual tasks, from human cognitive capacities. There were historical ancestors of computational science, such as astrolabes and orreries, but their operations were essentially dependent upon human calculations.

For an increasing number of fields in science, an exclusively anthropocentric epistemology is inappropriate because there now exist superior, non-human epistemic authorities. We have been discussing a special case of the anthropocentric predicament, the problem of how we, as humans, can understand and evaluate computationally based scientific methods that transcend our own abilities and operate in ways that we cannot fully understand.

Once again, this predicament is not entirely new because many scientific instruments use representational intermediaries that must be tailored to human cognitive capacities. Within the hybrid scenario, the representational devices, which include simulations and computationally assisted instruments such as automated genome sequencing, are constructed to balance the needs of the computational tools and the human consumers.

And so I am interested in a question that is common to computational methods in science and to mathematics. Simply put, there are two parts to this question. The first and easier part is: Is it possible to legitimately expand the set of concepts used in these areas to include some that we as humans do not currently possess? The second, harder, part is: Could science or mathematics be carried out using concepts and techniques that are essentially beyond human understanding?

The first part is easy to answer because the expansion has already happened. As for the second question, the answer also seems obvious – science as an objective mode of inquiry transcends human limitations and there already exist instruments – radio telescopes, scanning tunneling microscopes, and many others – for which a human/instrument interface can be somewhat crudely constructed but is irrelevant to the operation of the instrument. In the computational realm, data-mining algorithms on massive data sets, the detailed computations underlying many condensed matter simulations, and many others – all proceed in realms far removed from human computational abilities. There are, of course, serious dangers associated with these methods such as flawed code, hidden logic errors, wrongly calibrated instruments, and a general inability to check the methods in detail. These are not fatal to the enterprise; rather, they require a thoughtful understanding of how these new methods work. It is with understanding the concepts involved that the most problematical aspect of the new science enters.

'IT'S A COMPUTATIONAL THING – YOU WOULDN'T UNDERSTAND.'

Science has a number of aims. Some of these, such as the prediction and control of natural events, have already been automated. Most of us have safely flown on aircraft controlled by automatic pilots; driven cars assembled in factories by robots; been cured of illnesses by pharmaceuticals, the molecular structures of which were predicted and isolated by automated processes; and used electricity generated by computer-controlled nuclear reactors. These examples are drawn from applied science, but automata also play an important role in pure science. In astrophysics, gravitational lenses have been discovered by automated computer processing of data from robotic telescopes; in biology, computer assisted shotgun gene sequencing allowed the mapping of the human genome to be completed in advance of the stated deadline. In mathematics, automated theorem provers have proved results that eluded human mathematicians, such as the theorem that all Robbins algebras are Boolean algebras.

Another aim of science, understanding, seems to be beyond the reach of automata. This deficit will not be a problem if you follow certain anti-realist traditions in the philosophy of science, such as instrumentalism, which deny that explanation and understanding are appropriate goals of science. We also know that in some other areas of activity, such as chess, computers have achieved many goals of the game, such as predicting an opponent's most likely move and winning the game, without any understanding at all. (Other goals, such as gaining an aesthetic pleasure from a beautifully executed series of moves, are absent). Nevertheless, within the hybrid scenario, humans have to understand the human/machine interface, and if the concepts on either side fail to match, problems will ensue. In particular, if machines cannot provide the appropriate global concepts, there will be a serious conceptual discontinuity at the interface.

What happens to understanding when we lack the appropriate concepts? Here is where things become interesting and allow us to address a hard question. Until now, I have not discussed the egocentric predicament – the claim that an agent can understand the world only from its own individualistic perspective. One aspect of this predicament is not as pressing for computers and instruments as it is for humans because, unlike humans, exact duplicates of individual computers and most other instruments exist. Thus, your laptop's digital camera has exactly the same perspective on the world, and representation of it, as does mine when we trade them. Objectivity as intersubjectivity is therefore easy to achieve with artifacts. But the egocentric predicament reappears within computer models where only local perspectives are available. We saw an example with cellular automata. Other examples arise in agent-based models. These use a set of methods that begin with a collection of objects, which can be individual humans that participate in economic exchanges, molecules in a gas, trees in a forest, companies in an economy, and so on. Rules for how these individual agents interact are provided, but what is not initially included is a representation of the state of the entire society, the gas, the forest, or the economy. That is, each agent has its own local perspective and initially there is no overarching theory of the entire system. Using the rules for interactions, the agents in the model are allowed to interact many times. If we are lucky, a pattern will emerge that is a property of the system as a whole. If we are lucky again, we humans will already have a concept that captures that pattern, such as the temperature in a gas, a fire in a forest, or a welfare function for the society. But what if we do not?

An ancient tradition in science and mathematics dating at least as far back as Euclid and used by luminaries such as René Descartes, Isaac Newton, David Hilbert, Bertrand Russell, John von Neumann, and Andrei Kolmogorov uses an axiomatized theory to capture the fundamental truths in domains such as geometry, classical mechanics, logic, and probability. In some cases, the axiomatization will be complete, in the sense that all truths about the subject matter can be derived from the axioms. An important feature of a complete axiomatization is thus that, in principle, everything about the subject matter can be understood by understanding the axioms. This axiomatic tradition is related to two other ideals of science, those of theoretical reduction and theoretical unification. In its most extreme but widely held form, reductionism holds that, at least in principle, all scientific theories can be derived from the theories of fundamental physics and in turn these fundamental theories unify physics. Put another way, fundamental physics is theoretically complete with respect to all other sciences.

A common feature of axiomatized theories, although one not often remarked upon, is that the necessary global predicates are either built into the axioms or can be defined in terms of concepts contained in the axioms. It is this that is not true of many agent-based models and this puts the agents in the situation of the agents with only a local perspective that we discussed earlier. Global patterns require global concepts and if we, or a machine, have no way of representing them, they will lie undiscovered. The absence of certain global predicates is thus a form of incompleteness in the theory and it calls into question the axiomatic approach as a general method for representing scientific knowledge.

The need to introduce new global concepts is widely recognized in various areas of science and it is one reason why a full reduction to fundamental physics is not possible. The method of coarse-graining in condensed matter physics foregoes a detailed description of the components of a system in favour of a higher-level description for the sake of predictive efficiency. The related area of effective field theories requires physical intuition to produce the higher level concepts that are used.

I have emphasized the role of global concepts here but it is with concepts in general that the most challenging current problems of computational science lie. Whether in the hybrid or the purely automated scenario, some way of generating new representations has to be found. Yet this very problem may in its turn be the result of a lingering anthropocentrism. For it rests on the view that science needs representations, and that representations must employ concepts. Perhaps, unlike us, computational devices need neither concepts nor representations to carry out science. Therein lies the most important moral of this essay. One lesson that Copernicus bequeathed to us, and one that we periodically ignore, is that humans should stop thinking of ourselves as the centre of the universe. If we draw the proper epistemological conclusion from that lesson, then instead of forcing epistemologically superior devices to fit their results to our limitations, we have to begin to learn how to understand on their own terms the discoveries that they make. This is a lesson that the philosophy of artificial intelligence, for one, has largely ignored.

A dominant theme of philosophy over the last two centuries has been the emphasis on concepts and descriptions as intermediaries between epistemological agents and the world. Yet some instruments and some computers confront reality non-conceptually, and the sooner we try to understand how they do it, the faster we shall learn. It will be here that we can, perhaps, finally penetrate the barriers that have stood between us and the rest of reality.

We are standing on the edge of an enormous, mist-shrouded plain from which tantalizing, partial knowledge is brought to us by surrogates. The mist parts, folds, and in places permanently retreats. It distorts sounds, renders the touch clammy, brings odd, faintly familiar smells, and perhaps even suggests that our tastes must change. To stand here and to decode these messages is enormously exciting, more so than it has been for a hundred years. It is time to grasp pieces of this strange new world.

Notes on Contributors and Acknowledgements

Julian Barbour originally planned to be an astrophysicist, but in the mid-1960s became fascinated by the foundations of dynamics. After completing a PhD at Cologne on alternative derivations of general relativity, he decided to become an independent researcher in order to avoid the publish-or-perish syndrome. For twenty-eight years he supported his family and research activities by translating Russian scientific journals. He collaborated for several years with Bruno Bertotti on the implementation of Mach's principle, on which he has authored or co-authored numerous papers. In 1989 his *Absolute or Relative Motion? Vol. 1, The Discovery of Dynamics* (Cambridge University Press) was published. In 1995 he co-edited the conference proceedings *Mach's Principle: From Newton's Bucket to Quantum Gravity* (Birkhauser), and in 1999 published *The End of Time* (Weidenfeld & Nicolson), written for scientists and lay readers, in which he argued that the quantum universe is likely to be static. Together with numerous appearances on radio and in TV programmes, this book has made him well known to members of the public interested in the foundations of science. He has recently been appointed a Visiting Professor in Physics at the University of Oxford. Many of his papers can be accessed via his website (http://www.platonia.com).

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Interview with Julian Barbour conducted via email by Damian Veal.
Interview with Thomas Metzinger conducted via email by Damian Veal and Ray Brassier.
Interview with Jack Cohen and Ian Stewart conducted via email by Damian Veal.
Interview with James Ladyman conducted via email by Damian Veal.
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COLLAPSE

Philosophical Research and Development

VOLUME V

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Ever since Nicolaus Copernicus unmoored the Earth from its anchorage at the centre of the Universe and set it hurtling around the Sun, science has progressively uncovered the lineaments of an objective reality to which human experience stands as only the most superficial and attenuated of abstractions. **COLLAPSE V**, 'The Copernican Imperative', brings together some of the most intellectually-challenging contemporary work devoted to exploring the philosophical implications of this ever-widening gulf between the real and the intuitable from a variety of overlapping and complementary standpoints.

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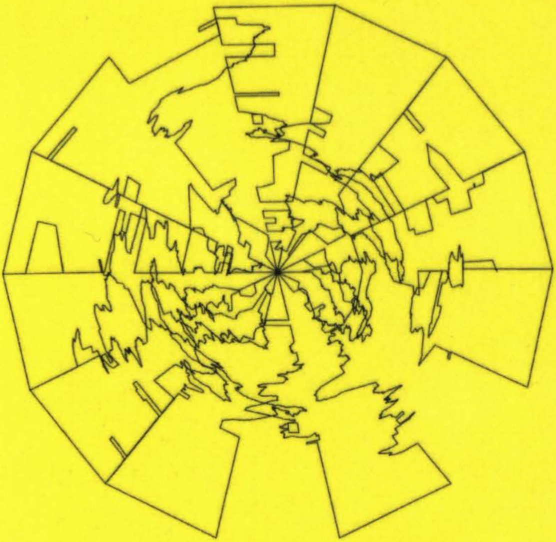

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VOLUME VI

Edited by

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COLLAPSE VI

January 2010
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Editorial Introduction

Robin Mackay

As far as we know, philosophy, indeed thinking as such, happens only on one planet. In our previous volume, we examined the ways in which philosophical and scientific thought pursued a liberation from the local conditions of 'earthly thought', counteracting the limitations imposed by our terrestrial locale and the biological heredity that binds our cognition to it. In this volume, we turn our gaze back towards our home planet to ask how, as products of the Earth, philosophers, scientists and artists have attempted to encompass it in thought; and how the philosophical enterprise of thinking 'the whole' has been, and continues to be, determined by our belonging to the Earth.

There is a timely aspect to this inquiry: Whereas the optimism of the late twentieth century saw 'globalisation' become a byword for limitless expansion, our image of the global in the first decade of the twenty-first century was characterised instead by contraction, by a forced recognition that the increasing technological interconnection and ever-intensifying exploitation of the Earth by humans was exposing finite limits, economic and ecological, of the planet upon which their world-systems are imposed.

Much of the response to the ensuing crises has remained entrenched within nostalgic regret, emotional imprecation and moral imperative. In this volume we attempt to forego this panic response and instead to present a diverse selection of contributions which demonstrate that philosophy, science and contemporary art continue to address the condition of thinking on and of Earth in original and engaging manners.

We know that thinkers have long used the surface of the Earth as a rich source of metaphor: in so far as it seeks for secure 'ground' on which to place thought, geographic cartographic and geological metaphors are endemic to philosophy. But beyond this metaphorics, as **NICOLA MASCIANDARO** argues in his 'Becoming Spice: Commentary as Geophilosophy', the practice of philosophy itself can be seen as a continual process of 'worlding'.

Beginning with the failure of the 'philosophical flight' from the earthbound in Dante, Masciandaro argues that philosophy belongs not to the 'folly' of a vertically-oriented 'straight path' but to a 'circular and endless' movement on the surface of the earth. And for Masciandaro, who directs the project Glossator,[1] dedicated to a contemporary revivification of the practice of commentary, it is the latter that provides the key to understanding this endless movement: commentary as the continual production of knowledge, a practice that 'proceeds by staying'. Philosophy's aim 'to render actual its absoluteness', to enter into self-immanence – the 'Copernican' impulse to absolutise – only proceeds, according to Masciandaro, through commentary's continual 'dwelling on the problem'. He further sees this role of commentary as being encoded in spice, as a global commodity whose currency and commercial movement figures the production of understanding through continual differentiation and distribution. Thus, commentary is not a mere 'condiment', but figures a peripatetic wandering and returning that draws forth the immanence of what is, only by adding to it, by 'spicing' it and thereby 'bringing out' the mode in which it is *more* than it is. For Masciandaro, therefore, 'the *telos* of commentary, its far-off end, is *tellus*, what bears us'; thinking brings us back to a continually-differentiated Earth.

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[1] See http://www.glossator.org/.

One significant modern attempt to create a philosophy that addresses the Earth system as an 'All' is **F. W. J. SCHELLING**'s *Naturphilosophie*, which sought to encompass within a single set of philosophical principles the production of nature and thought; of thought out of and as a part of nature. In Schelling's 1798 work, previously unavailable in translation, the philosopher revendicates the ancient theory of the 'World-Soul', entirely reconstructing it through the contemporary science of his time, which he supplements with the necessary speculative basis that will allow him to effect his grand synthesis. As **IAIN HAMILTON GRANT** tells us in his introduction to his new translation, Schelling's book must be understood as a bold experiment in systematically thinking 'the All': Not content with providing a transcendental account of thought's *a priori* determination of its object, Schelling attempts to ground this determination in a Nature conceived as a *prius*, the polarisation of whose primitive forces can be traced through all of natural organisation, conditioning even the consciousness through which they become manifest as concept.

The contemporary ecological crisis demands a (somewhat more modest) reframing of the task of conceiving systematically the 'All' of nature – the biosphere within which human beings are increasingly aware of their implication. We are all well acquainted with the dread auguries emerging from what the media generically refer to as 'scientists'; but this reception reveals little as to the difficulties that beset those tasked with making such projections.

Our interviews with **Stephen Emmott**, **Drew Purves**, **Rich Williams** and **Greg McInerny**, scientists working in Computational Ecology and Environmental Science at Microsoft's Research Laboratory in Cambridge, England, offer some insight into the contemporary stakes of ecological thought, revealing ecology as a science in a state of flux and renegotiation.

They describe how, combining empirical knowledge of the mechanisms of growth, evolution and competition with an arsenal of statistical and computational techniques, their virtual 'in-silico' world-systems – Purves talks of them as involving a selection from a 'universe of universes' – aim to refine hypotheses and constrain predictions regarding the effects of climate change. As the interviewees reveal, the challenges they face make necessary a 'new kind of science' in which the barriers between disciplines are being broken down, and the order of scientific research disrupted or reversed. Negotiating the fearsome task of creating, in Emmott's words, 'a precise, predictive science of complex natural systems' calls for a meticulous questioning of received truths, and a triage between abstraction, accuracy, and uncertainty, in a quest for a 'simplicity on the other side of complexity'. As Purves suggests, it is ecologists who are above all properly placed to give a 'high-level view'; but as we see in McInerny's description of his work, the indications of such a high-level view depend crucially on the selection of theoretical frameworks and on our understanding of low-level biological and genetic factors, shifts in the understanding of which can have radical consequences for prediction. In incorporating them into new computational models, Purves, McInerny and Williams have shown that the presence and interaction of these additional factors can crucially alter our understanding of global processes.

As well as exploring the details of the research underway, it was also important in these conversations to reflect on the predicament of the scientist called on to estimate the fate of the planet; a specialist whose area of research has been reinvigorated by the ecological crisis, but who must remain vigilant against overconfidence and oversimplification. Despite their optimism, the unanimous conclusion of our interviewees is that ecology remains a 'young science': a science already capable of providing an adumbration of the future of the biosphere, but which still faces a great many 'unknown unknowns'.

In addition, it emerges that this work is constrained on all sides by the contingencies of its history: dependent on legacy data and the choices made by those who preceded them, ecologists are involved in a continual reevaluation of their scientific and theoretical inheritance. Perhaps the most serious constraint, however, lies in the additional task of presenting their results to a concerned public. Struggling to be heard clearly amidst political manoeuvring, economic exigencies, and the evangelising of activists and conservationists, as Emmott remarks, ecology today must concern itself not only with theorisation and analysis, but also with clear communication of its point of view as a science.

As McInerny points out, 'activism' often reflects the uninterrogated prejudices and desires of those involved more than the state of scientific knowledge. **Timothy Morton**'s work in ecocriticism dissects the ways in which the narratives and aesthetics of 'environmentalism' remain captive to such unavowed assumptions. Morton's *Ecology Without Nature*,[2] which argued that the idea of 'Nature' is only ever an obstruction to ecological thinking, opened by making a heartfelt case for the importance of philosophical thinking and the creation of new concepts in order to prevent our sense of ecological emergency from precipitating a retreat into nostalgia and the safety of thinking 'Nature' as 'something over there'. In his article for **Collapse**, 'Thinking Ecology' – a preview of his forthcoming book *The Ecological Thought*[3] – Morton proceeds to pick apart the ideological attitudes, still in thrall to the Romantic view of 'Nature', that allow environmentalism, under cover of a naive sincerity, to avoid thinking ecological interdependence. As he argues, the latter thought is not to be attained through blithely asserting our 'community' with the denizens of nature. Simple denial of our own gaze, and the 'framing' it imposes on nature, is not an option: it amounts, as he argues, to the perpetuation of a 'beautiful soul syndrome'. Instead Morton invites us to experience the 'humiliation' of recognising our disturbing collective intimacy with 'life' as a

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[2] *Ecology Without Nature: Rethinking Environmental Aesthetics* (Cambridge, Mass.: Harvard University Press, 2007)

[3] Cambridge, Mass.: Harvard University Press, forthcoming 2010.

'strange stranger', drawing us into a 'dark ecology' in which awareness, rather than implying a contemplative 'letting-be' of 'Nature', delivers a melancholy, ironic recognition that our very rendering of the 'crime scene' implies our necessary and constitutive implication in the crime.

This critique of the ideology of environmentalism is extended and dramatised by UK artist collective FIELDCLUB. Their work explores the humour that emerges in actually following self-sufficiency edicts 'on the ground'; and the irony that comes from raising the principles of ecology to the most general context imaginable. Underpinned by a theoretical position drawing on the long-forgotten neo-Gnostic lore of 'agrosophy',[4] FIELDCLUB remove ecology and the 'anthropic technosphere' from the parochial domain of environmental politics and replace it within the framework of a Bataillean 'solar economy'.

Their irony is not the cynical resignation of the city-dweller; for their work documents a continuing attempt to live 'off-grid', disconnected from public utilities and drawing as little on outside resources as possible. Much of the collective's work draws wryly on incidents in the day-to-day course of this experiment in living, small occurrences that never fail to blacken the name of Eden. This intimate engagement allows them to challenge the credo according to which just a little goodwill and a little less technology could enable humans to temper their depredations in favour of a more gentle and wholesome coexistence with nature.

FIELDCLUB's concern with this uneasy 'complicity' with other living beings leads precisely into what can be seen as assays into Morton's 'dark ecology'. To become close to nature, they demonstrate, is at the very least to repudiate the notion that the Earth is something unreservedly worthy of our admiration, and from which we can draw comforting meaning. The series of devices exhibited in FIELDCLUB's contribution to this volume intimate that man's relation to the soil, no matter how 'traditional' or 'simple', strips us of our 'beautiful soul' credentials and reminds us we must 'kill to live'; at the same time, they lampoon the efforts made through technological mediation to flee the 'scene of the crime'.

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[4] See http://www.fieldclub.co.uk/texts.php

Evidently, any examination of the relation of thought to the Earth must address the way in which we dwell upon, thus transforming, its surface. **Owen Hatherley**'s project to rescue architectural modernism from the 'Ikea modernism' of 'light and airy' interior design belonging to the vacuous economic optimism of the late twentieth-century[5] leads him to the contention that, in restoring the links of modernism with its less palatable predecessors – such as the proto-brutalism of Hitler's Atlantic Wall – we reawaken a suppressed, but rich and provocative, historical lineage. Hatherley's analysis is inspired by Ballard's discovery of a 'warped modernism' in the structures of the Atlantic Wall. And as Hatherley's discussion implies, if we are to consider Ballard as a precursor to 'psychogeography', the latter must be understood in terms of *regression*, so that, as in Ballard's novels, in the contemplation of these (non)structures we experience an 'end-point of architecture': The enterprise of design and construction degenerates into an atavism where 'primal impulses and prehistoric building forms recur', but which paradoxically (as evidenced by Virilio's adaptation of this aesthetic for his brutalist church) also communicates with an impulse to the sacred. These 'instant ruins' thus tap into an architectural phylum which, actualised by a military 'science of compaction and impact', marries emergency with eternity.

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[5] See Hatherley's *Militant Modernism* (London: Zer0 Books, 2009)

Hatherley traces the few instances in which this rich seam resurfaces in architecture, but as he observes, in an increasingly hygienically-conservative architectural climate, it now belongs more to speculative thinking and to the work of artists such as Nicholas Moulin. The suggestion that with more attention, it might fuel an 'apocalyptic pulp of our own time' brings to mind the fact that, of course, Ballard's apocalyptic *Drowned World* must be considered the first science-fictional treatment of climate change. From Ballard's reflections on these forgotten structures, Hatherley thus draws out a as-yet unrealised 'earth-philosophy' as remote from tree-hugging as Ikea is from the Atlantic Wall; one that, via the exigencies of total war, sets the chthonic forces of the inner earth flowing through the Apollonian veins of modernism.

Architect and theorist **Eyal Weizman** transports this immanence with the 'chthonic' into architectural practice: His project *Decolonizing Architecture* seeks to apply an 'ungrounding' process to spaces previously invested with colonialism, practicing 'design by destruction'. *DA* has evolved from Weizman's examination of the role that architecture has played in the Israeli occupation of Palestine; in our interview, he describes the way in which he sees architecture per se as interacting with the 'political architecture' of this occupation, and how the structure of the latter has entered into conceptual commerce with theory. Weizman's conception of 'forensic architecture', in seeking to read the nature of historical events through their material traces, implies a new articulation of 'forces and forms', wherein forms not only register the multiplicity of forces that bear upon them, but in turn become actors in this political 'forcefield'. We discuss the way in which this materialist-pluralist conception of politics demands a rethinking of the notions of responsibility, ideology, and resistance, and how *DA*'s processes of 'design by destruction' and 'ungrounding' seek to disrupt the temporalities according to which the very question of a 'solution' to the problem of occupation has been posed.

Discussing the in some cases hostile reception to this work, Weizman also describes how it has led him to reconsider the very function of theory in the context of global politics: The theoretical enterprise can only operate, he argues, through an engagement with actual protagonists, whose functional roles within twenty-first century conflict bring to light the new conceptual frameworks within which that conflict is being conducted. Thus, concepts are not 'in the head' but 'in the world', and only by affirming this embeddedness of theory – by forensically examining the material traces of specific sites, and by journalistically naming names – can theory become a weapon of resistance.

Weizman's examination of the bonds between architecture and the martial recoding and territorialization of the Earth is further developed in **Manabrata Guha**'s 'Introduction to SIMADology'. Surveying today's 'global security ecology' Guha suggests that its regime of thinking the relation of war to the Earth – inherited, as he suggests, from the 'father' of the theory of warfare, Clausewitz – fails to register the radical difference that terror-operations impose upon the martial landscape. What Guha calls the SIMAD – Singularly Intensive Mobile Agencity of Decay – disrupts the Clausewitzian paradigm, drawing war-machines into a 'chthonic battlespace' which they are constitutively incapable of navigating. Even within the new paradigms of warfare which seek to confront changing conditions through 'network' or 'swarm' paradigms, the weapons of 'surprise' and 'terror' are read in the terms of a political and martial imaginary whose inappropriate causal and economic principles doom them to become, ultimately, a component of the threat they aim to neutralise. Extending Reza Negarestani's analysis of 'hypercamouflage',[6] and through a critique of the conclusions of prominent contemporary theorists of war, Guha depicts terror-operations as effecting a transformation on the instrumentalised war-machine of the state, causing it to proliferate and morph uncontrollably as it confronts the chthonic forces against which it attempts to differentiate itself – forces that owe nothing to tellurian structures, and whose eruption can only be registered as having already taken place. In attempting to 'seal off the tellurian surface' from these terror-Events, Guha suggests, war-machines operating on the Clausewitzian model merely generate self-deceiving fictions – bringing about a 'process of ontological decay' whose nature is opaque to strategic thinking. Maintaining the state at a 'tipping point […] between self-destruction and absolute consolidation', the SIMAD thus becomes the co-ordinator of 'global security governance' and the 'biopolitical model of the post-modern state'.

Confronting this 'complicity of visions' and drawing on **Reza Negarestani**'s contribution to **Collapse IV**,[7]

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[6] R. Negarestani, 'The Militarization of Peace: Absence of Terror or Terror of Absence?', **Collapse** I, 53-91.

[7] R. Negarestani, 'The Corpse Bride: Thinking with Nigredo', **Collapse IV**, 129-61.

Guha in closing declares that '[w]e are that which decays *and* the agents of decay. We are expressions of the terrifying envoiding chemistry of decay'. Negarestani's contribution to the present volume expands this theme into the analytic description of an 'architecture and politics of decay'. Excavating some of the more bizarre preoccupations of mediaeval thought, and tracing their influence on early-modern mathematics, Negarestani suggests that they offer us the formal basis for an 'architecture, mathesis and politics of decay'.

This mathesis, of which Negarestani finds 'the most refined expression' in politics, sees the interior ideal of a form not as an origin, but as emerging processually through its decay, in tandem with a production of exteriorised derivatives. Distancing his thesis from any nostalgic fetishising of ruins and insisting that it not only applies to superficially 'decayed' states but must be thought of as a general principle, Negarestani notes that a 'politics of decay' is disturbing precisely because – like Guha's SIMAD – it invokes a universal dynamic principle that undermines any claims to wholeness and wholesomeness.

Notably, Negarestani's argument also contains a confrontation with the nihilism expounded by Ray Brassier in his *Nihil Unbound*:[8] Science's evacuation of the realm of organic interiority into the exteriority of space, Negarestani suggests, does not take place without a 'twisting' in time and in space. His suggestion of a calculus of decay as 'mathematics with a chemical disposition or chemical revolution via mathematical distributions' problematises any straightforward vector of exteriorization, both in the realm of in/organic matter and in the history of thought, by locating both within a *humus* whose vermicular twisting can never fully be 'worked out'. In a parallel to his remarkable book *Cyclonopedia*, where the molten core of the Earth attests to its immanence with the sun – and again, recalling Guha's SIMAD – for Negarestani exteriority is already a chthonic 'insider'.

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[8] R. Brassier, *Nihil Unbound: Enlightenment and Extinction* (Basingstoke: Palgrave Macmillan, 2007).

In his precise definition of this positive process of 'decay as a building process', Negarestani in fact provides the abstract key to the strange confluences not only in Hatherley, Weizman and Guha's analyses, but also in Masciandaro's account of the continual self-differentiation of knowledge. As Masciandaro reminds us, commentary's addressing of the earthly condition constitutes, not a resignation to the inescapable finitude of the text, but philosophy's very 'boldness', its 'monstrous' aspiration to continually deform, denature and multiply what it attends to, in a twisting wherein the poetic impulse rejoins with the philosophical imperative, the wandering on the Earth with the will to flight. Negarestani's turn towards those incorrigible commentators, the Scholastics, elicits the formal identity of his vermicular chemico-mathematics with this process of exegetical 'twisting'. Perhaps then Negarestani not only succeeds Schelling as 'the philosopher of the new chemistry' – albeit, as Iain Hamilton Grant has suggested, a 'chemistry of darkness' – but also presents us with a 'chemistry of (the history of) philosophy'.

Needless to say, the Earth, in our dealings with it and our navigations on it, exists for us not in 'immediate experience', but in coded form. The work of artists **Angela Detanico and Rafael Lain** examines the many ways in which the surface of the planet is coded, and their playful constructions explore the peculiar grammatologies that emerge once this stenography between the geographical and the symbolic is in place; its disorientations highlighting the faith we place in our mediated figure of the world, often mistaking the map for the territory.

Charles Avery's work returns to what has long been a favourite geographical trope for philosophy. At a certain point in his practice, Avery decided to locate all of his future work within an imaginary Island, whose locations, inhabitants and culture he continues to render beautifully in a variety of media – including text, as in the enigmatic travelogue *The Islanders: An Introduction*,[9] an 'epilogue' to which Avery contributes to this volume. In **Collapse V** one of Avery's maps accompanied cosmologist Milan Ćirković's discussion of the 'archipelago of habitability'.[10] Setting out from this pairing, **Robin Mackay**'s prefatory essay to our presentation of Avery's work seeks to locate the latter as a possible contemporary successor to a rich history of 'Philosophers' Islands'. As Mackay remarks, the nature of Avery's project demands that 'the work' and its significance be sought, not in any one of the exquisite pieces exhibited by Avery, but in the Island 'itself' – the (unfinished) structural whole that will bind them together.

Our volume closes with two contributions that in very different ways address this philosophical obsession with the island and with the ocean that surrounds it. **Gilles Grelet** presents us with a manifesto of refusal: the task of philosophy as conceived by Althusser and systematically diagnosed by François Laruelle's 'non-

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9. C. Avery, *The Islanders: An Introduction* (London: Parasol Unit/Koenig, 2008).

10. M. Ćirković, 'Sailing the Archipelago', **Collapse V**, 292-329.

philosophy' – as a series of 'decisions' producing trenchant lines of demarcation that partition the ground of thought – is rejected. 'Ungrounding' himself by taking to the other, predominating element of the planet, with a boat as his 'theory-body', Grelet extols theory as 'world-less', indeed as 'a full-on attack on the world', an angelic thought whose 'crossings' operate without the territorial imperatives of the 'worldly'.

Renée Green's film 'Endless Dreams and Water Between', originally shown in 2009 as part of an installation at the National Maritime Museum in Greenwich, uses the island and its surroundings as the setting for an interrogation into the making of thought in-between four protagonists. Inconclusive, dreamlike and – recalling Masciandaro's opening contribution – both referential and peripatetic, Green's film, the script of which is presented here, concerns itself with the geophilosophical precipitation of thought, as four women driven by a curiosity about their own location and inclinations move toward a speculative coherence that the work preserves in a state of 'clear-obscurity'. The island, a 'non-location' which serves as a navigational point of reference, also allows its inhabitants those uninterrupted vistas for the imagination that have provided writers with (sometimes, as in the case of George Sands, ultimately disappointed) dreams of freedom. As suggested by Masciandaro, it is by 'staying', by contemplating their island locations, that Green's protagonists move towards a collective thinking that expands into the realms of the abstract only on the basis of their localisation and the contingency of their respective interests and circumstances.

Like Avery's, Green's work highlights shifting relations between fiction and fact, physical geography and imaginary geography, that govern our thinking of the Earth and the worlds we build upon it. They join the other contributions to this volume in demonstrating that 'Planet Earth' qua terrestrial entity or biosphere is but one among those many inextricable 'wholes'. Even new efforts at reconstructing it in scientific models are never entirely free from evolutions and selections of their own, from the contingencies of history, and from the legacy of its duality in thought as 'object and omnipresence'.

The bringing together of apparently divergent perspectives within this volume is, we must as ever insist, not merely whimsical. It aims to bring into view avenues of thought which run between them and which may lead to new spaces outside the rigid boundaries of disciplinarity. In our introduction, as in previous volumes, we hope to have indicated some of these; others it will be the reader's business (and, we hope, pleasure) to trace.

It seems appropriate in closing to reflect briefly on the coherence, not only of this particular volume, but of the project as a whole; a coherence which, as is appropriate for a journal of 'research and development', has slowly come to light only in the process of working on the series. Through the creation of these volumes, from the beginning deliberately and sincerely billed as an 'experiment', has emerged a curatorial model in which, rather than all of the contributions to a publication falling within a circumscribed discipline or subject, a broad theme allows contributions from diverse practitioners to form an overlapping chain or (adopting Timothy Morton's term) mesh, whose intermediate links span otherwise disparate elements. The hope is that this connectivity should reproduce itself in the broad audience that **Collapse** assembles; that the 'forced collaboration' operated within these pages should find its counterpart in a strange collectivity of readers who, drawn in by one or two contributions appropriate to their interests, find themselves unexpectedly befriended by writers and thinkers from entirely different 'mindsets'. This in turn suggests a model of the concept according to which the latter resides, not in an hierarchical structure of progressive generalisation (a structure which reproduces and is reproduced in institutional specialisation), but in transversal connections discovered, or produced, 'in the making'. Thanks to a growing network of contributors and readers, each volume brings with it such discoveries, so that its finished state bears but a faint resemblance to the terms of its initial conception.

If, in search of this conceptual consistency, we have traversed the abstractions of mathematics (Volume I), the emerging paradigms of Speculative Realism (Volumes II and III), the legacy of Deleuze (Volume III), the horrors of thought and the thinking of horror (Volume IV) and the Copernican Turn in its many guises (Volume V), only to come back 'down to Earth', it is an Earth which we no longer fully recognise, and which continues to offer numerous challenges – by turns urgent, melancholy, and twisted – to the thought it has given birth to.

We would like to conclude by thanking all of our contributors for their work and their patience in collaborating on this volume, and to our readers for their continued enthusiasm for this process of 'research and development'.

Robin Mackay,
Falmouth, January 2010.

ig. 1. Martin Behaim's *Erdapfel*

Becoming Spice: Commentary as Geophilosophy

Nicola Masciandaro

The overman is the meaning of the earth [...] *Once the sacrilege against God was the greatest sacrilege, but God died, and then all these desecrators died. Now to desecrate the earth is the most terrible thing, and to esteem the bowels of the unfathomable higher than the meaning of the earth.*
Friedrich Nietzsche[1]

I don't know if you were frightened, but I at any rate was frightened when I saw pictures coming from the moon to the earth. [...] *Only a god can save us.*
Martin Heidegger[2]

No knower necessarily stands so close to the verge of error at every moment as the one who philosophizes.
Martin Heidegger[3]

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[1] F. Nietzsche, *Thus Spoke Zarathustra*, trans. A. Del Caro (Cambridge: Cambridge University Press, 2006), 'Zarathustra's Prologue,' 6.

[2] M. Heidegger, '"Only a God Can Save Us": *Der Spiegel*'s Interview with Martin Heidegger (1966),' trans. M. P. Alter and J. D. Caputo, in *The Heidegger Controversy: A Critical Reader*, ed. R. Wolin (Cambridge, MA: MIT Press, 1993). 105-7.

[3] M. Heidegger, *The Fundamental Concepts of Metaphysics: World, Finitude, Solitude*, trans. W. McNeill and N. Walker (Bloomington: Indiana University Press, 1995), 19.

Mankind's movement through deep space placed a unique stamp on religion during the one hundred and ten centuries that preceded the Butlerian Jihad. [...] *Immediately space gave a different flavor and sense to ideas of Creation* [...] *All through religion, the feeling of the sacred was touched by anarchy from the outer dark.*
Frank Herbert[4]

Perhaps only a language in which the pure prose of philosophy would intervene at a certain point to break apart the verse of the poetic word, and in which the verse of poetry would intervene to bend the prose of philosophy into a ring, would be the true human language.
Giorgio Agamben[5]

We are allured by the fragrance of it.
Nicholas of Prato, letter to Nicholas Trevet, praising his commentary on Boethius's *Consolation of Philosophy*[6]

We are the heretics, apostates, false messiahs, deserters, non-believers, and nihilists, who immediately realise life outside the law on the body of the earth.
Benjamin Noys[7]

They took the body of Jesus, and bound it in linen cloths with the spices.
John 19:40

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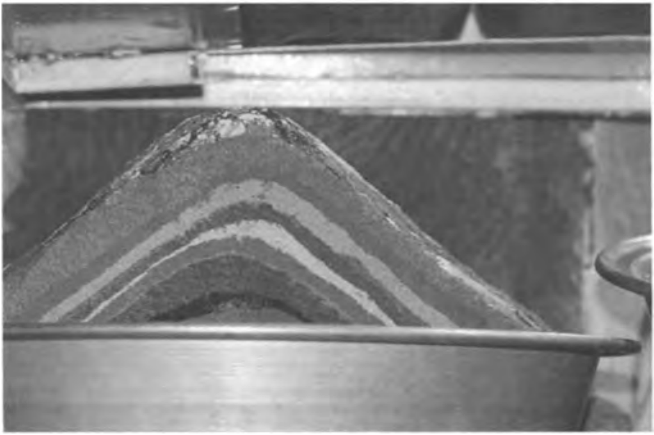
[4] F. Herbert, *Dune* (New York: Ace Books, 198), 501.

[5] G. Agamben, *Language and Death*, trans. K. E. Pinkhaus with M. Hardt (Minneapolis: University of Minnesota Press, 1991), 78

[6] 'Huius rei odore sumus allecti,' cited from R. J. Dean, 'Cultural Relations in the Middle Ages: Nicholas Trevet and Nicholas of Prato,' *Studies in Philology* 45 (1948), 550n16.

[7] B. Noys, 'Anarchy-Without-Anarchism', at http://www.sans-philosophie.net.

I. PREAMBLE



The twenty-sixth canto of Dante's *Inferno* voyages via the figure of Ulysses into the folly of philosophical *flight*: 'e volta nostra poppa nel mattino, / de' remi facemmo ali al folle volo' (26.124-5) [and turning our stern to the morning, we made our oars wings for the mad flight].[8] The deeper sense of the image is that oars are not wings, that such epistemological search, for what Ulysses calls 'l'esperïenza [...] del mondo sanza gente' (26.116-7), is fatally, merely earthbound. Ulysses's pursuit of 'virtute e canoscenza' (26.120) [virtue and knowledge] beyond the Pillars of Hercules ends in shipwreck within sight of the mountain Dante passes on his way beyond the stars: 'de la terra nova un turbo nacque / e percosse del legno il primo canto' (26.137-8) [from the new land a whirlwind rose and struck the forepart of the ship]. As accentuated by *canto* (prow), homonym with Dante's song-meaning word for the units of his poem, what is crucially at stake here is the boundary between philosophic and poetic modes of knowledge, the very boundary Dante's visionary text would overcome.[9] Ulysses's fate, recalled at the end of *Purgatorio*'s first canto ('Venimmo poi in sul lito deserto, / che mai non vide navicar sue acque / omo, che di tornar sia poscia esperto' (130-2) [we came on to the desert shore, that never saw any man navigate its waters who afterwards had experience of return]), also mirrors the opening impasse of the *Commedia*, where Dante is turned back from direct ascent of 'il dilettoso monte / ch'è principio e cagion di tutta gioia' (*Inferno* 1.77-8) [the delectable mountain, the source and cause of every happiness]. As commentators have noted, Ulysses's unidirectional demise refracts the abandoned prosimetric project of Dante's *Convivio*, which sets sail under the Aristotelian banner of knowledge=happiness.[10] The so-brief rejoicing of Ulysses and his men thus figures the impermanence and impropriety of such an easy equation, the impossibility of realising its truth by any straight path. The way to real knowledge passes through the underworld.[11] 'A te convien tenere altro vïaggio' (*Inferno* 1.91) [It behooves you to go by another way]. This way pursues a path that returns, one that begins by entering the earth.

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[8] Dante Alighieri, *The Divine Comedy*, ed. C. S. Singleton (Princeton: Princeton University Press, 1973).

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[9] 'convien saltar lo sacrato poema, / come chi trova suo cammin riciso [...]. non è pareggio da picciola barca / quel che fendendo va l'ardita prora, / né da nocchier ch'a sé medesimo parca' (*Paradiso* 23.62-9) [the sacred poem must needs make a leap, even as one who finds his way cut off [...]. It is no voyage for a little bark, this which my daring prow cleaves as it goes, nor for a pilot who would spare himself].

[10] The *Convivio* opens: 'As the Philosopher says at the beginning of the *First Philosophy*, all men by nature desire to know. The reason for this can be and is that each thing, impelled by a force provided by its own nature, inclines towards its own perfection. Since knowledge is the ultimate perfection of our soul, in which resides our ultimate happiness, we are all therefore by nature subject to a desire for it' (Dante Alighieri, *The Convivio*, trans. R. Lansing [New York: Garland, 1990], I.1).

The geophilosophical significance of Ulysses *folle volo*, newly seen from the sphere of the fixed stars with cartographic clarity as 'il varco / folle d'Ulisse' (*Paradiso* 27.82-3) [the mad track of Ulysses], lies in its contrast to the chthonic-celestial journey that surpasses it. Fleeing the place of human habitation, Ulysses remains ironically fixed to the earth's surface. Entering this place, Dante paradoxically reveals the heavenly beyond within the planet. The former movement is geometrically linear and terminal, the proper projection of the hero's finite concept of life as 'questa tanto picciola vigilia / d'i nostri sensi' (*Inferno* 26.114-5) [this so brief vigil of our senses]. The latter movement is geometrically circular and endless, the mode of the poet's impossible, always-already entering into eternity.[12] The former is terrestrial and territorializing.[13] The latter is spherical and peripatetic.

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[11] 'The distance that separates Ulysses' point of shipwreck from the pilgrim's survival, or, for that matter, the *Convivio* from the *Purgatorio*, is measured by the descent into hell. This is literally true, according to the geography of the poem, and figuratively true as well, as the descent into the self, *intra nos*, is the prerequisite for the kind of transcendent knowledge that all men desire' (J. Freccero, *Dante: The Poetics of Conversion* [Cambridge, MA: Harvard University Press, 1988], 146).

[12] 'A l'alta fantasia qui mancò possa; / ma già volgeva il mio disio e 'l *velle*, / sì come rota ch'igualmente è mossa, / l'amor che move il sole e l'altre stelle' (*Paradiso* 33.142-5) [Here power failed the lofty phantasy; but already my desire and my will were revolved, like a wheel that is evenly moved, by the Love which moves the sun and the other stars].

[13] As indicated by the opening of Canto 26 of *Inferno*, which prefigures the terms of Ulysses's flight: 'Godi, Fiorenza, poi che se' sì grande / che per mare e per terra batti l'ali, / e per lo 'nferno tuo nome si spande! (1-3) [Rejoice, O Florence, since you are so great that over sea and land you beat your wings, and your name is spread through Hell!]

Yet there is continuity between the two, an umbral link that repeatedly foregrounds the latter as the realisation of the former.[14] Shadowing himself with Ulysses, Dante illuminates the geophilosophical trajectory of his journey. In particular, he uses Ulysses to reflect upon the coming-to-be of the *Commedia* out of and after the unfinished auto-commentarial project that precedes it. Dante's epic originates at the crossing of a threshold or crux defined by the intersection of the boundaries between poetry and philosophy, text and commentary, authorship and exegesis. These are the generic 'Pillars of Hercules' he crosses to become the 'first modern author' and anomalous object of an immediate commentary tradition.[15] The ongoing moment or engine of this becoming, the Ulysses-passing 'navicella del mio ingegno' (*Purgatorio* 1.2) [little bark of my genius] whereby Dante overleaps his own autoexegetical impasse, is the *Commedia*'s originary digression within the dark wood,[16] the pilgrim's turning back from direct philosophic ascent and admission into a subterranean path.

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[14] As Singleton explains in his commentary on *Paradiso* 27.82-3, the poet's recollections of Ulysses coincide with threshold moments: 'the wayfaring Dante and the souls of those who pass Purgatory both complete successfully a fording which is denied Ulysses. And now, as the pilgrim is about to cross over from "the human to the divine, from time to eternity" (*Par.* XXXI, 37-8), his last glance earthwards takes in the "mad crossing" of Ulysses: again he stands on a "shore" that will forever be denied to the ancient hero.'

[15] See D. Parker, 'Interpreting the Commentary Tradition to the *Comedy*,' in *Dante: Contemporary Perspectives*, ed. A. A. Iannucci (Toronto: University of Toronto, 1997), 240-58; A. R. Ascoli, 'Auto-commentary: Dividing Dante,' chapter 4 of *Dante and the Making of A Modern Author* (Cambridge: Cambridge University Press, 2008), 175-226.

[16] 'Nel mezzo del cammin di nostra vita / mi ritrovai per una selva oscura, / che la diritta via era smarrita' (*Inferno* 1.1-3) [Midway in the journey of our life I found myself in a dark wood, for the straight way was lost].

I take this moment, which corresponds more precisely to the duration between the pilgrim's being turned back by the *lonza* (panther or leopard) and his meeting with his poet-guide Virgil (*Inferno* 1.31-60), as an invitation to think commentary's geophilosophical dimension, its constituting the *form* of philosophy's belonging to the earth. The question of this form is not only a problem of style and representation. The problem, as Dante's dramatisation of it reveals, concerns the very *how* of thought as a necessary relation between its content and its experience.[17] To succeed philosophically, to indeed arrive at and produce its truth, thought must realise or render actual its own absoluteness, the 'identity of identity and difference' with respect to itself. Thought must become the body it belongs to, a self-moving vehicle that carries its subject with it.[18] This imperative is beautifully presented in the *problemic* movement of the Dantean pilgrim who neither ascends above nor enters the earth, whose lower foot is always the firmer ("l piè fermo sempre era 'l più basso,' 1.30), and who is repeatedly turned back ('i' fui per ritornar più volte vòlto,' 1.36).

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[17] A problem to which commentary in particular speaks: 'Western culture could be characterized as being irreparably driven between *Halacha* and *Aggada*, between *shari'at* and *haqīqat*, between subject matter and truth content. Any healing between these terms has become impossible (this, incidentally, is evident in the loss of the commentary and the gloss as creative forms) – at least since the demise of the medieval theory of the four meanings of writing. (This theory has nothing to do with the gratuitous exercise of four successive and distinct interpretations of a text; rather, it takes place among them, in *the living relationship* between subject matter and truth content' (G. Agamben, *Infancy and History: The Destruction of Experience*, trans. L. Heron [London: Verso, 1993], 160, my emphasis).

[18] Cf. Augustine's description of the way of arrival as what joins seeing and dwelling: 'discernerem atque distinguerem, quid interesset [...] inter videntes, quo eundum sit, nec videntes, qua, et viam ducentem ad beatificam patriam, non tantum cernendam sed habitandam' (*Confessions* [Cambridge, MA: Harvard University Press, 1950], 7.20) [I could discern and distinguish what difference there was between [...] those seeing where to go but not seeing how, and those seeing the way leading to the blessed homeland, which is not only to be discerned, but dwelt in].

Such a turning and circling motion which passes inside and across the philosophy/poetry boundary is exemplary of the commentarial impulse, an impulse which paradoxically proceeds by staying. Understood in these terms, the pilgrim's impasse, whereby he is caught in a motion that keeps him to the earth, is not simply the problem which the salvific production of the *Commedia* resolves, but its very labour.[19] Staying with the earth is the means of not remaining stuck on it, just as a boulderer proceeds by tenaciously experiencing the problem, staying *within* the encounter of the crux and passing through its difficulty (*ex-per-ientia*, 'coming out of and going through'). On this model, the geophilosopher is one who philosophically experiences rather than flees the earth, who passes through by remaining with it. Geophilosophical experience entails facing, more and more deeply, the fact of earth as the place of philosophy, and more profoundly, experiencing earth as facticity itself, the site of thought's passage to the absolute.[20] Commentary, the space of deictic and anagogic understanding, encodes this experience in the form of spice. As spice is a foundational term of terrestrial exploration, so commentary is the form of our geophilosophical becoming-spice, the practice whereby thought enters the earth and makes itself aromatic, that is, achieves the nature of a panther: 'This is an animal that is said to be parti-coloured, indeed colourful, and is extremely beautiful [*speciosissimum*] and gentle. [...] When it eats and is thus satiated, it hides in its cave and sleeps. But after three days it rises from sleep, and emits a great roar, and from its mouth comes forth a very sweet odour like all spices.'[21]

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[19] The circular form of this productive impasse is elaborated in the pilgrim's later disclosure of the cord with he had hoped to capture the *lonza*: 'Io avea una corda intorno cinta, / e con essa pensai alcuna volta prender la lonza a la pelle dipinta' (*Inferno* 16.106-8) [I had a cord girt round me, and with it I once thought to take the gay-skinned leopard]. The cord is figurally associated with dialectic. See F. Masciandaro, 'La corda di Gerione e la cintura-serpente della Dialecttica,' *La conoscenza viva: Letture fenomenologiche da Dante a Machiavelli* (Ravenna: Longo, 1998), 45-54.

[20] 'We now know the location of the narrow passage through which thought is able to exit from itself – it is through facticity, and through facticity alone, that we are able to make our way towards the absolute' (Q. Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. R. Brassier [London: Continuum, 2008], 63).

A more literal image of geophilosophic implication between commentary and spice is provided by Martin Behaim's annotated globe (Fig. 1), made in 1492 on the eve of the great European voyages of discovery. The globe presents the superimposition of two geometries: one, of commentary, a global ancient genre, as a kind of writing that in its very form seeks to sphericise a text, to surround it on all sides; the other, of spice, the original global commodity, as a kind of writing on the earth, a movement that marks and remarks relational networks. Next to the Spice Islands, Behaim provides a lengthy gloss detailing how 'spices pass through several hands in the islands of oriental India before they reach our country' that concludes as follows: 'Twelfthly, those who use the spices buy them of the retail dealers, and let the high customs duties profits be borne in mind which are levied twelve times upon the spices, the former amounting on each occasion to one pound out of every ten. From this it is to be understood that very great quantities must grow in the East and it need not be wondered that they are worth with us as much as gold.'[22] As the product of these geometries, the comment demonstrates interpretation as commerce, a laborious extraction of significance across time and space whose very process generates the value it apparently only translates, and exposes the inescapable spatiality and topology of understanding, the matrices of distance and desire that make for the pro-duction of meaning, its being brought into presence. It brings to mind the enigmatic lines, interpreted by Francis Bacon as prophesying the age of discovery and made to comment on the image of a ship passing the Pillars of Hercules in the frontispiece to his *Novum Organum* (1620): 'But you, Daniel, shut up the words, and seal the book, until the time of the end. Many shall run to and fro, and knowledge shall increase' (Daniel 12:4).[23] These may be read, phenomenologically rather than factually, as figuring exactly the earthly restlessness of understanding, its interpretive movement *around* that draws forth from what cannot be penetrated. Between the sealing of the text and the increase of knowledge is established the

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[21] W. B. Clark, *A Medieval Book of Beasts: The Second-Family Bestiary: Commentary, Art, Text and Translation* (Rochester, NY: Boydell & Brewer, 2006), 123. Given Dante's emphasis on the beauty of the *lonza*, this is very likely the animal he has in mind, although the determination of its species 'seems next to impossible' (R. T. Holbrook, *Dante and the Animal Kingdom* [New York: Columbia University Press, 1902], 95) and is 'another of the *Comedy*'s little mysteries likely to remain unsolved' (Robert Hollander, commentary on *Inferno* 1.32-54, Dartmouth Dante Project <http://dante.dartmouth.edu>). More importantly, Dante's *lonza* is thus itself both figure and instance of the production of commentary's perfect object, something that generates unending commentary via the fact that it cannot be said or explained, only shown or indicated. Fulfilling the relation to *spice*, such an object is *special*: 'The *species* of each thing is its visibility, that is, its pure intelligibility. A being is special it if coincides with its own becoming visible, with its own revelation' (G. Agamben, *Profanations*, trans. J. Fort [New York: Zone, 2007], 57).

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[22] Cited from L. Jardine, *Worldly Goods: A New History of the Renaissance* (London: Macmillan, 1997), 296-8. On Martin Behaim's understanding of the spice trade, see P. Freedman, *Out of the East: Spices and the Medieval Imagination* (New Haven: Yale University Press, 2008). 141-2.

[23] 'And this proficience in navigation and discoveries may plant also an expectation of the further proficience and augmentation of all sciences; because it may seem they are ordained by God to be coevals, that is, to meet in one age. For so the prophet Daniel speaking of the latter times fortelleth, "Plurimi pertransibunt, et multiplex erit scientia': as if the openness and through passage of the world and the increase of knowledge were appointed to be in the same ages' (Francis Bacon, *The Advancement of Learning*, 2.10, cited from *Francis Bacon: The Major Works*, ed. B. Vickers [Oxford: Oxford University Press, 2002], 184).

surface over which understanding moves, a surface that is planetary, in the sense of enclosing what it contains. This is in an essential way the movement of philosophy, or rather philosophy itself as movement, 'the urge,' in Novalis's optimal topological definition, 'to be at home everywhere.'[24] For the practice of this restless urge also moves as over the surface of a whole, *as if movement itself would be relocated* and made the omnipresent term of equation between anywhere and everywhere. Such an equation is present in Heidegger's call to 'practice planetary thinking along a stretch of the road, be it ever so short,' which locates the global in a local path, the universality of thinking in the grounded practice (figural and/or literal) of walking where one is.[25] The movement of philosophy is thus not the means to, but precisely a freedom from destination, a *peri-patos* or around-walking that realises itself as processual and gerundive. 'Philosophy is philosophizing.'[26]

Tracing the movement of philosophy in these terms, as grounded in a movement of being that is unmistakably earthly and planetary, intersects with two essential features of commentary and geophilosophy that my exploration will pay particular attention to: digression and immanence, respectively. Digression belongs to commentary with respect to its 'go-and-stop' structure, its pausing of the text so as to move tangentially from it in any direction, but never so far or long as to prevent or forget returning.[27] The place of digression is the margin, the space into which commentary moves simultaneously away from, toward, more deeply into, and far beyond its text. The digression of commentary is not aimless or arbitrary, not merely wayward or adjacent. It is rather a wandering at once in and against the gravity of its return, like hunting or gathering *along the way*. Immanence belongs to geophilosophy, in all of its permutations and senses, as philosophy oriented to Earth, this earth, as the here-and-now place of its origin and space of its truth or realisation. Geophilosophy, above all via Nietzsche and Deleuze and Guattari, who established the term in the former ('Nietszche founded geophilosophy'), embraces the experiential, phenomenological fact of the absence of a transcendental outside and the rootedness of thinking in earth. 'There is no outside!' says Zarathustra, and the animals reply, 'In every Instant being begins; round every Here rolls the ball. There. The middle is everywhere. Crooked is the path of eternity.'[28] 'Thinking is neither a line drawn between subject and object nor a revolving of one around the other. Rather, thinking takes place in the relationship of territory and earth,' say Deleuze and Guattari.[29] Or, as Diane Chisholm explicates, 'The prefix *geo* does not signify a specialized branch of philosophy; it signals, rather, the *topos,* or the *now here,* of philosophical inquiry in place of a transcendental metaphysics that believes itself above being placeable, abstractly nowhere and universally everywhere.'[30] Geophilosophy's characteristic discursive ambivalence or confusion regarding the distinction between the literal earth and earth-as-metaphor, encapsulated in its Nietzschean phrasal cornerstone 'the meaning of the earth' [*Sinn der Erde*] and erroneously dissected by academic commentary, is part and parcel of its investment in immanence. The earth is the present object par excellence that can never be approached from distinctions between metaphorical and literal, figure and ground. Earth is so deeply present that its meaning is always falling back into earth 'itself.' Earth is 'too much with us,' as Wordsworth says of 'the world,' the *saeculum* of human work and worry, longing for a proportional belonging to the earth that world occludes. But it is exactly the combination of the earth's phenomenal unboundedness as object and omnipresence as fact that constitutes its inevitable diurnal occlusion, its constantly being forgotten via its very presence. So Heidegger grasps earth by defining it as closed and closing on itself: 'The earth appears openly cleared as itself only when it is perceived and preserved as that which is by nature undisclosable, that which shrinks from every disclosure and constantly keeps itself closed up [...] The earth is essentially self-secluding.

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[24] Novalis, *Philosophical Writings*, trans. M. M. Stoljar (Albany: State University of New York Press, 1997), 45.

[25] M. Heidegger, *The Question of Being*, trans. J. T. Wilde and W. Kluback (New Haven: College & University Press, 1958), 107. On walking and philosophy, see D. Macauley, 'Walking the Elemental Earth: Phenomenological and Literary Footnotes,' in *Passions of the Earth in Human Existence, Creativity and Literature*, *Analecta Husserliana 71*, ed. A.T. Tymieniecka (Boston: Kluwer Academic Publishers, 2001), 15-31; and R. Solnit, 'The Mind at Three Miles an Hour,' Chapter 2 of *Wanderlust: A History of Walking* (New York: Penguin, 2001), 14-29.

[26] Heidegger, *The Fundamental Concepts of Metaphysics*, 4.

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[27] 'Between the seemingly unavoidable and somehow joyful drive of commentary toward *copia* and commentators' obligations to show that their work is task oriented [...] between an aesthetics of exuberance and an aesthetics of streamlined reader functionality, commentators tend to develop a specific rhythm that one could perhaps characterize as "go-and-stop". On the one hand, they certainly want the user to appreciate the *copia* of the knowledge offered, but on the other hand, they hardly ever forget to insist on the rigorous functionality of their commentary, as if they anticipated protests of readers who would get lost in the meandering cross-references of the text on the margin.' (H. U. Gumbrecht, *The Powers of Philology: Dynamics of Textual Scholarship* [Urbana: University of Illinois Press, 2003], 45).

[28] Nietzsche, *Thus Spoke Zarathustra*, 'The Convalescent', 175. Cf. 'Nietzsche performs on the metaphorical level what Hegel attempts on the systematic one: the centralization of the earth, its relocation in the middle of the universe making the sun a satellite of our planet, the final withdrawal of the Copernican Revolution' (S. Günzel, 'Nietzsche's Geophilosophy,' *Journal of Nietzsche Studies* 25 [2003]: 82).

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[29] G. Deleuze and F. Guattari, *What is Philosophy?*, trans. H. Tomlinson and G. Burchell (New York: Columbia University Press, 1994), 85.

[30] D. Chisholm, 'Rhizome, Ecology, Geophilosophy (A Map to this Issue),' *Rhizomes* 15 (2007): 4, at http://www.rhizomes.net/issue15/chisholm.html.

To set forth the earth means to bring it into the Open as the self-secluding.'[31] Earthly immanence (from *in manere*, to remain within) is the remaining-within-itself whereby earth always remains within, is immanent to, world, the mode of its being that makes it always here. Earthly immanence is thus the counterpart of the presence of space, as that which everything always remains within. Earth is proportional to space, the chthonic to the khoral, which always remains without: 'And there is a third nature, which is space [*chōra*] and is eternal, and admits not of destruction and provides a home for all created things, and is apprehended when all sense is absent, by a kind of spurious reason, and is hardly real – which we, beholding as in a dream, say of all existence that it must of necessity be in some place and occupy a space.'[32] In short, space is to the sky as earth is to the ground. Earth and space are the twin dimensions where the boundary between the topological and the spatial totally breaks down. In one direction, space, embodied in the sky, gives way to absolute place, Plato's imperceptible container where everything must be. In another direction, place, embodied in the ground, gives way to absolute space, the abyss whose bowels Nietzsche esteems. In the neighbourhood of their mutual extremity, each becomes the other. And in the region of their most proximate differentiation, there is world (ground-sky), the mutually disclosing relation of earth and space that Heidegger calls the Open and feared technology to be closing.[33]

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[31] M. Heidegger, 'The Origin of the Work of Art,' in *Poetry, Language, Thought*, trans. A. Hofstadter (New York: Harper & Row, 1971), 47.

[32] *The Collected Dialogues of Plato*, eds. E. Hamilton and H. Cairns (Princeton: Princeton University Press, 1963), *Timaeus* 52b, 1178-9.

[33] Keith Tester comments on Heidegger's fear upon seeing photos from the moon: 'The photographs implied a containment of the meanings of the earth even as they also implied a freedom of humanity [...] from their natural home. But in that

Commentary is geophilosophical in the sense of being a movement that produces the immanence of the earth both formally and actually. Formally, commentary makes of a text, its earth, an *orbis*, a round world, by bringing text into the space around it. A dwelling in and on the text, commentary accords with Heidegger's explication of work as a dialectic of earth and world: 'Upon the earth and in it, historical man grounds his dwelling in the world. In setting up a world, the work sets forth the earth [...]. The work moves the earth itself into the Open of a world and keeps it there. *The work lets the earth be an earth*.'[34] Commentary likewise does not break its text, but preserves its integrity, shaping itself to it even in the midst of digging through it interlinearly and dwarfing, dominating it circumferentially. Something of the phenomenal earthiness of this complex relation is captured by our tendency to speak both of footnotes as *mines* and of *mining* footnotes. Commentary lets the text be a text and furthermore brings it into the open as self-secluding in the sense of presenting itself, not as some transparent medium for seeing behind or underneath it, but as *further* text. 'What [...] hermeneutic topologies of the below and the behind share,' says Gumbrecht, 'is a categorical – not to say dramatic – distinction between a level of primary perception and an always 'hidden' level of meaning and intentionality [...] In contrast, commentaries do not aim at a level 'below,' 'behind,' or even 'beyond' the textual surface, but commentators nevertheless do not see texts 'from above' or from that famous 'distance' that we so

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containment, the photographs also made the earth a problem to be dealt with; an opportunity to be exploited, a standing reserve waiting for animation by the designs and desires of humanity through technology' (*The Inhuman Condition* [London: Routledge, 1995], 3).

34. Heidegger, 'The Origin of the Work of Art,' 46.

readily associate with objectivity. We expect commentaries [...] rather to be "lateral" in relation to their texts of reference, and we want commentators to position themselves in "contiguity" not so much with an author but with the text in question. It is this contiguity between the commentator's text and the text on which to comment that explains why the material form of the commentary depends on and has to adapt to the material form of the commented-on text.'[35] Yet, it is absolutely necessary to add (else the deep *dialectical* relation between text and commentary might be lost), that commentary's topological contiguity with its text does not delimit its interpretive, archaeological function, but rather institutes it as realised and to-be-realised in the text itself and our being before it. In other words, commentary is an immanent geo-graphy, an inscriptional earth-writing that continuously asserts by its very movement that its truth belongs *here* in the most palpable and factical sense, that it is *written into* the place of reader and text, as exemplified by the formal continuities between glossing and graffiti. This more complex relation between commentary and text, the movement, neither orthodox nor subversive, whereby commentary keeps to and maintains the surface of its text by perforating it, is present within Reza Negarestani's concept of Hidden Writings: 'Hidden Writing produces [...] positive disintegration, or more accurately collectivization of one author (voice) or an authorial elite, and its transformation to an untraceable shady collective of writers, a crowd [...] So-called hermeneutic rigor follows the logic of textual stratification, and can be achieved by hermeneutical tools corresponding to the layering order of its text. But the subsurface life of Hidden Writing is not the object of layers and interpretation; it can only be exhumed by distorting the structure of the book or the surface plot [...] To interact with Hidden Writings, one must persistently continue and contribute to the writing process of the book.'[36] Commentary constitutes a structure of understanding and experience, i.e. consciousness, that opens world to earth. It is writing's way of staying original, in ever-new nearness to its earthly origins, in productive proximity to the fact that all writing is only on the earth. The *telos* of commentary, its far-off end, is *tellus*, what bears us. 'Turn it and turn it again for everything is in it; and contemplate it and grow gray and old over it and stir not from it' (Aboth 5.22). What the Talmudic commentator here says of the Torah is sayable of the earth.[37]

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[35] Gumbrecht, *The Powers of Philology*, 43-4.

Understanding commentary as geophilosophy, then, will involve understanding the relation between digression and immanence, as when two people, walking in conversation, stop walking and face each other. Or as when the Phoenix, in order to re-become itself, departs from her home, the blissful enclosure of Paradise, and seeks 'hunc orbem, mors ubi regna tenet' [this circular world where death rules].[38]

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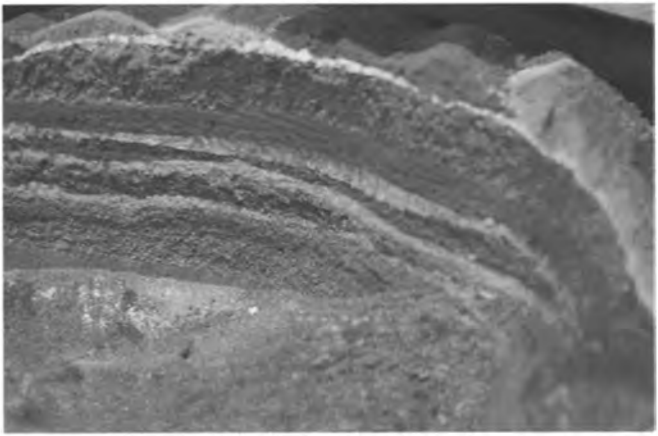
[36] R. Negarestani, *Cyclonopedia: Complicity with Anonymous Materials* (Melbourne: Re.Press, 2008), 62.

[37] Richard A. Cohen similarly identifies the 'concrete and productive integrity of spirit and matter' as a chief characteristic of (Levinasian) exegesis: 'Letters give rise to spirit, call for commentary, and spirit is rooted in letters, in a textual richness that is one of the marks of sacred literature, or literature taken in a sacred sense [...]. To fly with a text, to be inspired by it and discover its inspiration, requires not that one have wings, that one hover above it. Rather, it requires that one's feet be firmly planted on the earth, in touch with the concrete, never losing sight of a properly human dignity' (*Ethics, Exegesis and Philosophy: Interpretation After Levinas* [West Nyack, NY: Cambridge University Press, 2001], 247).

[38] Lactantius, *De Ave Phoenice*, ed. M. C. FitzPatrick (Philadelphia: University of Pennsylvania, 1933), line 64.

Here she encloses herself in a nest of spices, burns in her own flame, and is reborn. On the way back home, she carries in her claws the remains of her own body, mixed with balsam, myrrh, and Sabean frankincense, which she 'in formam conglobat ore pio' [forms with loving mouth into a globe].[39]

II. THE SPICE MUST FLOW



That spice has in fact been used to conceptualise commentary exemplifies one of its essential functions: to confound distinctions between utility and pleasure, necessity and luxury, food and flavor, literal and figural. In the Talmudic tractacte *Masekhet Soferim*, which deals with regulations concerning the preparation and study of the holy books, it is stated, 'The Torah is like salt, the Mishnah like pepper, the Gemara like spices.

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[39] Lactantius, *De Ave Phoenice*, line 120.

The world cannot exist without salt, without pepper, or without spices. So also the world cannot exist without the Scriptures, and the Mishna, and the Gemara' (15.8). The evident purpose of the comparison is to articulate simultaneously the shared absolute necessity of all three texts and the superior value of the commentaries, in keeping with a reverence expressed more extremely elsewhere in the Talmud: 'He who only occupies himself with the study of the Torah is as if he had no God' ('Abodah Zarah 17b). Logically, the comparison produces a kind of ambivalence-without-ambivalence with regard to their relative values, so that the Gemara (commentaries on the Mishna, the written oral Law which, by a proportional logic, both expounds and is esteemed as equiprimordial with the Torah), are identified as more valuable than the value that grounds them. Commentary-as-spice is not merely an authoritative supplement to revealed scripture, not a condiment, but something that actually holds the essence of revelation as living process. Or as Gershom Scholem explains, in fortuitously tellurian terms: 'The Biblical scholar perceives revelation not as a unique and clearly delineated occurrence, but rather as a phenomenon of eternal fruitfulness to be unearthed and examined [...] Out of the religious tradition they bring forth something entirely new, something that itself commands religious dignity: commentary.'[40] This is commentary's ex-uberance, the way it bears forth a text's unending abundance, the durable newness of its sempiternal self-difference, the perfect plenitude of its unfinishing futility, in other words, a text's *continuing being*, its staying itself by always being other and more than itself.

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[40] G. G. Scholem, 'Tradition and Commentary as Religious Categories in Judaism,' in *Understanding Jewish Theology: Classical Issues and Modern Perspectives*, ed. J. Neusner (New York: Ktav Publishing, 1973), 46-7.

'"Futility." [says Dr. Yueh to Lady Jessica] He glanced at her. "Can you remember your first taste of spice?" "It tasted like cinnamon." "But never the twice the same," he said. "It's like life – it presents a different face each time you take it. [...] And, like life, never to be truly synthesized."'[41] Commentary-as-spice thus upholds commentary as more *text* than the text it comments on, in a mysterious manner than both destroys and leaves intact the commentary/text distinction. Or, commentary embodies, not simply the relation of reader to text, but the relation whereby the text is itself. It is an externalisation of the existential medium whereby it is what it is, its essence or being. This accords with a proportional Talmudic passage which makes the ambivalence-without-ambivalence logic explicit: 'They who occupy themselves with the Bible [alone] are but of indifferent merit; with Mishnah, are indeed meritorious, and are rewarded for it; with Gemara – there can be nothing more meritorious; yet run always to the Mishnah more than to the Gemara' (Baba Mezia 33a). In other words, commentary materialises the movement, the flow of the text that makes it more than itself. And this *more*, this thing that is not a thing that makes all the difference, is spice. Commentary belongs to its text paradoxically as a property at once incommensurable and identical with its substance. In the graded terms of the comparison, such paradox is held within the aspecificity of the category of spice, the way it is both genus and species, such that spice simultaneously includes, exceeds, and is one of several among salt and pepper. With regard to spice's mixed resonances with the dimensions of pleasure and value, the metaphor may be understood as signaling that commentary is luxury as the perfection of necessity, the fruition of an essential textual value, or that commentary embodies the value of the value of the text, the earthly sublime or beyond *within* the text that makes it meaningful in the first place. Accordingly, talmudist Rabbi Hanina claimed that 'were the Torah, God forbid, to be forgotten in Israel, I would restore it by means of my dialectical arguments [*pilpuli*]' (*Baba Metzia*, 85b).[42] Wondrously, *pilpul* registers at once with round movement, hermeneutic dialectics, and spice. Jeffrey Rubenstein explains: 'Although literally meaning "turn from side to side", hence "search, examine, investigate", *pilpul* was derived by the Bavli from "pepper" (*pilpel*) and refers to intellectual sharpness and acumen. The term seems to be applied to a range of activity, including reasoning, interpreting and discussion, and need not always refer to sharpness in dialectics per se.'[43] *Pilpul*, glossed by Daniel Boyarin as the dialectical 'logic of commentary,' thus denotes the very *movement* of commentary's becoming, the roundabout way it enters into vital relation with the text as its own event.[44] 'Suspending time and space,' says Sander Gilman, '[*pilpul*] confronts the opinions of all authority, seeking the moment of resolution hidden within seemingly contradictory positions.'[45]

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[41] Frank Herbert, *Dune*, 64.

The place of commentary is the space of spice. The sense of this is fulfilled by understanding spice as flow, currency, a travelling thing that does not leave its site of origin, something whose aromatic ability to permeate what is proximate to it, to have always already permeated it, marks it as not a *thing* at all, something not bounded by time and space. Spice as the figure of commentary's hermeneutic *location* of meaning as a center, the turning movement that reveals and re-reveals a text's heart, also coordinates with the identification of spices with Eden as the mythic, lost, metaphysical center of the world. As Milton writes of Satan's approach to Eden, 'now gentle gales / Fanning their odiferous wings dispense / Native perfumes, and whisper whence they stole / Those balmy spoils' (*Paradise Lost*, 4.156-9). Just as the alar movement of these lines destroys the distinction between breeze and scent, so not only spice's aroma but spice itself *is* what it is *of*. Spice is the substance of the *topological* filling of space, a fundamentally spherical phenomenon whose pluridimensionality defines it as the olfactory analogue to the ancient definition of God as a sphere whose center is everywhere and circumference nowhere. Accordingly, when a thirteenth-century Beguine named Sybil sought to demonstrate to her community the fact of her conversations with angels, she strewed, or more properly glossed, her house with spices.[46] And in the *Zohar*, the height of mystical vision, which intersects with the cabalist's intercourse with his wife on the midnight of the Sabbath, 'the point in time outside of time when God, attracted by their devotion, likes to visit them,' happens through the saturating medium of spice: 'These souls are there bathed in the spices of Paradise, and behold all that is within their capacity to behold.'[47]

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[42] Cited from Jeffrey L. Rubenstein, *The Culture of the Babylonian Talmud* (Baltimore: Johns Hopkins University Press, 2003), 48.

[43] Rubenstein, *The Culture of the Babylonian Talmud*, 48. Similarly, Gematria (fr. Greek *geometria*), the numerological interpretation of Hebrew words, is called the 'spice of Torah.' See Gutman G. Locks, *The Spice of Torah – Gematria* (New York: Judaica Press, 1985).

[44] Daniel Boyarin, 'Pilpul: The Logic of Commentary,' *Dor le-dor* 3 (1986), 25.

[45] Sander L. Gilman, *Jewish Self-Hatred: Anti-Semitism and the Hidden Language of the Jews* (Baltimore: Johns Hopkins University Press, 1986), 90

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[46] See Freedman, *Out of the East*, 84ff.

[47] P. Beitchman, *Alchemy of the Word: Cabala of the Renaissance* (Albany: State University

Commentary-as-spice shows commentary as the savour of the significance of text, the actual phenomenal third thing between reader and text, subject and object, that exceeds both in a manner correlative to Aristotle's definition of tragedy as mimesis in 'spiced language' [*hêdusmenôi logôi*] (*Poetics*, 1449b25) – a definition which follows not condiment-logic but the ancient understanding of spice as the very potential of the edible: 'For when salts and seasonings [*hêdusmata*] generally are combined with a food,' says Alexander of Aphrodisias in his commentary on Aristotle's *Meteorology*, 'out of both a single thing is created (*apoteleitai*), when the food takes on an edible character from the seasonings.'[48] The sense of this notion becomes especially palpable in the context of commentary on the *Song of Songs*, not coincidentally at once the most spiced and the most

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of New York Press, 1998), 33; *The Zohar*, ed. J. Abelson, trans. M. Simon and H. Sperling (with P. Levertoff, vols. 3 & 4), 5 vols. (London and New York: Socino Press, 1933), III.389. Here citing the latter from the former.

[48] Alexander of Aphrodisias, *On Aristotle's Meteorology 4*, trans. E. Lewis (Ithaca: Cornell University Press, 1996), 89. Clarifies: '*hêdusmata*, which is a metaphor from cooking (sweeteners, condiments, aromatic herbs, spices), are usually taken [by modern commentators] to be non-essential additives to food, while it is precisely these additives which characterize the art of cooking [...] it is the interpreters of the *Poetics* rather than Aristotle who underestimate the importance of condiments to cooking as much as the significance of music for tragedy [...]. The proper use of *hêdusmata* is identified, not only with the art of cooking, but with the civilized way of eating: without seasoning, foodstuffs like meat and fish are undesirable and almost as if they would be eaten raw. This is at least what Hegesandros claims, an author of the second century BC, who 'in his Commentaries (FHG iv 418) says that everybody is fond of *hêdusmata*, not of meats or fish; and if they are not available nobody is happy to offer the meat or the fish (alone), nor does anyone desire the raw and the unseasoned' (G. M. Sifakis, *Aristotle on the Function of Tragic Poetry* [Herakleion: Crete University Press, 2001], 56-70) – a human logic that is followed even (and perhaps especially) when the human is the meal: 'When police searched the kitchen of the late twentieth-century cannibal Jeffrey Dahmer, so the story goes, they found nothing but the refrigerated flesh of his victims and [...] condiments; no fruit, vegetables, cereals or dessert' (T. Morton, *The Poetics of Spice: Romantic Consumerism and the Exotic* [Cambridge: Cambridge University Press, 2000], 31, Morton's ellipsis).

commented-upon of biblical books. Here, elaborating upon more universal links between odour and divine presence, the work of interpreting what spice is becomes spicy itself, the contemplative activity of commentary a becoming-spice. Spice, like a textual aroma of the Paradise which both is and is to come, signifies for the commentator the highest sense of Scripture, the 'anagoge, foretaste of heavenly things.'[49] The possibility for such loving collusion between embodied imagination and intellectual experience, for the interpretation of spice to become a kind of transcendental tautology, is captured in Bernard of Clairvaux's generous exegetical invitation in a sermon on the Song of Songs: 'Every person [...] is free to pursue the thought and experiences, however sublime and exquisite, that are his by special insight, on the meaning of the Bridegroom's ointments.'[50] Alan of Lille, remembering the Song of Songs, defines cinnamon and its theological meaning in one breath: 'Cinnamomum est species aromatica, interna contemplatio' [cinnamon is an aromatic spice, inward contemplation].[51] That *species* here still holds a semantic relation to appearance underscores the overlap. Commentarial contemplation, like those pleasurable sensations that happen to us near other substances, is an *aromatic* phenomenon. This phenomenon is realised in the mind's own becoming-spice or attaining of a quality that is open, expansive, permeating.

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[49] R. F. Littledale, *A Commentary on the Song of Songs, from Ancient and Medieval Sources* (London: Josesph Masters, 1869), 379. 'The spices are anagogical interpretation, the foretaste of heavenly things' (*Song of Songs*, trans. and commentary M. H. Pope, Anchor Bible, Vol. 7c [Garden City, NY: Doubleday, 1977], 697).

[50] Bernard of Clairvaux, *On the Song of Songs*, trans. K. Walsh, 4 vols (Kalamazoo, MI: Cistercian Publications, 1983), 22.2.4, vol.2, 16.

[51] Alan of Lille, *Liber in distinctionibus dictionum theologicalium*, s.v. 'cinnamomum,' *Patrologia Latina*, 201:741, http://pld.chadwyck.com/.

As Hugh of St. Victor explains, whereas meditation is an 'assiduous and shrewd drawing back of thought [...] [that] is always about things hidden from our understanding,' contemplation is 'a keen and free observation of the mind expanding everywhere to look into things [...] [and] is about things *as manifest*.'[52]

Spice is not a figure, but a generational integrity of spirit and letter, matter and desire, a sensuous reality whose structure takes the mind that *absorbs* it beyond itself, a hermeneutic psychedelic. Commentary, whose etymology (via *comminisci*, to devise, invent) indicates the creativity of thinking *with* something, is the inverted, external projection or manifestation of spice as such an integrity, the materialization of thinking as a condensation and spreading over a surface; or as Deleuze and Guattari say in their chapter on geophilosophy: 'thinking consists in stretching out a plane of immanence that absorbs the earth (or rather, '*adsorbs*' it).'[53] Susan Ashbrook Harvey perceives this in commenting on Gregory of Nyssa's *Commentary on the Song of Songs*: 'Gregory's olfactory imagery highlights the limits of noetic experience [...] In such instances he seems to rely on what the body can know through smell in order to capture what eludes the mind in understanding.'[54] And Arthur Green feels this when saying 'The canticle itself, we might say, became the "locked garden" of which it speaks, opening itself to those whose hearts longed to dwell by its streams and to be intoxicated by the spices of its perfumed gardens.'[55] Although my body, in the lightness of its earthly gravity, as the very space of odour, of what is neither/both subject and object, needs desperately to delete their critically-safe correlationism (Susan's *seems* and Arthur's *we might say*) or at minimum, ~~strike it through~~. How else will we ever taste the joy Bernard testifies to: 'Happy the mind that has been wise enough to enrich and adorn itself with an assortment of spices such as these'?[56] And not simply to adorn, but to become, following spice as the potentiality of a non-consumerist relation to world: 'In eating the world, boundaries between subject and object are broken down and in another way rigidly maintained. In the poetics of spice, however, a utopian space is imaginable in which boundaries between subject and object evaporate, as they are not predicated on a dialectic of consumer and consumed.'[57] *Where* else will we dine on texts in this way, the way late mediaeval bibliomane Richard de Bury asks us to, like *panthers*: 'You must first eat the volume with Ezekiel, that the stomach of your memory may be internally sweetened; and thus after the manner of the perfumed panther (to the breath of which men, beasts,

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[52] 'Meditatio est assidua et sagax retractatio cogitationis, aliquid, vel involutum explicare nitens, vel scrutans penetrare occultum. Contemplatio est perspicax, et liber animi contuitus in res perspiciendas usquequaque diffusus. Inter meditationem et contemplationem hoc interesse videtur. Quod meditatio semper est de rebus ab intelligentia nostra occultis. Contemplatio vero de rebus, vel secundum suam naturam, vel secundum capacitatem nostram manifestis' (*In Salomonis Ecclesiasten Homiliae XIX*, *Patrologia Latina*, 175:116-7).

[53] Deleuze and Guattari, *What is Philosophy*, 88, my emphasis.

[54] Susan Ashbrook Harvey, *Scenting Savlation: Ancient Christianity and the Olfactory Imagination* (Berkeley: University of California Press, 2006), 175. See also Rachel Fulton, "Taste and see that the Lord is sweet' (Ps. 33:9): The Flavor of God in

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the Monastic West,' *Journal of Religion* 86 (2006):169-202. Cf. 'By smelling things, we absorb them directly into our bodies, and consequently they provide what Kant otherwise only attributes to God: *unmediated* knowledge of the thing in itself' (A. Jaspar and N. Wagner, 'Notes on Scent, *Cabinet Magazine* 32 [2009]: 37).

[55] Arthur Green, 'Intradivine Romance: The Song of Songs in the Zohar,' in *Scrolls of Love: Ruth and the Song of Songs*, ed. Peter S. Hawkins and Lesleigh Cushing Stahlberg (New York: Fordham University Press, 2006), 215.

[56] Bernard of Clairvaux, *On the Song of Songs*, 12.1.1, vol. 1, p. 77.

[57] Morton, *The Poetics of Spice*, 229.

and cattle draw near that they may inhale it), the sweet odour of your aromatic conceptions [*conceptorum aromatum odor suavis*] will be externally redolent'?[58]

More discursively, commentary-as-spice embodies the risky work of philosophy, understood by Levinas as the 'adventure' of producing 'the truth of what does not enter into a theme' via the reduction of the said to the saying, a reduction which is 'both an affirmation and a retraction of the said' and which operates as a *continual interruption of essence*: 'The reduction could not be effected simply by parentheses which, on the contrary, are an effect of writing. It is the ethical *interruption of essence* that energizes the reduction.'[59] This is philosophy not, of course, as a discipline among several, but as the spice of disciplines, what makes all disciplines 'ways and kinds of philosophizing,' part of the movement Heidegger calls the attack [*Angriff*] that '*the Da-sein in man launches* [...] *upon man*,' driving us 'out of everydayness and [...] back in to the ground of things.'[60] Like *pilpul*, the movement of philosophical truth-production, says Levinas, is round and multitemporal: 'it is produced out of time or in two times without entering into either of them, as an endless critique, or skepticism, which in a spiralling movement makes possible the boldness of philosophy, destroying the conjunction into which its saying and its said continually enter. The said, contesting the abdication of the saying that everywhere occurs in this said, thus maintains the diachrony in which, holding its breath, the spirit hears the echo of the *otherwise*.'[61] And, it is a movement that originates in proximity: 'Saying states and thematises the said, but signifies to the other, a neighbor, with a signification that has to be distinguished from that borne by words in the said. The signification to the other occurs in proximity.'[62] So commentary, which happens in proximity to and not (as in the case of its bastard offspring the annotated critical edition) in parenthesis from the text, which moves from this proximity as the very ground of its truth, and which is saturated with its own event in the form of the *extra* or outside presence of its essentially deictic gesture, may be called the *savoury circulation of the interruption of our exposure to the otherwise*.[63]

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[58] Richard de Bury, *Philobiblon*, trans. John Bellingham Inglis (New York: Meyer Brothers, 1899), ch.4.

[59] E. Levinas, *Otherwise Than Being, or Beyond Essence*, trans. A. Lingis (Pittsburgh: Duquesne University Press, 1981), 44, my emphasis.

[60] Heidegger, *The Fundamental Concepts of Metaphysics*, 32, 21, respectively.

This essentially philosophical othering function of commentary, its diachronic expansion of the saying within the said, or holding open of the event of the text via the very procedure of encircling and enclosing it on all sides, like an unending erection of fortifications each inviting further and new forms of attack, is analogous to the apophatic function of the monstrous as explicated by David Williams: 'In the aesthetic production of the Middle Ages a favoured way of achieving [the progressive negation of logical affirmations about the world and the real] was to deform the representation of the thing described in such a way as to call into question the adequacy of the intellectual concept of the thing in relation to is ontological reality.'[64] Or as Carl Pyrdum writes, saying more than he thinks, 'Nothing *spices* up the margins of your boring old psalter like a picture of a cute monkey doing something really odd, like riding a stork who has a demon's head for a butt.'[65] Just as spice also deforms and distorts the material to which it is applied through a kind of reverse denaturation that turns the merely ingestible into the truly edible, so commentary is a fundamentally monstrous discourse directed toward the denaturing of the text into the earthy, ontic immanence of what it represents. Mazy, decentring, gargantuan, discombobulating, rhizomatic – the formal structure of commentary, geometrically proportional to the characteristic conceptual density and difficulty of philosophical and theoretical language that digressively makes one stop and think, is essential to its quote-unquote-meaning, its desire to multiply explanation and representation fractally, to generate more and more perceptual enclosures, spaces within which the unrepresentable is brought into presence. Commentary thus exemplifies a more universal interventional tendency within human thinking that can be called the *inevitable intrusion of the fictive*, our irreplaceable and individuating poetic compulsion to deform the object of understanding precisely so as to understand it, as the only way it can *actually* be understood.[66]

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[61] Levinas, *Otherwise Than Being*, 44.

[62] Ibid., 46.

[63] Cf. 'Citation and commentary open up the non-compelling obligation in reading – without abandoning discourse (and which only the most recalcitrant of readers can doubt reflects yet again on how we are reading and commenting, reading these others and writing for still other others – here, 'at this moment itself' that is also not now. I read and write commentary here to hold open for others, to call for other books to read. This text is a reading text, reading in the ethical exigency to call to other readers)' (R. Gibbs, *Why Ethics?: Signs of Responsibilities* [Princeton: Princeton University Press, 2000], 113).

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[64] D. Williams, *Deformed Discourse: The Function of the Monster in Mediaeval Thought and Literature* (Montreal & Kingston: McGill-Queen's University Press, 1996), 5.

[65] http://gotmedieval.blogspot.com/2008/03/welcome-boingboingers-here-have-monkey.html. My emphasis.

[66] Cf. 'But since there is some comparison between eating and learning, it may be noted that on account of the fastidiousness of many even that food without which life is impossible must be seasoned' (Augustine, *On Christian Doctrine*, trans. D.W. Roberston, JR. [New York: Macmillan, 1958], 4.11.26).

Yet another way of saying this: commentary *twists* its text spatially, that is, *the geo-metry of commentary is spicy*, following Timothy Morton's ingenious modeling of the word-concept of spice: 'The poetics of spice is a Möbius strip upon which an object appears to behave like a subject, until we have followed this behaviour right round to the "other" side, upon which a subject appears to behave like an object. The distinction, however, between subject and object is not collapsed, and they remain in tension [...]. *Species*, *specious* and *specie* suggest that *spice* belongs to a set of words that denote the non-universal, particular, contingent realm of appearance. But when we look 'behind' spice to find some general or universal category that might substantiate its meaning or fix its place, we find none. We simply re-encounter spice. It is as if the universal were on the side of the particular itself.'[67] Spice is a pure immanence or double one-sidedness whose structure is only intelligible in the form of *spherical* movement, movement that reaches the other side by staying on this one and in so doing simultaneously destroys and realises the distinction between the two. Explorer or exegete, spice is what gets you around earthily, what manifests the universal as the particular itself, in the place where you stand. Via spice, one goes through an impenetrable surface by going over it, by *staying* with it.

So the impulse *not* to escape, *not* to flee, to stay, to remain, not in stillness, but in the movement that one already is, in the more restful motion that dwells in the space of the ontological ambivalence of statements like *I am walking*, that knows it will arrive on the other side only as *this* one, resonates seismically with both geophilosophical immanence and the work of commentary.

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[67] Morton, *The Poetics of Spice*, 33-5.

The project of Nietzsche's tradition-dislocating and tradition-deepening call to 'remain faithful to the earth' and dwell in the 'new gravity' of the eternal recurrence of the same, a call that emanates with the earth itself, in the moment of Nietzsche's stopping before and being stopped by 'a powerful pyramidal rock nor far from Surlei,' is ordered towards immanence not as the negation or opposite of transcendence, but more truly as its *forgetting*, the experience of which he finds in sound: 'There is no outside! But we forget this with all sounds; how lovely it is that we forget!'[68] Sonically forgetting that there is no outside is not negation, much less some enchanting illusion that there is an outside, but more purely the post-cephalic letting go of the burden of consciousness that there is *no outside*, the apophatic negation of the negation of an outside that opens into full experience of the becoming of the *this*. '[N]o longer bury your head in the sand of heavenly things, but bear it freely instead, an earthly head that creates a meaning for the earth!'[69] Commentary is a homologous *amor fati* that stays with its text gravitationally, remains faithful to it as what remains, as what it cannot depart from. 'The womb of the inexhaustible earth ceaselessly gives birth to what is new; and each one is subject to death [...] Man should not cast aside from him the fear of the earthly; in his fear of death he should – stay. He should stay. He should therefore do nothing other than what he already wants: to stay.'[70] Commentary *stays* with its text, commits wholly to it, both in the quantitative sense of promising to *produce* commentary across its continuity and in the qualitative sense of promising to *extract* significance from each of its moments as a plenitude. In the words of fifteenth-century Talmudic scholar Isaac ben Jacob Campanton, ‘Always strive to show the necessity of all the words of the commentator or author, and for every utterance, why did he say? [...] And you shall take care to compress (*Itsamtsem*) his language and to squeeze out the intention, in order than not one word shall remain superfluous.’[71] In other words, commentary stays with its text *as a sphere*, as an object whose every point, via structural identity with every other, is both infinite and infinitesimal. Commentary’s durational staying with its text equals its self-acceptance as labour, as sustaining and unfinishing diurnal production-towards-death. Commentary thus means praxis, not without, but freeing itself from results, from anxious care about what does not belong to us. Accomplishing nothing, commentary becomes *capable* of everything and so constitutes the potentiality of a hermeneutic whose teleology and instrumentality fundamentally differ from, but do not necessarily contradict, the dominant *thesistic* standards of academic discourse. Commentary is knowledge-production as *immanent* to its labour, whether of writer or reader (which goes to explain the genre’s superior survival in law, religion, philosophy, pedagogy).

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[68] Quoting, respectively: Nietzsche, *Thus Spoke Zarathustra*, 'Zarathustra's Prologue,' 6; 'The Recurrence of the Same,' notebook entry from August 1881, cited from *Thus Spoke Zarathustra*, trans. G. Parkes (Oxford: Oxford University Press, 2005), xxii; and *Thus Spoke Zarathustra*, 'The Convalescent,' 175.

[69] Nietzsche, *Thus Spoke Zarathustra*, 'On the Hinterworldy,' 21.

[70] F. Rosenzweig, *The Star of Redemption*, trans. B. E. Galli (Madison: University of Wisconsin Press, 2005), 9-10.

Why not therefore also make in *this* place a hermeneutic bridge between commentary and the sound which Nietzsche indicates as the vehicle of immanence, of what cannot, if it is to really be itself, have a vehicle? Again, spice provides the link, the material to build across space.

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[71] Cited from Boyarin, ‘Pilpul: The Logic of Commentary,’ 6.

'The verb (*verbum*),' says Isidore of Seville, is so called because it resounds by means of reverberation (*verberatus*) in the air.' And: 'Spices [...] seem to have gotten the name "spice" (*aroma*) either because they are proper for putting on altars (*ara*) for invocations to the gods or because they are known to blend and mingle themselves with air (*air*). Indeed what is scent if not air that has been tinctured with something?'[72] Ergo, the spiciness of commentary similarly consists in its being textual sound, semantic aroma, the re-verberation, to play Isidore's etymology backwards, of the word it comments on.

Like word, like spice, commentary is space-filling. Whence Gumbrecht's suggestion of an imminent return to commentary in the context of our being haunted by new technic vistas of emptiness: 'The vision of the empty chip constitutes a threat, a veritable *horror vacui* not only for the electronic media industry but also, I suppose, for our intellectual and cultural self-appreciation. It might promote, once again, a reappreciation of the principle and substance of *copia*. And it might bring about a situation in which we will no longer be embarrassed to admit that filling up margins is what commentaries mostly do – and what they do best.'[73] Yet commentary does not simply fill space the way all writing *takes up* space. Rather, it fills space only in the sense that it also *folds* space, produces moments of identity across it, across the impassible, intimate distance that commentary auto-institutes as the text/commentary distinction. This distinction is simultaneously the inviolable, irreducible space of writing itself (the dimension of the page that cannot be filled in order for writing to ex-sist) and the crease through which commentary folds this space. Accordingly, commentary works to hold forever open *and* totally fill writing's space, as if to absolutely disclose the place of writing, which means to realise it as *curved space*, the immanent space-becoming-place through which everything leads back to itself. This spatial curving that commentary realises is visible materially as the becoming-round of the text/commentary border and conceptually as the turning motion commentarial reading and writing take: away from the text, turning back towards it, repeat [...] Commentary rotationally transforms the *space* of writing into an earthly *place*. Simple textual space-filling discloses the space of writing as writing's potentiality, the page, by enclosing and surrounding it *from the inside*. Commentary, whose meaning is founded upon proximate separation from its text, continues the enclosure *from within the outside* and thus holds open the space of writing by bounding it, pushes writing to the limit where the space of writing *intersects* with what it already is, the real space of the world. In other words, commentary does not merely take up room, but *uses room* to make itself the world, to bring its text back to earth. Infinite commentary on an infinitesimal text is commentary's ideal, not actually, but only as an unimaginable concept reasserting its deep desire, namely, to spatially achieve the ontological breaking-point of the text, the situation where there is *neither anything outside the text nor nothing outside the text*. Commentary seeks not to end, but to un-end writing, to arrive at writing's plenitude and ouroboric starting/stopping point, the saturated phenomenon of its perfection, as grasped by Agamben while contemplating the completion of the unfinished last work of Damascius, and final scholarch of the School of Athens and so-called last of the Neoplatonists,

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[72] Isidore of Seville, *Etmologies*, trans. Stephen A Barney (Cambridge: Cambridge University Press, 2006), 1.9.1, 17.8.1, respectively.

[73] Gumbrecht, *The Powers of Philology*, 53.

On First Principles (!): 'The uttermost limit thought can reach is not a being, not a place or thing, no matter how free of any quality, but rather, its own absolute potentiality, the pure potentiality of representation itself: the writing tablet! [...] This was why he was unable to carry his work through to completion: what could not cease from writing itself was the image of what never ceased from not writing itself [...] [E]verything was finally clear: now he could break the tablet, stop writing. Or rather, now he could truly begin.'[74] This point is not being finished with writing, but writing's becoming an unending beginning, the sphericization of the space of writing or our finding of the page as *unbounded finitude*, a surface for limitless writing whose every mark is first and last. Commentary's filling of the margins is an exercise in intentional, exuberant futility directed toward an ultimate forgetting of the outside, toward continual writing of the omnipresent impossibility of separateness, the always-never asymptotic union of text and world.

All of above goes to explain why, in the appendix of Frank Herbert's *Dune*, we read that 'the O.C. [Orange Catholic] Bible and the Commentaries,' a product of humanity's encounter with the outer dark via space travel and the textual analogue of the orange spice gas used by Guild Navigators to fold space, 'permeated the religious universe.'[75]

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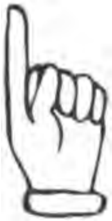
[74] G. Agamben, *The Idea of Prose*, trans. M. Sullivan and S. Whitsitt (Albany: State University of New York Press, 1995), 34.

[75] Herbert, *Dune*, 506.

III. Digression and Immanence



Dune. Dir. David Lynch. 1984.

Von

der Weltſeele,

eine

Hypotheſe der höheren Phyſik

zur Erklärung

des allgemeinen Organismus.

Nebſt einer Abhandlung

über das

Verhältniß des Realen und Idealen in der Natur

oder

Entwicklung der erſten Grundſätze der Naturphiloſophie an
den Principien der Schwere und des Lichts.

Von

F. W. J. Schelling.

Dritte verbeſſerte Auflage.

Hamburg,
bey Friedrich Perthes.
1809.

Introduction to Schelling's *On the World Soul*

Iain Hamilton Grant

EDITIONS

The first edition (1798) of Friedrich Wilhelm Joseph Schelling's *On the World Soul. An Hypothesis of Higher Physics for Explaining Universal Organism* was published by Perthes in Hamburg, as was the second, revised edition (1809) to which a new Foreword and Essay 'On the Relation between the Real and the Ideal in Nature, or the Development of the Basic Propositions of the Philosophy of Nature from the Principles of Gravity and Light' were added. The third edition (1809), also published by Perthes, slightly revised the second edition, but added no new material.

The edition from which the present translation is taken is that found in vol. II of K.F.A. Schelling's edition of *Schellings sämmtliche Werke* (*SW*), XIV vols (Stuttgart and Augsburg: J.G. Cotta'scher Verlag, 1856-61), reprinted in a new order, ed. Manfred Schröter (Munch: Beck, 1927), and the numbers in the margin refer to this edition. It is based on the 1809 edition of Schelling's text, and supplies the changes from the first edition in footnotes.

The text is found in vol. I, 6 of the new *Historisch-Kritische Ausgabe* (*HKA*) of Schelling's works, which provides a concordance with *SW*, but does not contain the 1806 essay, despite retaining the second edition's Foreword, which serves principally to introduce the accompanying essay, along with Schelling's revisions to the main text (in footnotes). The *HKA* edition is a work of considerable scholarship, with some one hundred and fifty pages of explanatory notes (some translated here), and was used as the source for Stéphane Schmitt's translation *De l'âme du monde* (Paris: Éditions Rue d'Ulm, 2007), which I have also consulted. Also consulted is the magnificent *HKA Ergänzungsband zu Werke Band 5 bis 9*, which contains a wealth of material on the scientific background against which Schelling produced his naturephilosophical writings up to 1800. Since the *HKA* remains incomplete yet infuriatingly references Schelling's works, where these have appeared in the *HKA*, only in that edition's pagination, I have maintained the *SW* pagination, since it remains the only complete referenceable edition of Schelling's works as a whole.

The section translated here includes the first edition preface (*SW* II, 347-51), which contains the nearest thing to an overview provided for this work, and the initial setting out of the 'primary force in nature' (*SW* II, 381-97). The footnotes are in part my own, in part K.F.A. Schelling's notes to *SW* II, and in part Jörg Jantzen and Thomas Kisser's, from *HKA* I,6, and their provenance is noted in the text.

INTRODUCTION

This is the second of Schelling's three major, early naturephilosophical books, published in 1798 between the *Ideas for a Philosophy of Nature* (1797; *SW* II, 1-343) and the *First Outline of a System of Naturephilosophy* (1799; *SW* III, 1-268). The other key naturephilosophical works of this period are the *Introduction to the Outline* (1799; *SW* III, 269-326) the *Universal Deduction of the Dynamic Process* (*SW* IV, 1-78), which Schelling published in his *Journal of Speculative Physics* vol. 1, no. 2 (1800). Across these works, Schelling had demonstrated an extraordinary capacity for synthesising the results, procedures and hypotheses that were leading the field in each of the sciences. As a result, the *Weltseele* is a systematic yet experimental, or 'constructive' work in the sense Schelling gave this term, pursuing the 'decomposition' of the All by chemical, electrical, meteorological and vital means across the entirety of the 240 pages of the *SW* it takes up.

It is often claimed that Schelling merely pursues the goals established by Kant's transcendental philosophy – namely, to suspend ontology in the interests of rational certitude, and therefore to place the ethical at the head of philosophy. Yet whereas analysis and synthesis were powers of the understanding for Kant, for Schelling, they are powers of nature; not content with chemical *analogies*, Schelling pursues a chemical philosophy, a distinction recognised by Novalis when he called Schelling 'the philosopher of the new chemistry, the absolute oxygenist'.[1]

Accordingly, *On the World Soul* presents a single, consistent 'decomposition' or *analysis* of nature into its primitive forces. Indeed, 'primitive force' is precisely the

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[1] Novalis, *Die Christenheit oder Europa und andere philosophische Schriften* (Köln: Könnemann, 1996), 300.

object of a 'higher science of nature', i.e., that at which this science aims. The work therefore pursues this object through the media of light, heat, gases, electricity, magnetism, meteorology, until it arrives at a determination of the concept of polarity, which became something of the cliché of Idealist philosophy of nature. At the core of this concept, however, is the 'dualism' or *real opposition* of forces[2] that animate all natural phenomena. Therefore, upon making the transition from 'anorgic' to organic nature, *On the World Soul* demonstrates a continuity of analysis in the twofold sense that primitive forces are thereby exhibited as the common medium of all phenomena, and that there is therefore no *specifically vital matter or vital force.* Rather than seek a substance dualism dividing the natural world, Schelling pursues that immanent duel of forces throughout it, by which nature is *organised.* So just as the concept of polarity is misunderstood if considered purely conceptual rather than actual, so too the oft-touted 'organicism' of romantic naturephilosophy ignores the true focus of Schelling's work: the origins and conditions of natural *organisation*, of which minerals, animals, weather systems and chemicals are merely regional expressions.[3]

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[2] See the third thesis with which the present translation concludes: 'real antithesis is possible only between things of one kind and common origin' (SW II, 397). Note the *chosiste* difference Schelling here introduces with respect to Kant's account of real antithesis in 'Attempt to introduce the concept of negative magnitudes into philosophy' (Ak. II, 167-204), tr. David Walford in *The Cambridge Edition of the Works of Immanuel Kant. Theoretical Philosophy 1755-1770* (Cambridge: Cambridge University Press, 1992), 207-41.

[3] There has been a lively debate on Schelling and self-organisation, beginning with Marie-Luise Heuser-Kessler, *Die Produktivität der Natur. Schellings Naturphilosophie und das neue Paradigma der Selbstorganisation der Naturwissenschaften* (Berlin: Duncker und Humbolt, 1986). Bernd-Olaf Küppers' *Natur als Organismus. Schellings frühe Naturphilosophie und ihre Bedeutung für die moderne Biologie* (Frankfurt: Klostermann, 1992) is a critical response to the thesis that there is a parallel between the modern natural scientific conception of self-organisation and Schelling's conception of the

What Schelling may here be said to retain from Kant is therefore twofold: (1) the conclusions of the latter's study of real (or actual, *wirkliche*) opposition; (2) that because the primitive conflict of forces is the *object* of the philosophy of nature, such forces are never (by 1, above) 'transcendently' available, i.e., uninvolved in actual oppositions, on the one hand, or something 'in themselves', on the other. In other words, the analysis of forces results necessarily in actual individuation. Rather therefore than the structure of consciousness furnishing phenomena and their conceptual forms, nature is its own analyst. This point is clearly made by Karl August Eschenmayer,[4] whose *Propositions from the Metaphysics of Nature* Schelling excitedly noted towards the end of his *Ideas for a Philosophy of Nature* of the same year.

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same, and the debate is critically presented by Camilla Warnke, 'Schellings Idee und Theorie des Organismus und der Paradigmawechsel der Biologie um die Wende zum 19. Jahrhundert', *Jahrbuch für Geschichte und Theorie der Biologie* 5 (1998): 187-234. See also *Selbstorganisation. Jahrbuch für Komplexität in den Natur-, Sozial- und Geisteswissenschaften 5: Schelling und die Selbstorganisation* (1994), ed. Marie-Luise Heuser-Kessler and Wilhelm G. Jacobs.

[4] Karl August Eschenmayer (1768-1852), medical doctor (1797) and chief medical officer (1800-1811) in Kirchheim an der Teck, Württemberg, before becoming professor of medicine and philosophy in the University of Tübingen. After two excellent critiques of Schelling's philosophy of nature, the first, 'Spontaneität = Weltseele', published in Schelling's own *Journal of Speculative Physics* vol. 2, issue 1 (1801), and the second, anonymously, as 'Über Schelling: Erster Entwurf und Einleitung' in the *Erlanger Literaturzeitung* no.67 for July 4, 1801. In *Propositions from the Metaphysics of Nature applied to Chemical and Medical Objects* (*Sätze aus der Natur-Metaphysik auf chemische und medizische Gegenstände angewandt.* Tübingen: Jacob Friedrich Heerbrandt, 1797: 8), from which Schelling quotes at the end of the *Ideas for a Philosophy of Nature* (*SW* II, 313-14n; tr. Errol E. Harris and Peter Heath. Cambridge: Cambridge University Press, 1988: 249), Eschenmayer writes: 'There is no absolute freedom or bondage of the forces in matter. – For the concept of matter would be eliminated thereby. In absolute freedom the forces would be independent of one another, and an infinitely larger or smaller degree of matter, that is, no degree at all, would be existent. Absolutely bound, the gradation would be equally eliminated and sensibility = 0.' Jörg Jantzen gives an excellent account of Eschenmayer's work in Thomas Bach and Olaf Breidbach, eds., *Naturphilosophie nach Schelling* (Stuttgart-Bad Canstatt: Frommann-Holzboog, 2005), 153-79.

In deciding whether naturephilosophy extends Kant's transcendental philosophy or inverts it, such passages are crucial:

> [I]t is only from the standpoint adopted by the metaphysician of nature that the necessary assumption of these forces can be proven and the duplicity of matters and forces which so many have introduced into natural science to explain the phenomena, justified. The theoretical dualism for natural science is actually postulated by dynamics, but we do not commonly observe its lineage. Thus we set acids and alkalis in opposition to one another, two electrical and two magnetic materials; hence Gren assumes a gravitational and an expansive force [...]. Ultimately such a dualism is deduced from the necessity of the original positing and oppositing, which are the conditions under which even the possibility of our consciousness stands.[5]

If the dualism in question amounts to the actual opposition of forces – in a later passage from the same work,[6] Eschenmayer argues that even Kant *proves their existence*, rather than demonstrates their transcendental necessity – and conditions 'even the possibility of our consciousness', it is clear that the 'positing' at issue is primitive, issuing *in* rather than *from* consciousness. It is precisely this inversion that *On the World Soul* pursues. Of course, that the ensuing 'constructions' thereby lose any purely epistemic guarantee follows from this; and here we note, albeit telegraphically, a central difference between Schellingian and Hegelian speculation: if the latter aims at the identity of identity and difference, the former differentiates the identity of the dualism that forms it.

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[5] Eschenmayer, *Propositions from the Metaphysics of Nature*, 3.

[6] Ibid, 60.

Finally, then, what sort of a theory of nature is the higher one from which this hypothesis concerning 'universal organism' derives? It shares with Kant's *Transition between Metaphysics and Physics* (*Opus Postumum*),[7] and with a great many contemporaneous natural scientists, the aether hypothesis. While the beginning of the twentieth century marked the end of the hypothesis concerning such a substance, its real import is that it is an attempt at a physical field theory. As such, the problem it poses concerns whether this 'universal medium' is a substance separable from the forces it vehiculates, or whether it is nothing other than the totality of such forces in actual oppositions. If this seems a merely historical point now, consider the extent to which powers ontologists from Bruno to our contemporaries, consider forces not as primitive, but as properties – the question 'what of?' still remains.[8]

In consequence, the animating 'soul of the world' that is the object of the work translated below is no indicator of a substance dualism, and instead assumes the character of a properly dynamic, field-theoretical theory of nature *within which alone* a dualism not of substances, but of forces accounts for individuation and organisation.

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[7] Schelling supplies this as the title of what is published as the *Opus Postumum* in his obituary for Kant (SW VI, 8).

[8] On contemporary powers ontology, see G. Molnar, *Powers* (Oxford: Oxford University Press, 1993) and S. Mumford, 'The Ungrounded Argument', *Synthèse* 149 (1996): 471-89. On Bruno, see G. Harman, 'On the Undermining of Objects: Grant, Bruno, and Radical Philosophy', in L. Bryant, N. Srnicek, and G. Harman, eds, *The Speculative Turn* (Melbourne: Re.Press, forthcoming), my response to it, 'Mining Conditions' and my 'Does Nature Stay What-it-is?', in ibid.

On the World-Soul

An Hypothesis of Higher Physics
for Explaining
Universal Organism

to which is adjoined a

Treatise

on

The Relation between the Real and the Ideal in Nature

or

The Development of the first Principle of Naturephilosophy in the Principles of Gravity and Light

F.W.J. Schelling

1798

2nd edition 1806. 3rd edition 1809

[*SW* II, 345-583; HKA I,6]

On the World-Soul

F.W.J. Schelling

Foreword to the First Edition 34

The reader, provided only that he has sufficient desire or curiosity, will become acquainted with what the goal of this treatise might be, and why it bears this inscription at its head.

The author first finds it necessary to explain himself on two points, so that no prejudices are assumed with regard to this inquiry.

The first is that no artificial unity of principles is sought or intended in this work. Consideration of the universal metamorphoses of nature as well as the state and progress of the organic world certainly conducts the natural scientist to a *common principle* in which, fluctuating between inorganic and organic nature, is contained the first cause of all change in the former and the final ground of all activity in the latter. Because this principle is *everywhere* present, it is *nowhere*; and because it is *everything*, it cannot be anything *determinate* or *particular*; language has no appropriate term for it, and the earliest philosophies (to which, after having completed its cycle, ours is gradually returning) have handed down to us an idea of it only in a figurative guise.

But a unity of principles is unsatisfactory if it does not return to itself through an infinite series of individual
48 effects. I hate nothing more that the mindless striving to eliminate the multiplicity of natural causes through fictitious identities. I observe that nature is satisfied only by the greatest dominion of forms, and (according to the claim of a great poet)[1] that it delights in *arbitrariness* in the deathly management of decomposition. The law of gravitation alone, to which even the most mysterious of cosmic phenomena are finally reduced, does not only permit, but even causes the heavenly bodies to be disturbed in their course, so that in the most perfect of cosmic orders there reigns the greatest possible disorder. Thus has nature circumscribed the vastness of space, which it has sealed within eternal and unchanging laws, widely enough in order within it to delight the human mind with the appearance of lawlessness.

Just as soon as our consideration of the idea of nature as a *whole* arises, the antithesis between mechanism and organism, which has held up the advance of natural science for long enough, and that may be as contrary to our inquiry as to many others, disappears.

It is an old illusion that organisation and life cannot be explained from natural principles. – If it were thus to be said: the *first* origins of organic nature are *physically* inscrutable, then this *unproven* assertion serves only to discourage investigators. It is of course permissible to oppose one audacious assertion to another equally audacious one, and so science advances not a single step. Yet at least *one* step towards this explanation would be taken were we able to show that the graduated series of every organic being is formed from a gradual evolution of one and the same organisation.

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[1] Schelling is referring to Schiller's *Dom Karlos*, act 3, from which he borrows his language.

That our experience has known no reorganization of nature, no transition of one form or type into the other (although the metamorphoses of many insects and, if every bud is a new individual, also the metamorphoses of plants could at least be adduced as analogical phenomena) is no proof against this possibility; for, were a defendant to answer it, the changes to which organic as much as 34 anorgic [*anorgische*] nature is subjected, could (until a universal stagnation of the organic world comes about), have happened over ever longer periods, for which our small periods (which are determined by the cycles of the earth round the sun) provide no measure, and are so large that until now there has been no experience of the course of a single one. Fine. Let us abandon these possibilities and see what then is true and what is false in the antithesis between mechanism and organism, so as to determine with as much certainty as possible the limits within which our understanding of nature must remain.

What then is that mechanism which frightens you as would a ghost? Is mechanism something that persists in itself, or is it not instead simply the negative of the organic? Must not the organic precede the mechanical, the positive precede the negative? Now if in general the negative presupposes the positive (as darkness does light, as cold does heat) and not vice-versa, then our philosophy must not begin with mechanism (as the negative), but rather with the organic (as the positive), and therefore of course the former is not so much to be explained by the latter, but rather only can be explained by it. Not where there is no mechanism, no organism, but rather conversely, where there is no organism, there is no mechanism.

To me, organisation in general is nothing other than an arrested stream of causes and effects. Only where nature has not inhibited this stream, does it fly forward (in a straight line). Where it inhibits it, it turns back on itself (in a circular line). Therefore, the concept of organism does not rule out all succession of causes and effects; rather, this concept indicates only a succession that *enclosed within certain limits*, flows back on itself.

Now, that the original limit of mechanism cannot be explained empirically, but must instead be *postulated*, I myself will show (by induction) in what follows; it remains
50 however to be proven philosophically. For since the world is only infinite in its finitude, and an unrestricted mechanism would destroy itself, then universal mechanism must be restricted *to infinity*, and there will be as many *individual, particular worlds* as there are spheres within which universal mechanism revolves in itself, so that, in the end, the *world* is an *organisation*, and a *universal organism* is itself the *condition* (and to that extent, the positive) of *mechanism*.

Viewed from this height, the particular successions of causes and effects (that delude us with the appearance of mechanism) disappear as infinitely small straight lines in the universal curvature of the organism in which the world itself persists.

Now what philosophy has long taught me, that the positive principles of organism and mechanism are the same, I have sought to prove in the following work from experience, in that the universal changes in nature (on which even the existence of the organic world depends), lead us at last to the same *first hypothesis* on which the universal assumption of natural scientists has long since made the explanation of organic nature dependent.

The following treatise therefore falls into two sections, the first of which treats of the force of nature that is manifest in the universal changes, while the other undertakes to search for the positive principle of organisation and life. The common result of these is that *one and the same principle binds anorgic and organic nature.*

The incompleteness of our knowledge of first causes (such as electricity), the atomistic concepts that lay here and there in my way (e.g. in the theory of heat), and finally the impoverishment of the dominant modes of thought regarding many objects of physics (e.g. meteorological phenomena), soon required that I be early led in the first section to make many special explanations – explanations that scatter the light, that I would wish to cast on the whole amongst particular objects, so indeed, that at the end they 35
can be collected again in a common focus.

The *wider* the sphere of inquiry is drawn, the more clearly one sees the deficiency and impoverishment of the experiments that up to now fall within its circumference, and thus few will feel the incompleteness of this attempt more deeply or vividly than he who conducts it.

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Note. This work is not to be viewed as a continuation of my *Ideas for a Philosophy of Nature.* I will not continue it before I find myself in a position to conclude the whole with a *scientific physiology*, that alone can round off the whole. First I hold it as a duty not merely to *venture* something in this science, the errors of which at least the perspicacity of others will effect the discovery and refutation.

I must nevertheless wish that the reader and critic of this treatise be familiar with the ideas presented in that work. The authority for assuming all positive natural principles as homogeneous, is only to be gained philosophically. Without this *postulate* (I presuppose that one knows what a *postulate with a view to a possible construction* is),[2] it is impossible to construct the first concepts of physics, for example, the theory of heat. Idealism, which philosophy is gradually introducing into all the sciences (it has long since become dominant in mathematics, especially since Leibniz and Newton), still seems to be little understood. The concept of *action at a distance*, for example, against which some still beat their heads, rests entirely on the idealist notion of space: for according to this notion, two bodies at the greatest possible distance from each other can be represented as in contact with one another, and contrariwise, bodies which (in accordance with the common conception) are in actual contact, as acting on one another at a distance. It is quite true that a body only *acts* where it *is*, but it is equally true that it only *is* where it *acts*, and with this single proposition the last piece of armour of the atomistic philosophy is overcome. I must abstain here from offering still further examples.

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[2] Schelling's theory of the postulate is given in 'On Postulates in Philosophy', the appendix to the 'Explanatory Essays on the Science of Knowledge' (1797), where Schelling writes, 'the expression "postulate" is borrowed from mathematics. In geometry, the *original* construction is not *demonstrated*, but *postulated*. This *original* (the simplest) *construction* in space is *the moving point*, or the *line*' (*SW* I, 444). Adopting this as the principle of a constructive philosophy, Schelling advocates a philosophy concerned 'only with original constructions', which does not 'consider any existential proposition *analytically*, but *synthetically* (as *arising* in synthesis)' (*SW* I, 447).

PART I: ON THE FIRST FORCE OF NATURE 37

> Venient tempus, quo ista, quae nunc latent, in lucem dies extrahat et longioris aevi diligentia. Ad inquisitionem tantorum una aetas non sufficit. – Itaque per successiones ista longas explicabuntur. Vienet tempus, quo posteri tam aperta nos nesciisse mirentur.
>
> [*Grant him time and lifelong diligence to bring to light what is hidden. Life is not sufficient for so many inquiries together. – Therefore let him make far-reaching advances in explanation. In time to come, we must wonder to whom so much will later be clear.*]
>
> Seneca[3]

Every motion that returns to itself presupposes, as the 38 condition of its possibility, a *positive* force that (as *impulse*) *initiates* motion (turning the starting point, as it were, into a line), and a *negative* force, that (as attraction), draws the movement back into itself (or prevents it from flattening out into a straight line).

In nature everything strives continuously forwards; we must seek the ground as to why this is so in a principle that, as an inexhaustible source of the *positive* force, always reinitiates movement in the world and uninterruptedly maintains it. This *positive* principle is the *first force of nature.*

But an invisible power draws all the world's phenomena into an endless circuit. We must seek the ultimate ground as to why this is so in a *negative* force that, in that it continuously limits the effects of the positive principle, conducts motion in general back to its source. This *negative* principle is the *second* force of nature.

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[3] Seneca, *Naturalis Quaestiones*, VII, 25, 4-5.

These two conflicting forces conceived at the same time in conflict and unity, lead to the idea of an *organizing principle*, forming the world into a system. Perhaps the ancients wished to intimate this with the *world-soul*.

If the originally positive force were infinite, it would lie entirely beyond the limits of all *possible perception*. Restricted by the opposing force, it becomes a *finite magnitude* – it begins to be an object of perception, or manifests itself in *phenomena*.

The one *immediate* object of *intuition* is the *positive* in every phenomenon. We can only *infer* the *negative* (as the cause of the merely *experienced*).

82 The *immediate object* of the *higher theory of nature* is therefore only the *positive* principle of all motion, or the *first force of nature*.

The first force of nature *conceals* itself behind the *individual phenomena* in which it is revealed to the desirous eye. In *individuated matter* it breaks out throughout the entire cosmos.

To grasp this *Proteus of nature* that recurs again and again in ever changing forms and in numberless phenomena, we must cast the net more widely. Our progress will be slow, but all the more certain.

The matter that in every system radiates from the centre to the periphery – *light* – moves with such force and velocity that some have even doubted its materiality, since it lacks the universal characteristic of matter, inertia. But to all appearances, we know light only in its *propagation*; most probably it is only in this state of *original motion* capable of reaching our eyes as light. Now every *propagation* and every *becoming* is accompanied by a particular and appropriate motion, however. If a very much higher yet nonetheless finite degree of elasticity were instantaneously to arise, there will also arise a matter of the highest degree of elasticity that, since the essence of elasticity is the expansive force, will expand into a space in proportion to the degree of this force. This will now give the appearance of matter in free motion, as if, so to speak, exempted from the universal laws of inertia, it held in itself the cause of its own movement.

Now this movement, however great or fast we may assume it to be, differentiates itself from every other, so that an equilibrium of the forces arises in any given matter, only according to degree. For let that elastic matter, without 38
any resistance that a body of lesser elasticity could set against it by its impenetrability or by the attractive force of its dissemination, spread out in a completely empty space, then since the degree of its elasticity is of course finite, and the elasticity of every matter decreases in proportion as the space in which it expands is increased, by which its gradually lowering elasticity reaches an equilibrium of forces relative to its degree of expansion, and thus makes *rest,* that is, a permanent state of matter, possible.

Therefore *light*, although it moves with wonderful speed, is nevertheless for that very reason neither more nor less *inert* than any other matter whose movement is no object of perception. For, to state it at the outset, *absolute* rest in the world is *not anything*, all rest in the world is merely apparent, and properly only a *minus*, but in no way a complete absence, of motion (= 0). The movement of light is therefore an *original* movement of which *every* matter as *such* has its share, except that, no sooner has matter *reached* a permanent state, with the minimum speed that light would equally have attained, than its original forces will have reached a common moment.

Since every matter fills its particular space only through the reciprocity of opposing forces, that it therefore *permanently* fills *that same* space, i.e. that the body persists in its condition, cannot be explained without accepting that these forces are equally *active*, whereby then the non-thing of absolute rest disappears of itself.

All rest and all persistence of a body is simply *relative*. The body *rests* in relation to a *determinate state* of matter; as long as this state continues (as long, e.g., as the body is solid or fluid), the moving forces will fill space with *equal quantity*, i.e. they will fill *the same* space, and *to that extent* the
84 body will appear to *rest*, although that this space is continuously filled can only be explained by a continuous motion.

That therefore light expands on all sides in rays, must be explicated by conceiving it as in *constant propagation* and as *originally* expansive. That light also reaches relative rest we can directly infer from this, that the motion of light from an unending mass of stars is not transmitted to us.

It is not in the interest of natural science to admit anything *unlimited*, nor any absolute force, but rather to consider each of these always and only as the *negative of its opposite*. Now we too may, of whichever of the forces we wish, let it grow to the highest degree thinkable, but we will never be able to bring it to the *absolute* negation of its opposite. Hence the striving of those who derive universal gravitation from the impact of some unknown matter that forces bodies against one another, is entirely idle; for since this matter creates gravity, without itself being heavy, we must conceive it as an absolute negation of the attractive force; but as such it would cease to be an object of possible construction and would as it were disappear into the universal repulsive force, leaving no material principle to explain universal gravitation, but only the obscure idea of a *force*, which is precisely what this hypothesis sought to avoid.

What keeps light within material limits, what *finally* turns its motion into an object of perception, is the force of attraction.[4] If some natural scientist assumes light itself or a part thereof as *imponderable*, all they thereby state is that a great force of expansion (which, as an original force, leaves all our explanations at a standstill) is active. Since however 38
this force of expansion never exceeds the limits of matter, i.e. can never become absolute, so *gravity* can certainly be considered as *collapsing* into a matter, as into light, but never as completely *negated*.

To that extent, it is not absurd to assert a *negative gravity* of light;[5] for since this expression, borrowed from mathematics, always indicates not a mere *negation*, but rather an *actual opposition*,[6] so *negative attraction* is in fact nothing more nor less than *real repulsion*,[7] so that this term states nothing more than what we have long known, that a repulsive force is active in light. Should this however suggest some cause by which the absolute (not the specific)[8] gravity of the body may be reduced, the concept of such a cause has long since been banished into the realm of fantasy.

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[4] 1st ed.: 'its ponderability'. [K.F.A. Schelling].

[5] The concept of 'negative gravity' was applied by Friedrich Albert Carl Gren, amongst others, although he later modified it, in his *Systematic Handbook of General Chemistry*, 4 vols (2nd edition, Berlin and Halle: Waisenhaus 1794-6), vol.1, 136: 'The gravitational being of particles of free caloric cannot consist in their rectilinear radiation. Hence it may already be demonstrated *a priori* that caloric is not subject to gravity, and nor can it be proven to be gravitational by any number of *a posteriori* experiments. Caloric is therefore an imponderable elastic fluid.' [editors' note, *HKA* I,6: 288].

[6] See Kant, 'Attempt to introduce the concept of negative magnitudes into philosophy', *Kants Werke* (Berlin: Königliche preussische Akademie der Wissenschaften, 1901ff) *Ak.*.II, 165-204, tr. David Walford and Ralf Meerbote in *Theoretical Philosophy 1755-1770* (Cambridge: Cambridge University Press, 1992, 202-41; here *Ak.* II, 193; 1992: 230-31: 'So far I have merely considered the grounds of real opposition, in so far as they *actually* posit in one and the same thing determinations, of which one is the opposite of the other. A case in point would be the motive forces of one and the same body which tend in exactly the opposite direction; and here the grounds cancel their reciprocal consequences, namely the motions. For this reason, I shall [...] call this opposition *actual opposition* (*oppositio actualis*).'

If accordingly no degree of elasticity can be thought as the highest possible, so that above this there are still higher degrees, and between these given degrees and the complete negation of all degree innumerable intermediary degrees can be thought, so too can each elastic material can be considered as the mean proportion of a higher and a lower degree, that is, as *composite*. If *we* have the means to decompose such a matter chemically, we never arrive at it; it is enough that such a decomposition is possible, and that nature has the means to effect it. Therefore (even if the colours of a body do not indicate a decomposition of light), we will consider *light* not as a simple element, but rather as the product of two matters,[9] one of which, as elastic as light, can be called the *positive* matter of light (the *fluidum deferens* according to de Luc), and the other, less elastic by nature, the *negative* (ponderable) matter of light.

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[7] Kant *Ak.* II, 179-80; 1992: 218: 'Now if you call *attraction* a cause, of any kind you please, in virtue of which one body constrains other bodies to press upon the space which it itself occupies or to set in motion (though here it is sufficient simply to think of this attraction), then impenetrability is a *negative attraction*. This serves to show that impenetrability is as much a positive ground as any other motive force in nature. And since negative attraction is really true repulsion, it follows that the forces with which the elements are invested and in virtue of which these latter occupy a space, albeit in such a way that they impose limitations even on space itself by means of the conflict of the two forces which are opposed to each other – it follows, I say, that these forces will give rise to the elucidation of many phenomena.'

[8] 'With the term "specific gravity" is designated the relations of the weight of a body to the space it occupies. A body is called *specifically more gravitational* or *heavier*, than another when it weighs more, *specifically lighter* when it weighs *less* than the other, when they occupy the same space.' J. S. T. Gehler, *Physikalisches Wörterbuch*, 6 parts (Leipzig: Schwickert, 1787-1796), part 3, 902 [editors' note *HKA* I,6: 291].

[9] 1st ed.: '*two matters*' [K.F.A. Schelling].

The positive matter of light is, in relation to light, the ultimate ground of its susceptibility to expansion and *to that extent*, absolutely elastic, although we cannot at all think it 38 as matter without considering even *its* elasticity in turn as finite, that is, as itself *composite*. It is the first principle of natural science that no principle be considered absolute, and that a *material* principle be assumed as a vehicle of every force in nature. Natural science has, as if by some happy instinct, steadfastly pursued this maxim, and would sooner always hypothesise unknown matters to explain natural phenomena than resort to absolute forces.

Hence the advantage of the concept of the *original forces*, which dynamic philosophy has introduced into natural science,[10] is now strikingly evident. Namely, they do not in any way serve as *explanations*, but rather only as *limit concepts* for empirical natural science, by means of which the freedom of the latter is not only unthreatened, but is rather secured, because the concept of forces, since each of these admits an infinity of possible degrees, none of which is an absolute (the absolutely highest, or the absolutely lowest), opens for it an infinite scope within which it can explain all phenomena *empirically*, that is, from the *reciprocity of diverse matters*.

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[10] The background of the 'dynamic philosophy' to which Schelling here refers is provided by Kant's *Metaphysical Foundations of Natural Science*, but also by his own *Ideas for a Philosophy of Nature*, which draws also on Eschenmayer's *Propositions from the Metaphysics of Nature* (cf. n.4 in my introduction above, and George di Giovanni, 'Kant's Metaphysics of Nature and Schelling's *Ideas for a Philosophy of Nature*, *Journal of the History of Philosophy* vol.17 (1979): 197-295.

Indeed, natural science has from the very first helped itself to this freedom in explanation, albeit indeed without being able to protect itself against the charge of arbitrariness which from this point on becomes invalid, since according to the principles of a dynamic philosophy outside the sphere of known matters there yet remains a broader one for unknown, other matters that yet we cannot pass off as invented, as soon as the degree of their energy is assumed to be proportional to actually observed phenomena.

So much for the rectification of common notions.

When I assert the *materiality* of light, I do not thereby exclude the opposite view, namely, that light is the motion of a moved medium. In the *Ideas for a Philosophy of Nature*, I posed the question: Must not the light from the sun propagate to us by decomposition? At issue was whether
87 we might not unify the *Newtonian* and *Eulerian* theory of light. What exactly do Newton's supporters want? A matter that has its own, proper relations to bodies, that is, that is capable of its own effects.[11] And what, by contrast, does Euler, and those who agree with him, want? That light is the mere phenomenon of a moving, vibrating medium. Yet must the vibration be necessarily *mechanical*, as Euler thinks? Who can prove that, between earth and sun, a matter does not fill it that is decomposed by the effect of the sun; and could not this decomposition propagate even into our atmosphere, since in precisely this there is a source of light?

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[11] '*Aether, celestial air, the fine matter of the universe, materia subtilis, elementum primum Cartesii.* Names that the natural scientist applies to the finest and most elastic fluid matter that is spread throughout the entire universe and penetrates the interstices of all bodies. Everything that can be said about these objects is *hypothetical* and acknowledged only to explain certain appearances; direct and clear experimentation on the existence and properties of the aether are entirely lacking.' Gehler, *op. cit.*, part 1: 82 [editors' note *HKA* I,6: 294-5].

In this way, we would have what Newton wants: a particular light-matter that is equally capable of chemical relations; and what Euler wants: a propagation of light by simple vibration of a decomposable medium.

As far as I know, both *Newton's* and *Euler's* supporters admit that each of these theories have their own difficulties, which elude those of the opposing theory. Would it not therefore be better, instead of setting these views in opposition one to the other as has until now been done, to consider them as *reciprocally supplementing one other*, so as to combine the advantages of both into *one* hypothesis?

One important argument for this new theory is that all the light we know is indeed only the *phenomenon of a propagation.* For

1) Assuming too, that the light that now reaches us is the same light that less that around eight minutes before radiated from the sun, then as has already been shown, we cannot explain the diffusion of light in all directions without assuming that this motion is *original.* But there is original motion in a matter only for so long as it has not yet reached a *dynamic equilibrium*, that is, for as long as it is still conceived as *becoming.*[12] Therefore all light that is in

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[12] Compare Eschenmayer, *Propositions*, 22ff: 'According to dynamical concepts, an equilibrium arises when two opposing degrees of reality act against one another. Here, however, we are only discussing a relative equilibrium, in which the effects of the two forces are thought not as cancelled by, but rather only as equal to, one another. An absolute equilibrium exists where two forces completely cancel each others' effects so that they are no longer an object either for mathematical construction or for the analysis of experience. We may think of an absolute equilibrium symbolically by way of the lever. As long as force and weight are distributed over the arms of a lever in some manner, then a calculation of the magnitude of motion also takes place, just as when I think of the force and weight as combined in the hypomochlion (fulcrum), the magnitude of motion is = 0. This is absolute mechanical equilibrium which, for mathematicians, is no longer an object. We can indicate a dynamic absolute equilibrium with the example of plus and minus electricity. As long as each works

contact with our organ is indeed such as remains in a state of *propagation.*

2) That the light from the sun is actually *merely the phenomenon*
88 *of a constant decomposition of its atmosphere* has been carried to a high degree of probability by *Herschel* (*Philosophical Transactions for the Year 1795*, vol.1).[13] According to the simplicity of means that we apply to the greatest and most widespread effects of nature, we may all the more extend this conjecture to all self-illuminating bodies in the cosmos, as many phenomena of its light seem to confirm such an origin; of which more below.

Since I have seen Mr *Herschel* himself, to make his hypothesis of the origin of sunlight more probable, appealing to the *propagation of light in our terrestrial atmosphere* (the Northern Lights, that are frequently so large and luminous, that they can probably be seen from the moon; the light that often in clear, moonlit nights, covers the sky), I am all the more strengthened in the conjecture that indeed all light is propagated by the vibration of an easily decomposable medium (see *Ideas for a Philosophy of Nature*, S.36).

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on the other at a distance, we have the sensation of electricity, but as soon as the one passes over into the other, every expression of this fluid vanishes and becomes = 0 for experience.' [Editors' note *HKA* I,6: 297]

[13] William Herschel, 'On the nature and construction of the Sun and the fixed stars', *Philosophical Transactions of the Royal Society of London for the Year 1795*, part 1, 46-72: 'That the sun has a very extensive atmosphere cannot be doubted; and that this atmosphere consists of various elastic fluids, that are more or less lucid and transparent, and of which the lucid one is that which furnishes us with light, seems also to be fully established by all the phaenomena of its spots, of the faculae, and of the lucid surface itself.' [Editors' note *HKA* I,6: 297-8]

Since then, I have read *Lichtenberg's Meteorological Fantasies*[14] from the opportunity afforded by *Herschel's* hypothesis, and from this too it seems to me that the hypothesis is more confirmed than refuted.

3) It is now agreed that the light that arises in the combustion of bodies, is propagated from the environing air, and indeed from those parts of it that, from their efficacy in the advancement of vital functions,[15] have acquired the name *vital air* (*aer vitalis*). Already from the outset it may be conjectured that indeed *all* the light that we are in a position to create, takes its origin from the vital air.

In the work referred to, I have maintained that the new system of chemistry, as soon as it has acquired its due extent, could indeed develop into a universal system of nature. The present work should provide the test for such an extended employment of it. The discoveries concerning the properties of the *gaz oxygène* should long ago have made it clear that oxygen, if it is what it is currently taken to be, 38 will indeed be much more than just that. We have even begun to ascribe to the ponderable basic matter of the vital air the most extraordinary effects in nature. Against this, one remark, that strikes me as very true, will be made, that it is absurd to accord an in itself inert body of the sort that so-called oxygen is, such power. (See, for example, what Brandis says in *Essay on the Vital Force*, p. 118.)[16] Most important in this chemical discovery is the *constant coexistence of this basic matter with the energetic matter* manifest in *light*, so that until now one had at least every right to consider it as genuinely that matter to which nature opposes the constant effects of an *ethereal, universally distributed fluid.*

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[14] Gorg Christoph Lichtenberg, 'Geologisch-Meteorologische Phantasien', in *Göttinger Taschen Calender. Für das Jahr 1798*: 83-120. *HKA* I,6: 298-9 cites Lichtenberg's discussions of the conditions under which variations are observed in the quantity of light from the fixed stars.

[15] Christoph Girtanner, *Anfangsgründe der antiphlogistischen Chemie*, second edition (Berlin: Unger, 1795), 61: '*Combustion* consists in the decomposition of oxygen gas by a body with which oxygen has a greater affinity than with caloric. *Burnable* or *combustible bodies* are such as have a great affinity to oxygen. During combustion oxygen is combined with the combustible body and acidifies it. The caloric previously bound to oxygen becomes free and bonds with the adjacent bodies; hence light and heat'

Since the vital air is a composite matter, and since all expansible fluids must be considered as composed of an original elastic fluid and a ponderable matter, we may here, since we find ourselves in the domain of a higher science, abandon the metaphorical language of chemistry and conceive the so-called acid-matter [*Sauerstoff*] or oxygen[17] as the *negative matter of the vital air* that in combustion is combined with the body, while the *positive* goes under the form of *light.* For brevity's sake we will designate light by +O, but oxygen itself by –O (provided that we do not thereby think of +E and –E).

If accordingly the vital air is the source of light, and –O is the *ponderable* matter whereby a *freely circulating,* highly elastic *fluid,* surrounding the planet, *limited* in its *motion* and as it were fastened to gravitating bodies, then the *old theory of Descartes, Huygens* and *Euler ceases, at least partly, to be hypothetical,* and perhaps, as *Newton* himself dared only conjecture, at the end of his *Optics*,[18] will be proven.

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[16] J. D. Brandis, *Versuch über den Lebenskraft* (Hannover: Hahn, 1795).

[17] A. Lavoisier, 'Freier Auszug aus dem *Taité elementaire de Chimie à Par. 1789 mit Anmerkungen*', in *Physikalisch-chemische Schriften. Aus dem Französischen gesammelt und übersetzt*, vol. 5 (Greifswald: Anton Ferdinand Röse, 1794), 161: '*Vital Air*. Like all gaseous matters, the breathable part of our atmosphere contains caloric, to which something must be added to manifest this kind of gas. We may most appropriately call this acid-matter (oxygen, from oxus and geinomia), because through its bonding with most substances it produces acid; hence the vital air is acid-matter gas (oxygen gas).'

[18] Isaac Newton, *Optics*, Query 22, in Andrew Janiak, ed., *Newton. Philosophical Writings* (Cambridge: Cambridge University Press, 2004): 138-9. 'May not planets

What we call *light* is now itself the phenomenon of a *higher* matter capable of many more and other combina- 39 tions, and with each new combination takes on yet another mode of activity. Although it seems to be the most simple element, an *original duplicity* must nevertheless be assumed in light, or at least the light from the sun seems to be the sole cause that sparks and maintains all duplicity amongst the earths.

In light, as it radiates from the sun, only one force seems to govern, but doubtless as it approaches the Earth, another, antithetical matter enters with it and thus, since it is itself capable of bifurcation, forms together with that matter *the first principle of the universal dualism of nature*.

Such a dualism must however be assumed, because without opposing forces, no motion is possible. Real opposition is only thinkable, however, between *magnitudes of the same kind*. The original forces (to which in the end all explanations revert) would not be opposed to one another were they not originally *one and the same* (*positive*) force, which only acts *in opposite directions*. For this very reason it

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and comets, and all gross bodies, perform their motions more freely, and with less resistance in this aetherial medium than in any fluid, which fills all space adequately without leaving any pores, and by consequence is much denser than quick-silver or gold? And may not its resistance be so small as to be inconsiderable? For instance; if this *aether* (for so I will call it) should be supposed 700,000 times more Elastick than our air, and above 700,000 times more rare; its resistance would be above 600,000,000 times less than that of water. And so small a resistance would scarce make any sensible alteration in the motions of the planets in ten thousand years. If any one would ask how a medium can be so rare, let him tell me how the air, in the upper parts of the atmosphere, can be above an hundred thousand times rarer than gold. Let him also tell me, how an Electrick body can by friction emit an exhalation so rare and subtle, and yet so potent, as by its emission to cause no sensible diminution of the weight of the electrick body; and to be expanded through a sphere, whose diameter is above two feet, and yet to be able to agitate and carry up leaf-copper, or leaf-gold, at the distance of above a foot from the electrick body? And how the *effluvia* of a magnet can be so rare and subtile, as to pass through a plate of glass without any resistance or diminution of their force, and yet so potent as to turn a magnetick needle beyond the glass?'

is necessary to think all matter as *originally homogeneous*, for only insofar as it is *homogeneous with itself* is it capable of a *bifurcation*, that is, of *real opposition*. But every *actuality* already presupposes a bifurcation.

Where there are appearances, there are already opposing forces.[19] *Natural science* therefore presupposes as its immediate principle a *universal heterogeneity*, and to be able to explain this, a *universal homogeneity* of matter. Neither the principle of absolute homogeneity nor that of absolute heterogeneity is the true one; the truth lies in the *union of the two*.

91 Without original heterogeneity no partial motion would be possible in the earth. For the opposing forces possess a necessary striving to *equilibriate*, that is, to set themselves into a relation of *minimal reciprocity*; consequently, were the forces not *unequally* distributed throughout the universe, or were the equilibrium not constantly *destroyed*, all partial motion would ultimately vanish from planets, and only a universal motion would persist, until perhaps finally even the inert, lifeless masses of the planets would collapse into a single heap, and the entire world sink into inactivity.

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[19] Kant, *Critique of Pure Reason* (A265/B321) 'We are acquainted with substance in space only through forces which are active in this and that space, either bringing objects to it (attraction) or preventing them penetrating into it (repulsion and impenetrability). We are not acquainted with any other properties constituting the concept of the substance which appears in space and which we call matter.' See also Eschenmayer, *op. cit.*, 5-7: 'Matter is conceivable only by assuming two basic forces, and matter fills a space not through its mere existence, but by forces. Now since the empirical filling of space is given as endless difference in our intuition, but the multiplicity of a force can only consist in degrees, we may also consider these differences as degrees. Qualities are therefore degrees, and a degree of matter is any magnitude of proportion in which the attractive and repulsive forces stand one to the other. It is in this way that the dynamic is distinguished from the mechanical philosophy of nature.'

In order that the forces be unequally distributed throughout the universe [*Welt*], an original heterogeneity of the planets in each system must be postulated. There must be a principle that not only incites, but also, by continuous influence, sustains the conflict of particular matters on subordinate planets. Were this principle uniformly distributed throughout the universe, then it would soon find itself in equilibrium with opposing forces. It must therefore flow from somewhere else than, and from outside, the individual planets; in each system there must be only *one* body that always generates this principle anew, and dispatches it to all the others.

There is therefore no doubt that the *self*-illuminating bodies of the solar system owe this property to a quality that is properly their own, and which they obtain from the very beginning through a universal precipitation from the common solvent medium that precedes the formation of worlds.

To this extent, the view that the light from suns is generated from their own laps, still has a great deal going for it. Or should suns only be *light magnets*[20] for the universe, and all the light that nature generates from throughout all space be collected in them? Must there be, apart from planets and suns, a third class of bodies that are expressly determined to those processes by which nature generates ever new light matter (perhaps comets)? If for a moment we 39 think the world as finite, we must believe that from that point where the common centre falls, there emanates a constantly renewed and inexhaustible stream of positive matter. Is *Lambert's* argument that the planets that cycle within the centre of the solar system must be *dark*, convincing?[21] The star that in the sixteenth century suddenly appeared in Cassiopeia shone for one month more brightly than Sirius, and once it had arisen, as if from the void, gradually reduced in brightness, manifesting always weaker colours before finally disappearing completely; or was the star that Kepler saw at the start of the following century near the heel of the Ophiuchus, which demonstrated a constant change of colour (running through almost all the colours of the rainbow), but was as a whole *white* – according to Kepler's statements the brightest phenomenon in the heaven of fixed stars – perhaps, as *Kant* suggested, extinct suns reviving from their ashes, or were they the stage for another great process, by which nature generated light in the depths of the universe?

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[20] Peter Joseph Macquer, *Chymisches Wörterbuch oder Allgemeine Begriffe der Chymie nach alphabetischer Ordnung. Aus der Französischen nach der zweyten Ausgabe übersetzt und mit Anmerkungen und Zusätzen vermehrt von Johann Gottfried Leonhardi*, 2nd edition, 7 parts (Leipzig: Weidmann, 1788-1791), part 4, 577: *light magnet* is the 'Proper name for Balduinic Phosphorous. This is nothing other than a combination of chalk with nitric acid. […] This phosphorous (which some… call *light magnets*, because it only lights once exposed to light at a distance) […]'. [Editors' note *HKA* I,6: 303.]

At least if, following Herschel,[22] the propagation of light in the sun is only an *atmospheric process*, then there must be a reason why at all solar atmospheres erupt into light propagations. Must we assume that originally some elastic essence from which nature propagates light, accumulates around the solar body, and that the existence of this matter in the atmospheres of subordinate astronomical bodies is due to the long influence of the sun alone? At the very least, the source of light in our atmosphere is not *purely* and *unmixedly* to hand.

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[21] See J. H. Lambert, *Cosmological Letters on the Arrangement of the World Edifice* (Augsburg: Klett, 1761), tr. S. L. Jaki (Edinburgh: Scottish Academic Press, 1976): 'Should I, however, out in the common centre of the fixed stars, which together constitute a system, a body toward which they all gravitate, then I must give that body an enormous size and I must enhance its mass so much that even the most distant stars of the system would have considerable gravity toward it, because this is always proportional to the mass. Were I here to write a novel, I would then state that this body has either no proper light or only a very weak one. I would so arrange the world that the smaller dark bodies, like, for instance, the planets, would move around bright suns, but these again would orbit around dark bodies. For the suns would need no other light because they themselves possess so great a brightness, while the dark body can still sufficiently be illuminated by the suns which move closest around it.' [Editors' note *HKA* I,6: 303.]

[22] See note 13, above.

Who knows if suns are not surrounded by a completely *pure air*,[23] while a principle proper to planetary atmospheres prevents the outbreak of the propagation of light? There, in the sun's vicinity would shine an unchangingly pure light, unmenaced by any hostile principle. If it developed from the constant decomposition of a gaseous essence, we 39 would have to think this as provided with an extraordinarily high degree of elasticity, since as the largest masses of every system, suns, through the original transition from a fluid to a solid state, emit the largest quantity of elastic matters. To this, of course, is to be added the effect of gravity, which maintains the sun's atmospheric cover by intense compression, increasing its original elasticity to an extraordinarily high degree.

It is known that the intensity of light in its propagation is proportional to the degree of elasticity of the air from which it propagates. We experience this in great cold, when all fire burns brighter, sparks spread more quickly, electric light arises from the least friction, and even the earth's atmosphere at the poles radiates in electrical rays.

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[23] Gehler, *Physikalisches Wörterbuch* part 2, 371: '*Gas, dephlogisticated, dephlogisticated air, non-combustible air, pure air (Bergman), Fire air (Scheele), artificial pure air (Keir), vital air (Ingenhouss), Empyreal air, Gas dephlogisticatum, aer dephlogisticatus, Aer purissimus, aer verus factitius, aer vitalis, gas ou air dephlogistiqué*: That component of the atmospheric air that makes it suited to sustaining fire and the breathing of animals.' [Editors' note *HKA* 1,6: 304.]

If then around the central body a gaseous essence emanates of so high a degree of elasticity that light propagation erupts unprovoked of itself, then continuous rays of light from these would spread in all directions and an ethereal sea would fill the empty spaces of the entire system whose midpoint they occupy, then indeed even spread into the spaces of more distant systems. For if the light developed never comes to rest until the gradually decreasing elasticity of its mass attains equilibrium, then the space it occupies at rest becomes proportional to its elasticity. But the degree of elasticity can increase to infinity, and be assumed to be as great as the explanation of appearances requires. Therefore the elastic matter that is propagated from the circumference of our sun can spread in a steady, unbroken stream to our atmosphere. The daily revolution of the earth will necessarily create the change of day to night, but not prevent the light from other, far distant suns from maintaining the continuum of their atmosphere with ours. Just as the hemisphere that we inhabit turns 94 towards our sun, so too will larger light rays penetrate it, and effect the phenomenon of *day*. A common medium fills our entire solar system; every individual planetary body will acquire as much light from the commonality as is possible in accordance with the quality of its materials, but nowhere in the whole planetary system is there a hiatus, or a space that is not filled by the common atmosphere of all.

If finally the fixed stars too yet belong to a higher system, governed from a common central body, then the atmosphere of this system will also be common. Thus the atmosphere of each sun is in contact with the atmosphere of a higher system, and all the light that is spread throughout the world is the common light of one *universal atmosphere*.

If meanwhile an original diversity amongst the planetary bodies exists, then the universal light cannot be *uniformly distributed*, but must radiate from all spaces of the world to the *suns*, and only from these to the planets.

Doubtless, however, it is not only individual, divergent rays that come to us from the sun, it is the *decomposed solar atmosphere*[24] itself that, as a constant whole, reaches even to us. The phenomenon of day is inconceivable as an accidentally diffused light. Since a source of light was formed in the vicinity of dark bodies, would this not at the same time have to be set in motion by the influence of the sun? The conflict of elastic matters in our atmosphere can only arise when our globe is transformed into a self-lighting body by an alien influence, becoming *sun and planet* at the same time, and thus combining heterogeneous properties in itself.

It is not enough, however, that the positive principle is only non-uniformly distributed throughout particular solar systems. If it radiates uniformly to a subordinate planetary body, a universal uniformity would soon arise upon it, that would ultimately terminate in a universal decomposition.

Light could not act upon the subordinate planetary bodies unless a force were extended over them that, excitable by light, must be primitively affinate to it. That however no enduring excess of this force of nature arises through the influence of the sun's light, is ensured by the world's very structure, by the change of day and of night, of the seasons, even by the form of the planets, since, to judge analogically in accordance with the form of our earth, without doubt wherever light rays strike most vertically (towards the equator), the greatest mass is accumulated; while where they more obliquely hit (towards the pole), they gradually flatten off.

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[24] See note 13, above.

395 The *positive* cause of all motion is the force that fills space. If motion is to be maintained, then this force must arise. The phenomenon of every force is therefore a *matter*. The first phenomenon of the universal force of nature, through which motion is sparked and maintained, is *light*. What radiates to us from the sun (since it maintains motion) appears to us as the *positive*; what our earth (as mere reagent) opposes to that force, appears to us as the *negative*. Without any doubt, what bears the aspect of the *positive* is a constituent of *light*; with it, we simultaneously acquire the positive elements of electricity and magnetism. The *positive* in itself is *absolutely-one*, therefore the primitive idea of an inexhaustible *primal matter* (of aether), which, as if broken down in an infinite prism, extends into innumerable matters (as individual rays). All multiplicity in the world arises only by the various *limits* within which the positive acts. The factors of universal motion on the earth are *positive*, which radiates to us from outside, but the *negative* is what belongs to our earth. The latter, evolved from a positive force, is capable of an infinite multiplicity. Where a force of nature encounters resistance, it forms its own sphere, the product of its own intensity and that of the resistance it encounters.

396 The negative force is aroused only by the positive. Therefore in all nature, neither of these forces exists without the other. In our experience, as many individual things (particular spheres, as it were, of the universal forces of nature) arise as there are different degrees in the reaction of the negative force. Everything terrestrial has this property in common: that it is opposed to the positive force that radiates to us from the sun. In this original antithesis lies the seed of a universal world organisation.

This antithesis is postulated *absolutely* by natural science. It is not susceptible to an empirical, but only to a transcendental deduction. Its origin is to be sought in the original duplicity of our mind, which only constructs a finite product from opposing activities.[25] Those who adhere to experimentation know nothing of this antithesis, although they could not deny that their constructions of natural phenomena (for example, combustion) are wholly and utterly incomprehensible without such a necessarily postulated, if not empirically demonstrable, conflict. Those who simply propound this antithesis (for example, in the theory of combustion), expose themselves to the reproach that they invent hypothetical elements where they ought to experiment. This contradiction can only be settled by a philosophy of nature.

Experimental physicists are right to adhere to the positive, for this alone is directly intuitable and cognizable. Those capable of the larger view of nature must not be afraid to confess that they have *inferred* the negative; it is not for that reason any less real than the positive. For where the positive exists, the negative exists – and precisely because of it. Neither the latter nor the former exists *absolutely* and *in itself*. Both maintain a single, isolated existence only in the moment of conflict; where this breaks off, the two disappear into one another. Nor is the positive perceptible without contradiction; and when they boast of a direct intuition of the positive, they themselves presuppose the negative.

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[25] See Eschenmayer, *Propositions*, 3: 'A remark is to be made here that it is only from the standpoint adopted by the metaphysician of nature that the necessary assumption of these forces can be proven and the duplicity of matters and forces which so many have introduced into natural science to explain the phenomena, justified. The theoretical dualism for natural science is actually postulated by dynamics, but we do not commonly observe its lineage. Thus we set acids and alkalis opposite one another, two electrical and two magnetic materials; hence Gren assumes a gravitational and an expansive force [...]. If we understand ourselves properly, then it is only in name that these materials differ, but are one in concept, and the assumption of such a dualism becomes necessary as soon as we analyse the concept of matter in regard to the category of quality [...] Ultimately such a dualism is deduced from the necessity of the original positing and oppositing, which are the conditions under which even the possibility of our consciousness stands.' [Editors' note, *HKA* I,6: 306]

This is what Newton found. As he established the force
7 of attraction as the negative principle of universal planetary motion, he does not deny, but rather affirms, that it is an *inferred* principle. He does not attempt to present a direct intuition of it, but rather *postulates* it, since not even the directly-intuited positive would be possible without it. He even acknowledges that if this principle were intuitable, merely apparent, then rather than being the actual force of attraction, it would have to be simply the illusion of a jostling, gravity-producing matter. That is, he shows that the demand to know something positive concerning the force of attraction is vain, and is based on inconsistent concepts.[26]

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[26] See Newton, *Optics* Query 31: 'Have not the small particles of bodies certain powers, virtues or forces, by which they act at a distance, not only upon the rays of light for reflecting, refracting and inflecting them, but also upon one another, for producing a great part of the phaenomena of Nature? For it is well known that bodies act one upon another by the attractions of gravity, magnetism and electricity; and these instances shew the tenor and course of Nature, and make it not improbable, but that there may be more attractive powers than theses. For Nature is very consonant and conformable to herself. How these attractions may be performed, I do not here consider. What I call attraction, may be performed by Impulse, or by some other means unknown to me. I use that word here to signify only in general any force by which bodies tend towards one another, whatsoever be the cause. For we must learn, from the phaenomena of Nature, what bodies attract one another, and what are the laws and properties of attraction, before we inquire the cause by which the attraction is performed.' Eschenmayer, *Propositions*, 60f: 'I conclude with the remark that Kant, in the proof of the existence of an attractive force and the explication of its properties, has gifted us the key with which in the future the majority of the burdensome problems of nature may be resolved, and even the windows that were opened by the immortal Newton, when he accepted the attractive force as valid but not a priori provable presupposition for discovering the laws of gravitation, is satisfied by the proof of their existence that Kant presented.'

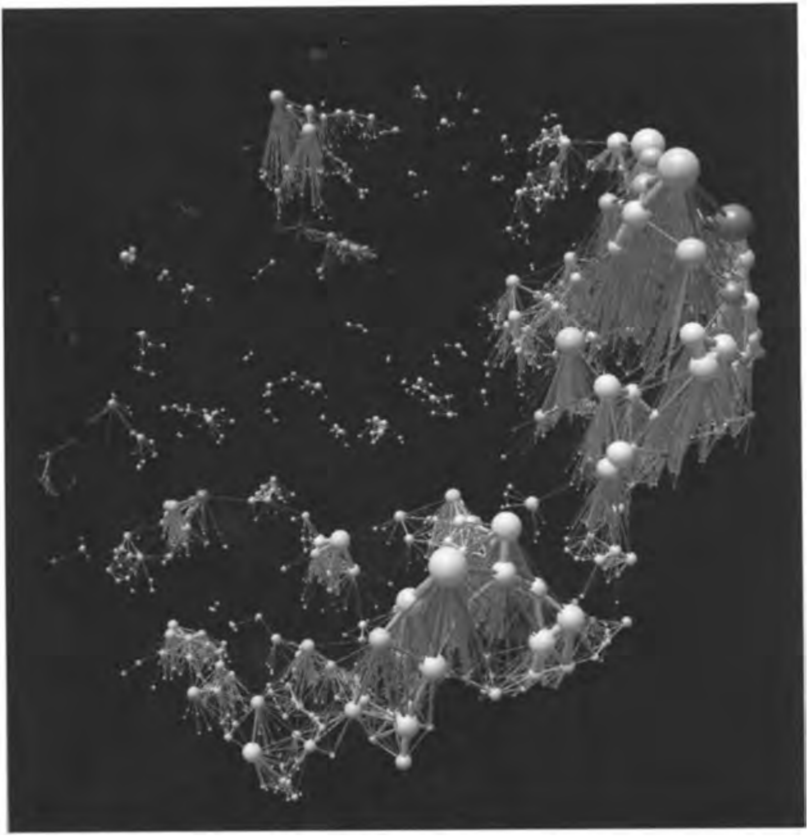
Let us from the first solemnly renounce a *physical* explication of that universal conflict of the negative with the positive principles, from which alone the system of nature develops harmoniously. And in order that our philosophy does not, by reason of its assertions, take second place to experimental physics, let us demonstrate, by a complete induction, embracing all phenomena, that its one-sided explanatory method actually comes to nothing without inner contradiction (the source of all life), and makes any construction of the first phenomena of nature impossible.

We will consider it proven:

1) That light *is the first and positive cause of universal polarity*;

2) that *polarity can create* no principle without having *an original duplicity in itself;*

3) finally, that *real antithesis* is possible only between things *of one kind and common origin.*



g 1. Meadow network from Yosemite National Park. Each node (ball) is a meadow. ode diameter is proportional to area. Each link is a possible connection between eadows, where link strength is proportional to meadow size and inversely proportional d distance between meadows and links below some threshold strength are omitted. he network is viewed looking to the north and looking down; the x, y location of each de is the meadow's geographic location and height is the meadow's connectivity umber of links attached to the meadow). Node colour is proportional to elevation d link colour is proportional to distance between des. Data courtesy of Eric Berlow.

New Ecologies

Interview with Stephen Emmott, Drew Purves, Greg McInerny and Rich Williams

The many dire environmental warnings to which we have become accustomed all have their basis in predictive models devised by scientists. But what degree of confidence can we place in such models, and on what basis are they constructed? Scientists in the Computational Ecology and Environmental Science Group at Microsoft's Computational Science Lab, based in Cambridge, England are working at the cutting edge of environmental science, devising new methods to computationally model climate change and its effects. This work involves adapting statistical methods to reflect the particularities of the extremely complex and interconnected objects of biology and ecology.

In **COLLAPSE** *'s interview with four of the scientists working at the Lab, we discuss the new impetus that environmental concerns have imparted to ecology as a science, demanding a re-examination of its objects and its aims. They describe the delicate compromises that must be made between tractability, complexity, and the urgency of the problems which they are addressing, and the necessary confrontations with the historical scientific legacy involved in rethinking the biosphere. In this process, new models of scientific thought and practice are emerging.*

STEPHEN EMMOTT (HEAD OF COMPUTATIONAL SCIENCE)

COLLAPSE: Some may be surprised to see Microsoft involved in scientific research of this kind; could you explain the aims of, and the thinking behind, your team's work?

STEPHEN EMMOTT: When Microsoft asked me to join the company, science certainly wasn't natural territory for the organisation. That Microsoft is doing science – and in particular natural science – is the result of my convincing the people who run the organisation that science is set to become increasingly important to Microsoft, that Microsoft has the potential to make a significant contribution to the future of science, and that there are many potential benefits to Microsoft actually doing (in addition to just funding) science. The case I set out was as follows: Firstly, that there is every reason to believe that science (in particular natural science – or more accurately, a precise science of complex natural systems) is set to be the single most important driver of our times (especially in relation to environment, health, medicine, energy and the future of computing), the impact of which in the twenty-first century, from a societal and economic perspective, is likely to dwarf that of 'IT era' of the twentieth century. Secondly, that new kinds of software will power this science – enabling the realisation of unprecedented ability for predictive multi-scale models that permit 'Grand Challenges' in science to be tackled, large scale 'in-silico' experiments (e.g., future climate), highly novel data acquisition, analysis and visualisation techniques, and enhancing creative imagination in scientific discovery (interestingly, much in line with what Alan Kay originally envisioned in the 1970s as the potential of computing). Thirdly, that science is where numerous developments have come from that have shaped the company's business and technical strategy: the World Wide Web, the Browser, Object Oriented Programming, Search – and science is likely to be where future such developments emerge from.

C: You have spoken of pursuing a 'new kind of science' – could you elaborate on what you mean by this, and how your vision of it relates to that of Stephen Wolfram?[1]

SE: The last century saw an increasing fractioning of science, and 'natural science' has suffered most severely as a consequence of this. Biology, for example, is a discipline that has become divided into (to name but a few) cell biology, developmental biology, genetics, genomics, metabolomics, proteomics, structural biology, microbiology, epidemiology, 'systems' biology, mathematical biology, theoretical biology, cancer biology, population biology, stem cell biology, evolutionary biology, plant biology, ecology, neuroscience and now even 'ageing science'. This has in part been an expected consequence of the increasing specialisation of each of these various branches of biology, but it has been at some cost, and may well be looked upon by future generations of scientists as highly deleterious. I think this century will demand a significant (re)unification of science if we have any hope of making the kinds of advances that are now urgently required and that will fundamentally shape our society and our future. This will require radically new thinking, radically new ideas and radically new approaches in science in order to overcome existing barriers to fundamental advances in natural science – and it is precisely this radically new thinking and these new approaches in science that my Lab is focused on.

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[1] S. Wolfram, *A New Kind of Science* (Champaign, IL: Wolfram Media, 2002).

As for Wolfram, when his book *A New Kind of Science* was published, both it and he were roundly criticised – unfairly in my view. I think this was because many focused on the narrow 'example' he focused on of Cellular Automata. I wouldn't call CAs a 'New Kind' of science, but Wolfram was actually making a much more important argument: that nature may not obey or be explained by existing mathematics – the 'rules' that have been (arguably) successfully applied to physical systems, most notably calculus and in particular Ordinary Differential Equations; and that therefore there is a strong case to be made that we need a new kind of science that is based on new kinds of thinking and a new kind of computational 'language' or approach that is likely to be fundamentally, radically, different to that of the 'first' (so-called) Scientific Revolution of the late sixteenth and early seventeenth centuries, which continues to dominate science today.

C: In our interviews we have spoken with those in your team who are working on ecology and climate modelling. Why can the kind of approach you have described make a difference specifically in the area of ecology? And what other areas is the lab working in?

SE: Rather than ecology being a priority, it's more accurate to say that the priority is to accelerate a precise, predictive science of complex natural systems – a new natural science – spanning biochemistry to the biosphere. The focus is on both developing new theory about complex living systems as information processing systems (e.g., cells as information processing devices and biochemistry as information processing machinery), and on novel computational approaches that allow the testing of such novel theory – including a scientific, computational and software framework to enable 'impossible' ('in-silico') experiments to be conducted (especially about the interactions between climate and ecosystems, where such an approach is really the only way to conduct experiments, other than the biggest experiment on earth – the one anthropogenic activity is currently conducting). Drew, Rich and Greg eloquently expand in different ways upon why our approach might make a fundamental difference in this area so I shall not attempt to do so here.

C: You have attended global summits on climate change to present this work. What is your impression of what happens when science meets politics?

SE: Well, we've seen recently all too clearly what can happen – with the fiasco of the COP15 outcome, the stolen emails from UEA CRU, the (thankfully unrealised to date) H1N1 flu pandemic issue. The list is a long one – I highlight just a few. My first quarter of a century in science has led towards the increasing impression that politicians of all persuasions are to a great extent guilty of using science (or the statistical summaries of science) much as a drunk uses a lamp-post – for support rather than illumination. On the other hand, one can't really blame politicians for doing so, since scientists are, on the whole, dreadfully poor at communicating science and its implications clearly and simply. Scientists need to do a much better job of informing the policy debate on just about every issue imaginable.

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DREW PURVES (RESEARCH SCIENTIST)

COLLAPSE: It may be that some of the questions we are going to ask will seem naïve to a scientist …

DREW PURVES: This makes me think of Stephen Pacala from Princeton, from whom I learned a lot of science, but who also shaped my thinking about how to be a scientist these days. And he's someone who's always had a lookout for things that other people weren't doing, or which were said to be impossible, and he would just stick his neck out – which is part of his natural character, he's a very confident kind of character. He would just go in with the default assumption that "my naïve thought might just be relevant – let's see". And on several occasions, in the end he's been really listened to. Have you come across this 'wedges' approach to global climate change? It's the one where you say, over a given period of time, here's what we would emit if we were to carry on as we are, and here's what we can allow ourselves to emit if we want to avoid dangerous climate change. Then we look at the graph, and between the two there's this triangular difference. The area under that triangle is the total amount of carbon that we need to avert – the amount that we need to not emit. At the time, I think it turned out to be seven gigatons in total. So Pacala said, "well, let's visualise these seven units as seven wedges that add up to that big triangle, and then let's look at technologies and see how many wedges different technologies can give us." So, you know, more efficient cars gives us two wedges, and so on. And it turns out we've got fourteen wedges of technology right now. If we didn't invent anything else, we've already got fourteen wedges, and we only need seven. So we've got twice the capacity to offset climate change up to 2050. Then it gets harder, because the what-we-would-have-done is getting ever bigger, whereas the what-we-can-do stays still, if you see what I mean. After 2050, he says, you might need some more radical technologies, but even so, to be honest, you still have the other seven left – maybe that will get you another twenty-five years! So you are saying there might be seventy-five years worth of technology in place to solve climate change right now. So he just wrote that down and he gave it to me and said, "what do you think?" I said, "Well, okay, I guess ... " And it is now a standard thing in policy – people talk in terms of wedges, and it featured in David Attenborough's TV show – it had Pacala in it and his graphic with the wedges. It just shows you, to my mind, that a lot of the challenges we are facing are sort of 'nobody's business'. Everyone always thinks it's someone else's business, everyone always thinks that someone else is an expert on it. The fact is, no-one's an expert on climate change, or on solving global resource problems. The economists think "we can't do it because we don't know anything about biology or conservation or agriculture", but the ecologists think "we don't know anything about economics", and so on. So actually, a naïve approach, firstly, is valuable, and secondly, might not be as naïve as you think. When you ask these questions, they are probably the same questions that everyone is asking in that field.

C: And so what do you think of as being, on the broadest level, your contribution to understanding the problems – if not solving them?

DP: There are two sides to it, you see. Going back to the 'wedges' idea for climate change, we firstly need to predict how big the problems are going to be under different kinds of actions of humans, one of which is 'business as usual', where we don't think about it and just carry on; and then, knowing how bad the problems actually are, we need to find out, if we want to cap the problem at a certain level then how much do we need to do? So you are setting the size of the problem.

For instance, in climate change, what you want to know is, what is the relationship between the CO_2 emissions and climate change. You know, the way it is described in books sometimes makes it sound like a pretty simple process: you pour CO_2 into the atmosphere, and it's like thickening the glass, it warms up the earth. There is some of that, but in fact half of the CO_2 we put in the atmosphere goes into either forests or oceans straight away, so only half of what you put in even stays up there. But because oceans and forests are highly responsive to climate, as we change the climate the oceans and forests themselves change – they might suck up either more or less carbon. So actually, at the moment we don't know what the relationship is between the CO_2 that we put in the air and the CO_2 that stays in the air. We don't even know the relationship between CO_2 emissions and atmospheric CO_2. At first glance this seems almost ridiculous – surely you just put it in the air and it stays there; but it doesn't. Secondly, we don't know what the relationship is between whatever CO_2 stays up there and the climate. That's where a lot of my work comes in, because the largest uncertainty at the moment is the forests.

C: Before we discuss your work, by now, readers may well already be wondering how it is that we are assaulted by terrifying predictions about climate change and by directives as to what we must do, if we haven't even determined these simple causal relationships.

DP: People are talking more and more about this now – that it is really hard to convey uncertainty to the public. Up until recently people have been very wary of even admitting there *is* any uncertainty because it was in the balance, you know: Are international governments going to believe or not believe there's going to be a problem? Whereas I think that's done now, and we can be a bit more honest about the uncertainty. So, for example, in principle it would be just about possible to put more CO_2 into the atmosphere and for the global system to react in such a way that the end result of that was *lower* atmospheric CO_2. But frankly, that's extremely unlikely, it would be like a strange over-compensating mechanism. In reality, you can be sure about certain things: you can basically be sure that if you put more CO_2 into the atmosphere the atmospheric CO_2 is going to go up, even though it is not a one-to-one relationship. It is also very hard to imagine that the atmospheric CO_2 could go up without warming up the planet. So basically, you know that if we keep emitting CO_2, then atmospheric CO_2 will keep going up, and the planet will warm, and there will be other climate effects. The uncertainty is about *how much* the climate will change, and how quickly. But even the minimal predictions are still slightly worrying

– the minimal ones say maybe it will only be one or two degrees – but one degree, two degrees could be a big deal. So if you think about the spread of uncertainty it is really tricky, because if you just pay attention to the outer bounds of it, that could be really misleading. If you have a certain range, most of the predictions are going to say that it is somewhere between two and four, but some of the models will give you one and some of the models will give you six. It's quite hard to convey that sort of uncertainty. There are qualitative things we don't know about the subsystems, but I still think there are certain qualitative things that we *do* know, as near as you can know anything. It's very hard to imagine that the earth would overcompensate in some way.

The other debate that I think is really funny – I've had this debate with a relative who's really sceptical, and it's been really interesting bouncing things off him, and he said, "you know the atmospheric CO_2 is going up; how do you know this is caused by humans?" So, if you do an inventory of how much CO_2 humans are putting into the atmosphere and then how much the atmospheric CO_2 is going up, that's pretty suggestive; it's going up by less, not more, than it should, based on what we're emitting – that is, we are putting in more than enough in for it to be going up by the amount it goes up. So, imagine that it's not due to us: you would somehow have to imagine that all of our emissions are being perfectly soaked up by something, and then some other process is responsible …

C: A very circuitous explanation!

DP: Exactly. So, I do almost have to have two heads when I think about it: If you blur your eyes to the system, it doesn't look all that complicated really – I mean, you've got the atmosphere, you put CO_2 into it, there's not that much to it. But in going from that to any more quantitative predictions, suddenly there's a massive break in the amount of complexity that you need to think about.

C: If that 'blurred', high-level view already tells us that we have to reduce CO_2, what is the argument for even striving for a really detailed understanding of it? So that we can determine what's the least possible we need to do ...?

DP: The truth is that yes, that's been the argument. And I worry about this kind of stuff – about the role of this kind of science plays in the climate change debate – for those reasons. I think for a long time, essentially, you just had to persuade governments to worry and take it seriously. Now that job's done. If we could say, here is the exact response of the Earth's systems to different levels of CO_2, that would be fantastic. I guess that's what we are heading towards, but we are a long way from it now. And yet the policy that's really going to matter is being set right now. So there is this question in my mind: you could say – if you ascribe this type of rationality to global government – "I'm spending a bit too much every month, I want to get back to balance, I've got to cut down ten percent, I'm going to stop buying wine." And it's just like that: "you've got to reduce CO_2 by this much"; "Okay, we'll do it, thanks. We'll work out how to do it." Like they are completely rational and in control of everything, right. But in fact, is that the amount of CO_2 that they're going to reduce by, or will the reductions be set entirely by political and economic agendas? They may just want to do it as fast as they can, but 'as fast as they can' is determined by democracy and global economies, and all that kind of stuff. And if that's the case, I mean, look at the UK saying they want a ninety-percent reduction by 2050 and that we're going to carbon-neutral as fast as we can.

If that's the situation, then where does the climate modelling prediction come in? Obviously, there'd be a kind of reactive role for it: You could say, let's assume then that the world does do a ninety-percent reduction by 2050. Putting that into the model, let's see how much climate change, and where, and what should we be worried about. Look, there's a good chance that a chunk of Africa that is currently productive for agriculture would become a desert ... In which case it's just giving us warnings of things to come, if you like. Not the old kind of warnings which were meant to shake someone by the shoulders and say "you have to worry," but actually saying, "no, really, this is exactly what's going to happen, so we better plan for this." So it's giving a different kind of message, I guess.

C: And do you believe your work will contribute in the future to specific warnings, and thus legislation, of this kind?

DP: I would be very much hope so. I would almost say that if it didn't, I'd have failed. I used to think that the main role of my kind of work would be providing predictions of things that policy-makers care about, and how they would respond to different kinds of legislation. For example, if I ban GM crops, what does that do to agricultural productivity?

But more recently, I've come to realise that ecologists in particular have a big role to play in looking at global questions in a joined-up way, looking at all parts at once and what that means. For example, you encourage biofuel demand to offset fossil fuel emissions, but this increases the price of biofuels, which encourages Amazon deforestation in order to grow more biofuels, and that deforestation actually emits CO_2. That kind of tracing of effects, comes naturally to ecologists, but not to many policy-makers, I now realise. Of course, building models of these problems serves a dual purpose – it provides predictions, but also, in describing the model, you describe the problem in way that can really help policy-makers.

But there is another part of me, when I think about myself longer term, and what I want to do with the sort of science I study – the science of complex reactive organisms, especially plants. It says, maybe we just move on to a different kind of scientific problem, like improving agriculture, where you are thinking about plants and their relationship to the environment. And whether we could have much more productive crops, in particular crops that use less inputs – so, even if they are not more productive, they use less water and less fertilizer and things like that. As well as larger questions, sometimes I see things about poverty and I think, "Blimey, maybe I should get on board on that one." It's not like I come in every day and think, "Am I doing the right thing?" like some people do. I've got a lot of momentum. But I do worry sometimes about those things, and keep in mind that the science I'm doing has potential for those other problems too.

C: Returning to your current research, you said that the greatest uncertainty in modelling and prediction concerns the forests, and this is where your work is focussed.

DP: Most of my work at the moment is on forests, which dominate the global terrestrial carbon cycle. There are two projects, and they differ quite significantly in their complexity. One of them concerns the fact that, if you look at the carbon stock that is held in living trees, essentially, as the trees grow, they swell up and that carbon stock increases; what stops it increasing infinitely is that the trees die. So they die, fall over, and then it rots back into the soil and is emitted back out into the atmosphere. So let's consider the rate of tree death – or, to see it inversely, tree lifespans. Now, all the models assume that that lifespan is the same everywhere – that trees basically die one percent per year everywhere. Whereas if you take any kind of more detailed look at this, it will tell you quite the opposite. So, existing models have quite a nuanced approach to how growth depends on temperatures, and the same for rainfall, but the mortality is actually very fixed.

I've got a student at Leeds University who's been trying to get all these forest inventory datasets that have been taken for forestry purposes all over the world, knit them together in a database, and just basically observe the different rates of tree death in different climates, so as to replace that one constant with a function of climate and soil. By doing this we can genuinely help to constrain the future of the global carbon cycle.

C: What explanation can be given for the omission of that factor in the existing models? Is it simply a reflection of the history of scientific disciplines, what ecologists have been interested in (life rather than death)? Or did someone simply make that assumption at a given point and it was never questioned …?

DP: One of the things I have really tried to do is to look at all the parts that are involved in answering one of these questions to do with climate change. Traditionally what we've been taught in science – and to a certain extent it's become the natural tendency – is to do a jump from something that's already been done. So scientists build on each other's work, which of course is good sometimes; but sometimes it just misses an entire area, because you are only ever writing on something that's already been done. So you end up with more and more people studying the physiology of tree growth, and nobody doing death.

This was one of the big benefits to me of the global climate models. Because I was really sceptical about them, like a lot of ecologists still are – "oh, come on, it's too complicated, we're not ready". And it is kind of boring to put them together, because one hundred people have to work together, and it slows you down – I prefer me and a blackboard and a bit of paper – and we know the predictions aren't going to be reliable for a really long time, so you ask whether it's worth the effort … but, as I say, one thing that it really has done is that it's made us question what ecology is about. Well, it's about understanding the biosphere – and these big global modelling efforts have really given a shape to that problem. And there are now entire groups of people doing research and publishing papers on systems that by themselves just look so boring that no one wanted to know before. So people would go to the tropics and it was all the epiphytes, or the intricate relationships between ants and plants, and whatever else, whereas more often than not, they didn't measure the heights of the trees. And now we're doing climate change research, that really matters. In a lot of this work you are just hoping to have a balanced approach that in the future might help us to understand the whole thing. But along the way it opens up many new and very specific avenues of research.

C: A lot of the data that you have to work with was not gathered for the purposes for which you are modelling, which introduces a measure of historical dependence in the selection of the parameters and the setting up of the scientific problem. Consequently, as you're saying, this emphasises the need not to accept the legacy, but to reassess it at each stage.

DP: Yes, but we are just getting there. And in truth, it is partly a matter of time: You produce a lot of data for one purpose, and a bunch of other people say, "Hey, it's good for this different purpose." So there's a natural time-lag that operates through a sort of feedback. Another aspect of this is to do with different communities of people: By and large, NASA just loves putting satellites up, because they love building lasers and they love tracking satellites and doing new exciting things. So there's been a disconnect between the data-gathering and the use of the data; but I think now it is linking up a little bit more. I get the impression that NASA would realise now that they need to make some kind of rational argument – to President Obama, say –

for putting up a satellite to measure sea surface heights or something, and not just because, "Hey, we can do that, isn't it cool" – that actually it matters in some way to people. Still, in the majority of cases, even when people do their own experiments they typically end up analysing the model and asking questions they didn't anticipate when they designed their own experiment, so it even happens on a micro level.

Stephen [Emmott] talks about a 'new kind of science', and we're trying to find the broadest way in which to describe this. But I think some of the activities that make it different – the more day-to-day aspects – include a kind of turning of the scientific process on its head: Traditionally, we start with simple observations, move on to some sort of quantitative measures, and at some point we assemble it into a model and then we make some kind of prediction. Whereas we're now thinking that if you look into a problem for the first time, you might want to *start* by building a model, and then do virtual experiments on the model. We do statistics on the results of those virtual experiments, and then we ask at the end how well we did that virtual experiment. Then, we go and alter our virtual experiment – remember, at this point we are still not going into reality! – for example, we say, let's fertilise the plants halfway through the experiment, does that give me an increased ability to tell my hypotheses apart or not? If so, I'll retain that change to my virtual experiment. So there is this loop, an optimisation loop, and all I'm doing is optimising the design of an experiment, and it is only *after* all of that, that I actually go and do my experiment in reality. Whereas at the moment, even the people that do quite cutting-edge computational science in ecology still design their experiments based on 'gut instinct'; at the end of it they come in with all sort of bells and whistles, computational analysis, but typically they end up thinking, "I wish I had fertilised the plants half way through"! We're now calling this – thanks to Greg [McInerny] – 'joined-up ecology', the idea being that we join up all stages of the scientific process and move up and down it seamlessly. Going back to your question, it means we'd never again gather data without having at least one model ready to use that data.

C: In the case of planetary ecology, how is such a 'virtual world' designed to start with?

DP: On a grand scale, what we should be doing with Earth system models is to make them take in the entire Earth system – so that running the model simulates everything. We don't know how the real Earth system is built, but we have a sort of virtual Earth, which we build with our best guesses, to be realistic. Then we add a virtual sampling system, with virtual satellites and so on. We put that into the virtual model of the virtual earth and we ask, "How well does the virtual sampling scheme observe what we *know to be true*, within the virtual Earth?" We don't cheat – we don't tell the virtual sampling scheme anything about the virtual Earth, even though we know everything about it because we created it ourselves. Everything it knows has to come through the virtual data from the virtual sensors. Next, we can feed that data into a second virtual Earth model. Now we can ask how well the second model reproduces the behaviour of the first. Finally, we can alter the number of satellites and what they're measuring in a way that gives the second virtual Earth the greatest fidelity to the first virtual Earth, and then this is the plan of satellites that NASA needs to build. The point being that this whole (virtual) process is analogous to what we're trying to do in reality. We're trying to gather data, to make a virtual Earth that behaves like the real Earth.

C: People have a naïve idea that what scientists do is go out into the world measuring everything and then go home and write it all down and that's where they start. Whereas a scientific experiment is always constraining: you are always placing a frame over something and it can only tell you what you ask it. But to a certain extent you're saying that the naïve view has been true in the past – that there has been this process of sending satellites up, collecting data and not really knowing what's going to be useful.

DP: That's right, just as people would think. Then you look at all this data and you're trying to figure out what's going on.

I guess this is related to the use of Bayesian statistical methods: I pretty much just use Bayesian as a tool, but in ecology the philosophical implications have been much discussed. It's really a simple way to visualise the way science works: it's quite useful that you've got your current system of belief, and that really it is a sort of probability attached to any universe. So you can imagine a universe where tree death doesn't depend on temperature, but here there's a universe where it does, and here there's another universe where it depends even more on temperature. So you have all these different universes and each one's got a probability – how much do I believe that we're in universe *a* rather than universe *b*? Once you bring in your data it helps you make that decision about which universe you're in:

When I plot tree death against temperature I get this great big steep line, so I'm now really quite sure that I'm not living in tree-death-doesn't-depend-on-temperature universe. So you are continually updating where you think you are. If you knew it perfectly in the end you could say for sure exactly which universe you are in and then simulate your own universe perfectly. And that Bayesian process describes fairly well what scientists do.

C: Using that framework, then, what does your work tell us about the universe we are in that we didn't know before?

DP: The work that I've done that I'm proudest of is that I worked on a model of a forest that let you scale up from the rules that govern the growth and death of individuals to the long-term development of the forest itself – it was a scale-transition problem model. So the question is then examining that and finding a kind of model that works. That involved saying "I'm in the universe where that kind of model works against a real forest" – it was quite carefully tested to see whether it would actually work in a real forest. I've worked with a colleague at the University of Toronto on forestry, and he's looking at the problem of how you optimise any factor in a forest – whether it's yield, conservation value, carbon storing, biodiversity, or whatever. And we've looked at how the trees break up space in the canopy; whether you can understand how the trees' growth and mortality depend on the amount of canopy space that they capture and their size and age and so on. And so we found a lot of things out there: You get this U-shaped mortality rate where trees die quickly when they are young and old, but they die slowly when they are middle-aged, which of course is kind of like what humans do. And we worked out that the reason that the mortality comes down when they are young is that they are moving up the light gradient, so the environment is getting better, whereas when they are old it is worsening. And it turns out that if you double the canopy area you don't double the growth rate for an individual tree, so you discover new relationships like that, which seem to be common across all forests.

All of that does in fact constrain the universe of possibilities, because we didn't know it was going to be like that. And I think that once you know that you can really say a lot more about how forests work in general and how best to manage them.

But the mortality thing I'm really excited about. Again, we really don't know the relationship between mortality and climate; once we've done this work I think we will approximately know what it is and we really will have taken what Bayesians call a 'flat prior' – we really had no prior belief about temperature and drought and their effects on mortality – and created a much more concentrated posterior – we now think that trees die in *this* way in response to climate change. That posterior then becomes the prior for the next piece of work. So the next piece of work starts off thinking we're probably in this one of the many possible universes.

C: Such flat priors correspond perhaps to the type of 'naïve questions' we were discussing – they are factors that we have no beliefs about, because they have not been thought of as significant in the past. As such, considering them introduces new variegations and differentiations in the domain of 'possible universes'.

DP: Actually, I do have some beliefs – which if they're confirmed show how this work on mortality is crucially important in climate change: If you take a gradient across the Earth from a load of places where it is wet, the real difference between wet, say, in the tropics, to wet up north, say the redwoods or somewhere like that, is the length of the growing season. So you've got a twelve-month growing season in the tropics and it gets shorter and shorter as you go up. But it seems that trees die primarily in the on-season. So in the winter, it's almost like pausing a videotape: All the inputs through growth stop, but all the outputs through mortality stop as well. If most of the mortality occurs through pathogens and so on, this makes sense – it gets freezing cold so the trees can't grow but the fungi can't attack them either, so everything just stops. So I actually think that in wet places tree mortality is relatively unresponsive to temperature as opposed to somewhere a little drier, where similar kinds of patterns suggest to me that when you reduce the productivity through drought you actually increase mortality. And that makes sense again: they literally die from the drought. Things like that, just knowing if that is true, could change our prior assumptions about the way that water and temperature interact, and give entirely different predictions. And that immediately impacts the understanding of biomass over the globe: It says that if you reduce productivity by cooling a place down, it doesn't really have much effect because the gains and losses balance each other out; but if you reduce productivity through drying it out, it really changes things as such – the gains come down but the losses actually go up. So you've got this completely different effect.

And that affects predictions, so that, under a given scenario, like 'business as usual, anthropogenic emissions', I've got a prediction for global temperature and one for rainfall – and knowing these things could change that distribution. So, depending on which universe you believe you are in here, now, you get a different trajectory in the future, and if we can constrain which universe we are in, then hopefully that prediction will be constrained and that's what makes it more useful for forecasting climate change.

C: Understanding science 'idealistically' for a moment as being interested in the world for its own sake, it sounds like the advent of our understanding of climate change has opened up a whole new set of problems and questions which, as you were saying, were 'flat priors', which people didn't even think were particularly important questions, or which hadn't even been framed before. So has it opened up a lot of opportunities for studying what we didn't even know we didn't understand before?

DP: Yes, absolutely. You must have heard Donald Rumsfeld's phrase …

C: The unknown unknowns!

DP: I've been surprised how many emails I've had relating that to ecology, you know. People laughed at it at first, then they've started quoting it, thinking, "well actually …".

C: It's quite a profound statement, politicians have said far stupider things!

DP: Yeah, I think that's true. One of the things is that … I don't know, maybe there is a residual feeling of guilt amongst ecologists, because the truth is that there are plenty of ecologists out there whose immediate emotional reaction to the issue of climate change has been "Great! Because I happen to be the kind of person who likes to study the sorts of thing that feed into our understanding of climate change, and who can take the kind of approach that is valuable." You know, I'm a bit like that myself, because no matter how much I try, I can't get that much into the individual biology of species and things like that. Somehow, I can't get into the details – I'm a systematiser, I always want to look at eco-systems as systems, I'm willing to make simple hypotheses and go out there and test roughly whether they are right or wrong. A lot of people don't like that kind of work, because they would say, for example, "how can you say tree mortality has a relation to temperature? Malaysia is roughly the same temperature as Brazil, but Malaysia has got dipterocarps and Brazil doesn't – that doesn't make any sense!" And I say, "well, so Malaysia has got dipterocarps … we'll just have to find out if that matters at a later date."

So for me, there is a slightly guilty feeling of luck, in that my way of thinking is in many ways what is needed for tackling these issues; I think it's great to have a problem to go after, and then you can say, what do we need to do to answer that problem …? You know, we've got this 'shape' for our science, and the 'unknown unknowns', and of course those unknowns are really sort of low-hanging fruit: If you are the first person to take them seriously, then you can do something, you can feel good about it because its important, it feeds into this big issue. And I think that's why its important to have that 'other voice', like I said before, actually saying "erm … no". It's relatively easy to convince yourself that anything you do on this 'map' of what's important to do for climate change scientifically, is really achieving something that's great for mankind. But there is another voice that says, actually, where is the debate right now with climate change – what matters? Is the climate debate finished, because the world has signed up to doing something about it? – Job done, move onto something else like food security or the global economy, poverty and inequality or some other kind of complex problem. Or do we need to do a different kind of science – rather than a science that feeds into the understanding of climate change, or reinforces the warnings that there is trouble coming, do we need to ask different questions: How are we going to cope with climate change? Which regions are going to go through a qualitative change, meaning that we have to start thinking about human migration ...?

So I'm sure I'm not the only one who is on the one hand essentially worried about climate change and thinks it would be great if we averted it; and on the other hand thinks it's exciting because it's given us a great thorny problem. I guess cancer biologists probably feel the same way, sometimes they probably get excited about understanding cancer then feel guilty because actually it's such a horrible thing!

C: As we understand it, the latest models produced have made the problem seem worse than it had previously thought to have been – by building in all these interactions within the biosphere, the predictions for temperature rise look worse than in the simpler models.

DP: Yeah, that's right. With the forest ones, there was this famous result, it was one of the first Earth systems models to include truly reactive vegetation – before, they basically had the vegetation as a fixed thing. [Peter] Cox's team were the first people to say "hey, trees grow and die, and they might be taken over by grasses," and so on; and they put that into the model and warmed up their virtual world. And everything was fine for about fifty years (fifty years into the future, that is) and then something switched in the Amazon and suddenly it very quickly turned into a savannah, and all of the carbon that was in this great big forest suddenly went up into the atmosphere – so it acts as this great big turbo-charge, and in the model it released the equivalent of about sixty years worth of anthropogenic emissions in about ten or twenty years. So this was almost like a 'top-up', you know: we put it in, and the forest will match our CO_2. And that's the top line, if you look at the spread of the predictions which were in the IPCC report five or six years ago, their top line is exactly that, it's the Amazon collapse.

But then there is another model, to be honest equally believable, where as things warm up and the CO_2 increases, the Amazon trees just grow ever faster and store up ever more carbon.

Now, what I think is that, as we have added in these extra biotic feedbacks, there has been more freedom in the model – more things can happen, and one of those things is that there can more disastrous results. And that has been an important warning, I think, not to treat the system like a bath where you pour carbon in here and it comes out there. Actually, it's this non-linear thing, much more unpredictable. So that's been an important general message. But the question now is whether it's possible to constrain these feedbacks sufficiently to get back to a decent prediction! Or whether the only contribution from that work is a really general "hey, this is dangerous, you'd better …". Are these feedbacks simple enough that we can understand them sufficiently well to say, "right, now here is the prediction, and sure, it's different to one that we had before, but this one is right", or is the general message that Earth's systems are so complicated that we should simply not expect to be able to predict them? That's the other conclusion isn't it? Because there are always more feedbacks we could put in.

C: To have a complex enough model we would have to build another Earth.

DP: Exactly! If we could build another Earth that we could run much faster than the real Earth, it would be a useful tool!

C: Firstly, there is a problem of abstraction – to know which parameters need not be considered within a model. But, given the interconnected nature of the biosphere, in doing so one always risks neglecting feedback effects, and therefore leaving 'unknown unknowns' out of the picture. What you were describing before, with the virtual worlds, seems to be an iterated methodology designed to avoid that.

DP: It's interesting to hear you take that very abstract, general view – talking about the Earth model like it's any other complex system. I think that is actually very helpful when we're thinking how best to improve these models. Like you say, we can use general principles to help us. Sometimes, being deliberately blind to the reality, and the details, can be really helpful.

To be honest my instincts are: Yes, the feedbacks are there, but it shouldn't be that hard. We just need to do them correctly. There will be this initial chunk of effort, and we will bring the uncertainty down by about ninety percent, and then yes, you could spend the rest of your life doing the other ten percent. But I feel like, if we could approximately know the things that we need to know …

There is a project now for instance, AMAZONICA,[2] which is a bunch of people, some of whom I know, who are all just focused on that one issue of 'will the Amazon collapse into a savannah or not under climate change?' If they answer that question, they will have taken the single biggest uncertainty out of the Earth system models overnight, really. And, you know, that's maybe a big fifty percent, and if you do fifty percent of what's left with a similar-sized project, you might get there. But then at the same time someone might say "hey, you haven't put in the boreal permafrost lichen feedback in there" … So, while someone is constraining the Amazon, someone else might be increasing the uncertainty somewhere else!

C: All this might lead someone not conversant in the field to ask what kind of 'certainty' we are talking about here. It seems difficult to accept that we could ever reach the point of having any degree of confidence.

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[2] See http://www.geog.leeds.ac.uk/projects/amazonica/.

DP: And we won't know for sure until it's either happened or not. People have said similar things elsewhere in the history of science, you know, 'why the guess?' 'why the prediction?'. And to be honest, I don't really believe it. I couldn't exactly prove it.

C: But to remain a scientist, you have to retain some faith in the predictability of nature!

DP: Exactly. So, here is an interesting example: there is a diagram that people often see. It's this chart that has temperature horizontally, rainfall vertically, and it's got zones drawn on it, and each zone corresponds to a different kind of vegetation. Now that basically applies all over the globe. So if you know the average temperature and the average precipitation, you can essentially say what kind of vegetation will live there: grassland, savannah, evergreen forest, deciduous forest, and so on. And that happens in South America, North America, Africa, Malaysia. By and large, all these different places have different plants that have evolved separately, but the relationship between climate and vegetation is the same.

Another example I really like which I find incredibly compelling is this weird kind of shrub: It's a bit like an aloe, and what it does is die off every year and the new vegetation grows back on top the old and it ends up looking like a great palm tree kind of thing about twelve feet tall. You find them in the high tropical Andes – cold, but on the equator. These are unusual places, they have huge diurnal swings of temperature. Now, if you go over to Mount Kilimanjaro, which is also a tropical, high mountain, you find shrubs that look exactly the same but they have no evolutionary history in common at all. Another example is succulents like cacti: you've got old and new world cacti, they look really similar, they do similar things, they have evolved similar tricks to do with water. You find them where you have two wet seasons a year, that's the rule. Wet-dry-wet-dry, every year. Not wet-dry once a year – that gives you something else, maybe grassland.

So the new world and old world cacti look really similar, but have no common evolutionary history. What this tells you is that there is predictability out there in ecology. For me, I see a lot of signs of determinism – if you know *a* you can predict *b*. Even if prediction does not work, we can simple observe that *a* and *b* are highly correlated in effect, so the shrubs are highly correlated with high tropical environments and so on. So for me, it says that nature isn't this unpredictable, wacky thing. And if that's true in this context, why shouldn't I be able to take something like a tropical forest and warm it up and dry it out, why shouldn't that be predictable too? So that's essentially what we are looking at when we look at these diagrams.

If I didn't see that kind of predictability in nature, I think I would be having major thoughts about being in ecology. You know, even if it was predictable on some micro level… You must have thought about this whole Creationism/Darwinism thing, where a lot of people say Darwinism isn't scientific because its not predictive, all it ever does is explain things after the fact. Whether or not that's true, I think that if there wasn't this sign of predictability in ecology that would be all that we were doing, we would be saying, well, we've got coalescent shrubs in the high tropical Andes, they are the only place on earth I'd find them, I'd like to find out why, and somehow with enough effort I would be able to unravel the fact that there was an original aloe that didn't have a stem, and then one evolved that grew up on a stem, and so on. But to what end? That's literally just uncovering a story, a kind of archaeology, if you like, rather than ecology. Whereas to actually say there is this determinism, there is this pattern, *a* leads to *b* here, *a* leads to *b* here, so why is it in general that *a* leads to *b*? That's much more scientifically interesting.

C: If we simply deal with correlations, we ignore a large part of what is important for the operation of biological systems – which includes contingent things like contiguity, the fact that a certain species is separated from a habitable region by an ocean, and so on; but here you seem to be saying that it is valuable sometimes to abstract from the actual contingent conditions of the Earth, and look at the hard-and-fast rules in nature quite apart from the way in which they have, in evolutionary history, played out …

DP: Sometimes, yes. More generally, I'd say it's a case of working out for which processes knowing the history helps you to predict the future, and for which processes working out the history is just a waste of effort.

C: You said that you can't get interested in biology on the level of species. But the relation of your work to biology seems an important question. What status does a thinking of these questions on a global scale have in relation to biology? Is it a kind of 'ecological physics' which abstracts entirely from biological knowledge?

Although your work combines high-level modelling and 'on-the-ground' research, because ecologists have to think on a global scale, it must be difficult to connect that back to any of the things that we know deterministically on the biological scale: it's almost like there is a disconnect between the two things, that you are talking a different language.

DP: I think to some extent that is true. I think if you pushed most ecologists they would say the same thing, that's its really all about taking what we know about individuals and maybe less than that, like physiology, scaling up from there and working out what gives you these patterns. There are two ways that people talk about ecology: It's either the study of the interactions among organisms and their environment, or it's the study of the distribution and abundance of organisms. You really need both to define ecology, because what it should be doing is explaining and predicting the abundance and distribution of organisms *from* their interactions with each other or their environments, that's what it's about really.

I think that's what we want. I see the patterns at large scale and you are right, with some of the things that we do, like this work on mortality, we just find a pattern in mortality against climate, and use that pattern in a model. Everything in there happens from this kind of large-scale 'blur our eyes' standpoint. But really, more exciting for science is to ask, how do we get to this pattern from what we know about the way things interact? So, as I've explained, we would look at trees and how they interact with different species, how they put carbon into trunks and roots, and how from that we can explain why trees die more slowly when it's cold …

C: As you've said, before the modelling process begins, before you do these global-scale models, you already have some intuitions of what might be the case and what is important to look at, and those come from thinking about actual trees, individual trees, and their interactions.

DP: Yes. That's exactly right, you come from both directions really. Sometimes you'll look at the pattern and you will instantly have a little guess about what it is about the interactions that is causing that pattern, or sometimes the other way around, you know about the interactions and you have a guess as to the pattern. This comes back to 'joined-up science' again.

I'm working with Greg on this whole modelling effort looking into the distributions of organisms, which are highly correlated with the environment – it's another sign of determinism. So it implies that if you change the climate, this distribution is going to change. If you always find beeches when the annual temperature is between *a* and *b*, and, owing to climate change, that annual temperature band moves across the map, you'd expect the beeches to move, right? But a lot of the models people have used to predict that movement are simply incompatible with any of what we know about how organisms interact, and that just seems, to Greg and I, the wrong way to do the model.

Their models, for instance, say that if you removed all the tree species on earth except beech, the beech trees would just stay where they were. And any forest ecologist will tell you that no, of course if you remove all the other trees on earth, the beech trees will just spread into the vacated zones. They'd be pushed back through competition. And if your model doesn't do that, if it doesn't show that if you remove species then the remaining species move into the remaining space, then there is something wrong.

So, Greg thinks a lot about these sorts of things, more deeply than I do, I tend to rush in and say 'let's see what we can do'. He really wants to get a set of models that are consistent with the theories about the way organisms interact or the theories about what really causes the distribution of particular species; he wants to work that kind of theory into this applied modelling which describes how they are going to respond to climate change.

So, firstly, I think there is a disconnect; but secondly, it's all about removing that disconnect … as much as possible.

C: Do you sometimes have moments when you are absorbed in work, in the technical work of building these models, and suddenly have a flash of realisation that it is actually this planet, and all of our lives, that your work is talking about – or does the reality of what you're trying to model disappear beneath the process of doing the work? One would suppose that it would have to, otherwise your job would be extremely stressful!

DP: Yes, I very much do have those moments. It's been over ten years since I started my PhD, and in that period I've learned a bit about plant ecology, done a very few bits of new work, and have maybe sharpened my plans about what to do next. In the meantime CO_2 has risen a lot, there have been wars, people have starved to death, and a species of dolphin has gone extinct. We'll never get it back. So yes, it's a good job that most of the time, I'm lost in a much more abstract world.

C: Finally, if we were to run a model where humans actually achieve the ideal and become 'carbon neutral', do we know what ramifications that (unlikely) scenario would have?

DP: We have a range of emission 'scenarios', some of which are very optimistic. I'm not sure whether there is one where we achieve the ideal – but there should be. You would think of course that the result would be that on that great day when we stop emitting, everything stops changing. But there's no way that would happen. The Earth system is so complex, has all these time-lagged effects, that it would keep changing for centuries anyway. And that's before we consider the many other kinds of impacts human have on the Earth system, quite apart from carbon emissions. It really is, unfortunately, very very scary when you think about the next thousand years of the unremitting effects of humans. We're going to be staving off one disaster after the next – hopefully.

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GREG MCINERNY (POST-DOCTORAL RESEARCHER)

COLLAPSE: Could you tell us what is involved in the work you are currently doing?

GREG MCINERNY: At the moment I'm working with what are called Species Distribution Models (also known as Bioclimate Models, Climate Envelope models or Niche Models). Basically, this involves trying to produce a description of why populations occur where they do rather than elsewhere. For instance, an organism has tolerance limits for temperature, so we may be able to describe those in a model. The organisms may also have tolerance limits for light levels, so we can include that extra gradient in the model. And so on, with factors such as rainfall, the occurrence of frosts.

Because there is variation in the environment across the Earth (for example in temperature and availability of light) we can begin to get an approximation of where things can live across the globe. These are the basics of a Species Distribution Model – a mapping of a species' 'success' across variables that can describe its geographical distribution.

These are quantitative models developed from data using statistics, so there are lots of considerations with regard to how the statistical assumptions match up with the biological assumptions. The hope is that if you get the quantitative description right, you can use that model to make predictions – for instance, in relation to climate changes. If the spatial distribution of temperatures is going to change, we can make basic predictions about where organisms will be in the future. Will Britain have a Spanish Flora in a hundred years' time?

Up until now most of the models have been merely statistical descriptions, usually based on correlative relationships between observed presences and absences of a species, and the 'climate' variables that have been measured as part of that. However, when such models are used to make projections for climate change or for a different area of the earth, the results don't necessarily hold much weight.

This is because the assumptions of the statistics aren't explicitly biological, and in fact implicitly ignore most of our ecological understanding. So Drew and I are trying to create 'next-generation' Species Distribution Models where a bit more biological and ecological understanding goes in at the beginning – for instance, competition between species. The factors determining where species can occur include both abiotic and biotic factors.

I really got interested in climate change during my PhD because I was investigating what the important factors were for climate change responses and how those factors might interact. The simple conclusion was that more processes are important to describing climate change responses than we actually study now. And, importantly, that the novel interaction between these processes can lead us to new understanding. Climate changes have occurred in the past and these events could have had a large influence on why we have the biodiversity that we do today, and what we will have in the future. Once you accept the importance of these interactions between processes during climate changes, then you need to study things in a different way. A mechanistic way.

In the simplest sense, a statistical model just draws information from the raw data. So if you've got *x* variables and your observation data, you choose the ones that you are interested in and then you do some kind of regression looking for correlations between the variables and the observations. In that way, you discover a fact about the correlation between variables, but there is no causal information whatsoever in there. What we want is to include the causes – the important processes. Then the models will be valuable to the research community to develop the knowledge and understanding that can really inform policy.

C: So, with a statistical model in physics, say – where the fundamental causal mechanisms are known – the predictions need to be supplemented with that knowledge in order to give a full understanding; but what has been lacking so far in biological computational models is knowledge of those causal mechanisms. Furthermore, one would assume that in the biological realm, such mechanisms may not scale smoothly, and may be subject to unexpected discontinuities under certain conditions – and indeed this is precisely what we need to know in order for the models to be useful: In effect, we need to define a kind of behavioural landscape that tells us where statistical correlations between variables remain constant, and where they break down and in what way. And that's precisely the task of 'eco-logy' here – supplying a logic of the living environment to supplement this raw data-processing.

GM: In principle yes, understanding the mechanism is the key to developing the most useful statistics. In ecology we know an incredible amount about the mechanisms but we don't necessarily go about developing models in the best way, based on this knowledge. We are a relatively young science compared to physics! We do know a lot but don't necessarily implement all of it.

But also we are very different from physics – dealing with units that are highly variable, that can change (through plasticity or evolution) to new forms, and that live within an environment that varies through space and time. That makes it far more interesting than physics!

If we could develop the 'behavioural landscape', that would be a good proximate solution to modelling. We would be able to make predictions based on those correlations. But that model may in turn be specific to correlations that occur in a certain set of conditions. If we change the climate then during climate change new processes may become more important in describing a new set of correlations. So a purely correlative model becomes a second choice.

That is where the methodology of Species Distribution Modelling begins to break down, because it was *descriptive*, and we need something that is actually *predictive*. And yes, that is exactly where the ecology should come in.

C: The model needs to account, not only for all of those different variables and their correlation, but for the causal interaction between variables as well.

GM: Yes – if you strictly follow a principle of parsimony when you are building your models, you would go for the simplest explanation. But there are a variety of ways in which you can judge that 'simplicity': Is it purely statistical simplicity, or simplicity with regard to the topic being studied?

Ockham's razor would need to be used in a different way if you are to build a model that is applicable to a different set of conditions as well. So in the case of Species Distribution Models the data you have is from a 'stable' climate, but from that you want to build a model that is applicable in a changing climate. You have to begin with a set of requirements that are known to be important before you approach a problem – for instance a set of important processes and their relationship to climate – rather than being a bad statistician and just looking for statistical interactions. If we take the challenge on appropriately and in a biologically-meaningful way then we could have a model that can cope better with situations such as climate change.

C: Is there a conflict between this attempt to build in all the complexity of the empirical biological world, and the need to build a model that is actually tractable, from which are going to be able to extract something of use? Is there a trade-off there?

GM: Totally. This generates conflict between what we might think occurs and what is actually tractable in a model in a rigorous way. We need models that are rigorous so that we can inform, but also tractable so that we can progress.

The trade-off comes in many forms. Firstly it is important to bear in mind that the set of requirements will depend on what the question is. At the moment the set of requirements is very large with respect to climate change prediction, because we haven't been able properly to explore what is actually important as we don't yet have the models. Once we have those models there may be some approximations or simplifications that can be made.

But if we were only interested in 'stable' climates then we could be less explicit about some processes. These are trade-offs involved in making models that are as simple as possible but as relevant as possible.

We also have to make models that are implementable and within which the statistics can actually work.

For instance, for each part of the model we are going to have parameters that control the strength of effects of different processes within a model. The more complicated the model, the more parameters we need to evaluate and the more combinations of parameters can potentially exist. Parameters can trade off against each other, so a high value in one can compensate for a low value in another and vice versa, so the interpretation of the theory has to acknowledge the statistical methods.

Also, the more complicated models get, the more difficult it becomes to analyse models so as to attribute cause and effect. We also have trade-offs defined by the amount of data we have: With low levels of data, as is generally the case in ecology, we are restricted in what we can actually parameterise.

A good way of exploring the challenges of model building is the generality/precision/reality trade-off described by Richard Levins.[3] A general model would apply to many species but would as a result be less realistic for specific species or situations. We could make highly precise models but that may come at the cost of generality as it becomes so specific. To build a realistic model might reduce your ability to be precise as we lack appropriate data for the realistic mechanisms and have to draw out information in a less precise way. This is one of the reasons why ecological science always challenges you and requires a bit of a philosophical bent.

One of the components of our Next Generation Species Distribution Models is investigating how you could incorporate competition into a model and make it tractable.

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[3] R. Levins, 'The Strategy of Model Building in Population Biology', in *American Scientist* 54 (1966), 421–31.

C: Competition for resources between species?

GM: Yes – So, say you have six species of grass, which are using reasonably similar sets of resources, then in your model you could have a matrix which statistically describes how strong the interaction between species A and species B is, between A and C, and so on until you have the full matrix. For all the species described, you will have a value for each of those pairwise interactions.

That can make considering large communities of species difficult because the matrix grows non-linearly. If I have two species the matrix would have two parameters, the effect of A on B and B on A. If I have three species we need the effect of A on B, A on C, B on A, B on C, C on A and finally C on B. That's six parameters. If it was describing interactions between ten species, the matrix would have to contain ninety parameters. You can see that the parameters don't scale linearly with number of species that you consider, as you would like them to.

What we've done is to use ecological theory to make that relationship between number of species and number of parameters linear. One way is to describe interactions in terms of effects and responses, so A has an effect on other species and a response to other species. Field experiments have shown that this can be a useful way of describing the competition and allows us to make the model more tractable.

We can add more detail by describing in the model species traits that define competition – for instance, a plant's rooting depth or its height might define competition for water or light. Then we can describe competition in terms of the difference between traits. This is similar to an effect and response model, but the model includes description (and so assumptions) at a greater level of detail. We can go on to further levels of detail but we might need more data to do so.

In this case we find that ecological theory actually makes that model more tractable than the statistical interpretation of the problem. Our parameters scale.

The ecological theory reduces, not the amount of data, but the complexity of the model that you produce: To make it tractable, the amount of parameters in that model has to be as small as possible, really. So on the one side you've got knowledge of what you should be putting into the model, all of which you need; and on the other side you've got the practical nature of actually modelling so it has to be as small as possible; and this produces an appropriate solution for the task.

C: So, not only is the theoretical framework crucial to building models that answer to the complexity of the domain, but it can actually *reduce* complexity as compared to a purely statistical model. One could expect this, since the very notion of looking for statistical correlations involves a deliberately 'blind' approach to the data. Is this a novel approach because modellers have been unsure about the ecological theory they should employ? One could understand such a reticence, since ultimately the accuracy and the usefulness of a model would depend on the ecological-theoretical framework that you use.

GM: Yes, theory is crucial. Theory deconstructs the world into useful abstractions, general models of mechanism. Then, given the parameters that are realistic, we can make a prediction of the outcome. If we were only able to interpret the world in a correlative way humans wouldn't be able to accomplish all the amazing tasks that they do.

It's basically the power of explanation: We can say that lots of factors are important to an event, and give a precise answer that relies on complicated interdependence between the factors, or we can describe how those factors are mechanistically related to each other, in which case the interdependence may actually be smaller. We are reducing the problem through theory.

But explanation can be complicated, so some non-mechanistic correlations are very useful and may provide a simpler solution. The trade-offs in model building return and then we have to think about task-orientated solutions to the problems rather than an omnipotent model that reconstructs the entire world.

As to the second part of your question, about the selection of which theory to use, this is more about the human condition: Theory is sometime caricatured as the domain of the 'thinkers' – mathematicians, physicists – rather than the 'doers' – the people who apply models to practical situations. There is an incredible amount of theory out there but isn't necessarily applicable in practice. So we need to think in a joined-up way and develop ecological theory within the context of statistics, and statistics in the context of theory. This can be an unenviable task sometimes, as you may be less productive in doing so, and you may need to invest much more initial effort in being technically and conceptually literate in more techniques, ideas, skills, and so on.

Also, the theoretical and statistical communities can be separated socially – even at conferences theory sessions may be specialised and populated by theoreticians. We need more democratically-selected theory and we need to increase the interactions between increasingly specialised communities. So the short answer is that this reticence can exist because it is hard to mix theory and stats; but it should be recognised that we can shift the culture of our science to make it easier. We are all theoreticians whether we like it or not, so we need to increase the dialogue.

C: We're talking, then, about the effect of a contingent institutional history concerning the disconnect between computational science and ecological theory?

GM: From the more institutional and historical points of view there are choices that are made during science's development that are driven by the personality of individuals and groups and the natural growth of scientific communities. You only have to look at the names of models, theories and philosophies to see that individuals have had a large influence on a 'punctuated' development of science. This is especially so where a new scientific revolution occurs, such as that around computers, and when new subdisciplines emerge. Personality can play a large part in how new groups engage with each other. There is some trade-off between establishing a new approach and not getting swamped by previous approaches, whilst also maintaining a useful dialogue.

But it is a 'disconnect' found more widely across ecology: Field ecologists use theory in a very direct way but don't always recognise it as theory. There is a lot to be gained by extending our joined-up view of ecology, as it informs the generation of good experiments, which in turn inform better theory. In many cases, theoreticians are the most computer-literate and appreciate the value of this interaction. So the real challenge is to enable a larger dialogue with the broader community.

C: With this in mind, and to start again at the beginning, maybe you could explain what you understand by 'ecological theory'?

GM: Theory is a simplification of the world that allows its prediction, i.e. an explanation. This is a very broad interpretation and takes in mathematical or syntactic formulations, but also verbal and visual formulations.

'Life' is a complicated multi-scale system, so theory requires useful abstractions. For instance 'population growth rate' has got ecology a long way so far, but is an abstraction that takes in survival, growth and fecundity of a population. These abstractions may be useful in some cases but, again, more detail may be useful elsewhere. In this case a joined-up approach would consist of theory that is based in abstractions that are measurable in field or laboratory experiments, or that are retrievable from data.

Ecology doesn't really have laws like physics does in its construction of theory, so it's an understanding of the actual mechanics of how ecological interactions would work. You could go on all day and all night describing the processes of life in lots of detail. But there are certain things which field, laboratory, simulation and mathematical experiments have shown to be useful simplifications of models, showing what is best left out.

C: So any *applied* ecological theory is essentially *not* a complete account of causal interaction in the domain, but involves primarily a principle of abstraction.

GM: Definitely, this is where the boundaries of scientific disciplines are usually formed. And in some cases these boundaries are useful – but in others we need to make cross-cutting abstractions. Population Ecology generally considers the world from the organism above. This obviously leaves out most of biology. Theory is a question of understanding the system in the appropriate way.

C: And you suggested that the level and nature of this abstraction is determined by experimentation – so experimentation on the ground sets the parameters for modelling?

GM: Yes and no. Not all experimentation is going to be directly applied in a quantitative model. It may highlight new facts, mechanisms, and so on. It is more about exploration. This might set the parameters and formulation of modelling, but modelling might reveal that more useful model formulations are available for that same process, and then experiments may need to address different questions and field observations may be ideally made in a different way. Then there needs to be feedback with experimentation.

It's just how science progresses, but we need to recognise that the feedback between the theory and experimentation comes from an appropriate dialogue between sub-disciplines. For instance the statistics used by an experimenter may not be useful to a theoretician, and the abstractions used by a theoretician may be useless to an experimenter. This is of course a caricature but the principle holds true.

C: This suggests that, short of a purely statistical approach, you can't have a mathematical model that doesn't somehow rely on some theory-based filtering of what goes into it, this filtering itself perhaps having been influenced by previous empirical experimentation … A prior selection, an abstraction, always sets the scene for any scientific work – Philosophers will recall Immanuel Kant's famous comments about Galileo's 'inclined plane' experiment: 'reason has insight only into that which it produces after a plan of its own, and […] it must not allow itself to be kept […] in nature's leading-strings'.[4]

GM: The way I always think about it is with reference to 'population thinking'. Ernst Mayr said that an overlooked 'benefit' of Darwin's theory to science was the abstractions he made in thinking about the system. Darwin saw variation within populations and put that into his verbal model of how the populations worked and then ran his thought experiments.

Some variations could be more successful than others in surviving or reproducing, and so give rise to natural selection, a natural process. So Darwin showed that once you've thought about the right sort of 'population' of variation, in this case very literally variation in a population, then the dynamics can come out of that system. In his case natural selection could occur, whereas it could not occur in previous models because the variation is abstracted out. A lot depends on abstractions.

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[4] *Critique of Pure Reason*, Bxiii

'Population thinking' gives clarity about what you want to include in your model. A lot of the time it has a single form that you'd actually go for because you are interested in a certain kind of dynamics. For instance you might need to acknowledge that there is variation in ages within a population and so abstractions on age need to be assessed. The variation doesn't need to be heritable, you just need to get the correct units. For instance, using numbers of individuals within a population can give very different results to using numbers of individuals of certain age classes within a population.

In the case of natural selection, evolution wasn't possible theoretically until Darwin got the abstractions correct. Darwin's great innovation was to give importance to variation within the species. For instance, if there is variation in different grasses then the small ones might get selected in certain environments and the big ones might get selected in other environments, but if there is no variation, that population's going to have no change in its average no matter what environment you put it into. Now, you could easily think that some other trait was important in your model – it doesn't necessarily have to be variation – but, say, if you are creating a model of a species' whole geographic distribution, it isn't going to move through space in response to climate change unless there are parts of the model which actually incorporate movement or dispersal of organisms in some way. It's that basic and fundamental.

C: Obviously, there is a 'selection' at work within scientific ideas themselves, according to the insights they yield.

GM: That's the progress of science! But it is important to recognise the correct form of selection. One of the best ways of putting it, I heard from Rich Williams: The ideas have to be agile.

C: So, the aim of Species Distribution Modelling is to try to understand why species end up in one place rather than another; and that's going to be important to understand species' reaction to climate change.

GM: Yes, indirectly – it is understanding abundance and distribution that is of fundamental importance: If you reduce down all ecological questions they would come down to 'why is what where': Why things occur where they do and in what amounts – which obviously requires understanding why they don't occur where they don't as well. If you can predict abundance of a species, then you're doing pretty well – and, as ecologists, we can't yet do that. In that sense Species Distribution Modelling encapsulates all of ecology. But, as we've discussed, the *current* models do not – because ecology is also fundamentally a science of interactions.

From the point of view of climate change, having appropriate Species Distribution Models would enable you to actually make predictions about what areas are important for future biodiversity: Living in the world where we live now, we need some sort of protected areas, but where would it be best to put those protected areas in order to conserve everything that we've got now; how can we develop a network of protected areas that can safeguard the future of that biodiversity?

If we caricature climate change as an increase in temperatures across the globe and consider that populations have limits as to where they can live defined by temperature, we would expect geographic range shifts in those populations. At the hot end of their range populations will become less successful as the temperature warms, and so they will reduce in number; but at the cold end of their limits populations will become more successful as the local temperatures move towards the organism's optimum temperature. As populations colonise locations that were previously uninhabitable, a geographic range shift can be induced by climate change.

Now, one of the properties of a range shift is that there will be lags in the rate at which locations become available and the rate at which populations colonise these areas. Things aren't in all places all of the time selecting where to live, they are born in places and might seek new places from there, with a limited ability to move. It is through these lags that the shape of a population through space is generated.

If you think about the shape of a drop of water on a flat surface, that's a bit like the shape of a population along a gradient. Now if you tilt that surface, the water droplet changes shape. It becomes more like a teardrop. That's a reasonable analogy for the change in the spatial structure of populations under climate change.

A recent piece of theoretical work I did[5] looked at how that change in structure affects evolution.

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[5] G. J. McInerny, J. R. G. Turner, H. Y. Wong, J. M. J. Travis and T. G. Benton, 'How range shifts induced by climate change affect neutral evolution', *Proceedings of the Royal Society B.* doi: 10.1098/rspb.2008.1567.

What this highlights is that, as soon as you start thinking about climate change, you are actually thinking about a whole new, different but predictable, part of ecology and biology. The lags create a new quasi-equilibrium with the environment during climate change. This alters who is most successful in a population through space and in relation to the environmental conditions they experience. Because the individuals colonising new habitats contribute far more to the next generation, whilst those at the rear of a range shift are contributing less to the next generation than they would have done without climate change. This means that a genetic revolution in a population could happen far more quickly during a range shift induced by climate change. The suggestion is that genetic changes and evolution could happen more rapidly during climate change. This might be very important to our understanding of how biodiversity is maintained and generated. Whilst the great focus has been on the extinction of species that couldn't survive, because of the way this frees up resources for other species, these spatial processes have been overlooked.

So we have the genetic changes occurring in a population; but also, populations are exposed to environmental conditions – such as temperature – in a different way. This alters how natural selection will act within populations: Individuals may be exposed to 'novel' temperatures. It's a new area of ecology and evolution really.

C: So this could alter significantly the type of issues we think are involved with climate change, and their impact on biodiversity.

GM: It's certainly interesting from the point of view of how we manage biodiversity in the future, but it also makes you think about how those processes have generated the biodiversity we see today. These processes are a bit like a phase transition from one form of dynamics in stable climates to another form of dynamics in a changing climate. The suggestion is that the forces change populations more quickly during climate change, and it takes a while to 'relax' after a range shift. So we might be able to understand how species are packed together through space – what are their niches, why are they a certain size – through this better understanding of climate change responses.

C: So attacking the specific problems of climate change uncovers new insights into the general problem of species distribution, the very framework in which that problem is posed.

GM: Yes, this could give us some insights into why there are the number of species there are, rather than ten times more or ten times less. *Niche* is the key term, because if you could model the niche more appropriately than you could have better Species Distribution Models; but then people get scared of saying that they are doing niche modelling, because the niche is a nightmare!

C: How has the niche been understood in ecology generally; and in your work how do you *mathematically* define it – what kind of space does it exist in?

GM: It's difficult, because different people use the word 'niche' for vastly different things. It started out as a description of where a species is likely to be found – a correlative description. The simple explanation of the niche is the set of conditions in which a species can survive. For instance the ranges of temperature, light, water availability, pH, and so on. [G.E.] Hutchinson defined the niche as an *n*-dimensional hyper-volume.

C: With, in each dimension, limits of tolerance?

GM: Yes, within this hyper-volume, everything's going to have some sort of limited range where its births and deaths are equal, another range where births are more, and so on. So long as deaths aren't greater than births, then the species can survive.

It gets a little bit more complicated, because species might also *augment* the environmental variables, for instance light may be reduced by a tree. If you think about these variables being used as resources, you get a different formulation of the niche than if you think of variables as merely defining tolerance. Light is directional, so if I'm a tree in an area with my favourite light level I might thrive. But through my growth, anything below me in height gets less light. So I've engineered my environment a little bit – it doesn't just affect me, it affects everyone else. And my presence affects my offspring as well, if they can't get far enough away from me.

From the resources that come in, you've altered the niche and created something else. So if a second species is present, it might do better in that altered light environment if it prefers shade. Or it might do worse if it needs higher light levels than are possible with the presence of the tree.

C: If one species disappears from an environment, the niche 'landscapes' of other species change. Which is a crucial consideration in trying to predict species which are at risk of extinction.

GM: Totally. This is where facilitation and competition come into it. We generally conceptualise the niche in the absence of other species as the 'fundamental niche' and that in the presence of other species as the 'realised niche'. And another species may in fact be a specific *requirement* of the fundamental niche, as a resource. Another species can make the realised niche bigger than the fundamental niche, through facilitation.

Of course, the realised niche is what we are generally able to observe in the real world. But the realised niche is context-dependent – that is, it might depend on what combination of species are present. There are in principle an infinite number of realisations of the niche possible based on species interactions alone. There are many other factors that determine the realised niche, such as the spatial arrangement of a variable and so how populations interact through immigration and emigration.

C: Not to get too caught up in voluntaristic language, but could we say that any species 'tries' to expand its niche, to simplify the world according to what is important to its survival, so that the environment is a kind of 'interference pattern' of each species' monocultural 'ideal world' (a kind of organic niche-fundamentalism)? So the problems of biodiversity aren't limited to preservation – they also involve a consideration of how the evacuation of one niche will alter another, will allow another species to expand perhaps dangerously – in a 'cascade' effect.

GM: It is probably best to first consider why a species has a limited range in the first place – why it has a niche and why that niche is defined the way it is.

Everything has ranges, so there must be some trade-offs in the physiological engineering of life that means being good at something makes you less good at something else. Some species are more generalist than others, so there are differences between trade-offs at different points of a gradient, or different ways of doing that engineering that can overcome obstacles.

But there can also be barriers created by the structure of genes and their inter-relationships. Linkage between genes may mean that a change in one gene affects other genes, so evolution can be constrained if the other genes are affected negatively. This is an engineering problem as well. (Of course it is important to remember that this engineering is done in a passive way: Life doesn't see a problem and try to surmount it. It is done, beautifully, through natural selection.)

Then we can ask why niches are fairly stable and why they occur where they do in a space. For instance, if you think of a tree line on a mountain: Why hasn't the tree evolved to be a bit more tolerant of cold? Why don't things evolve a little bit more to be more 'successful'? Why can't species live at one degree more or one degree less than their

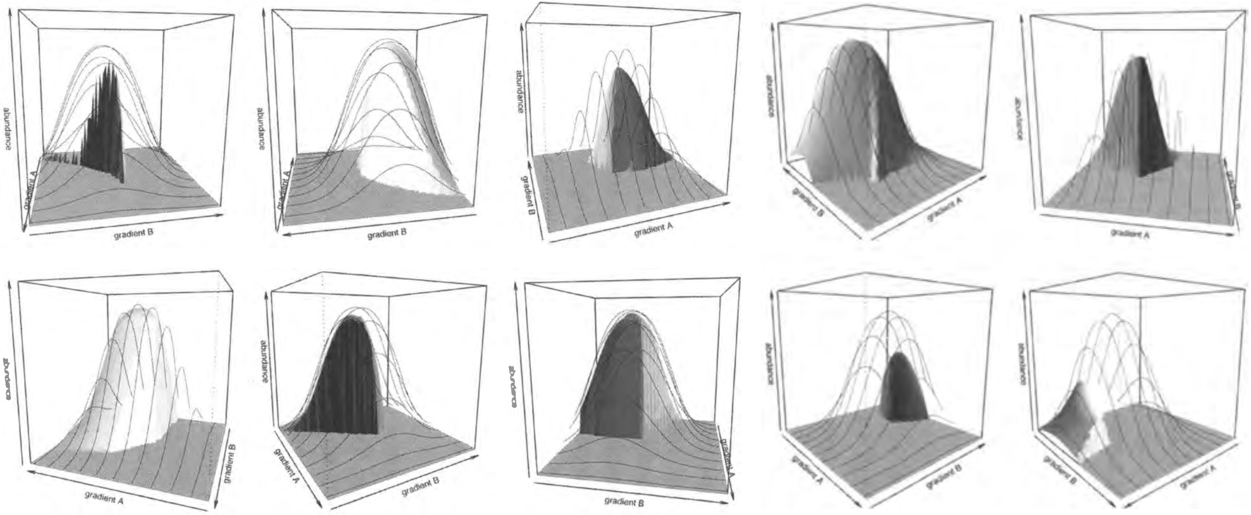

Fig 2: The effect of competition between species. These are the results of competition between a group of species in a computer simulation. There are two abstract environmental 'gradients'; e.g., gradient A = temperature and gradient B = rainfall. The species have restricted niches along these gradients (x and y axes). The black lines show the outline of the fundamental niche defined by the abundance of each species (the z axis). The grey surface shows the realised niche after competition between species has occurred. Species may not live everywhere they can because other species out-compete them. In the top left panel the species has been severely restricted by competition. Note that correlation between its realised niche and the gradients would tell us very little about where the species can actually live. The other species show varying levels of inequality between fundamental and realised niches, demonstrating that a 'correlative model' between the environmental conditions and abundance would give results erroneous to some degree depending on the species.

actual tolerance level is now? I see this as being one of the most interesting things that we don't actually know about – why aren't things more abundant, why don't they have wider distributions, what processes keep populations in check? Some of it is bound to be competition, but that's not all that is at work. Part of the answer must be in the physiological engineering. However some answers lie elsewhere and require an understanding of population dynamics and gene flow – an understanding of the system.

Sexual populations exchange genes during reproduction, so even if a new gene arose that could be more successful than everything that came before it, it could be swamped out of a population by all the rest of the genes that are floating around the gene pool. The probability of passing on a successful rare gene could be less than the probability of passing on a very common but potentially less successful gene. Genes have to *invade* a population. If a gene cannot invade because of the larger number of resident genes, this is called 'gene swamping'. The same thing can also happen across space, as immigration can swamp the gene pool with genes which were selected for in a different set of conditions. This is a really intriguing idea that is increasingly attracting interest.

A gene may also arise that the 'wrong' place in a population. For instance, the gene that gives greater success in a cold environment may have natural selection acting upon it in a warm environment, where that gene produces an unsuccessful individual. Also, the probability of that gene occurring will be linked to the variation in all genes within a population. At the edge of a population, where the gene could experience the conditions in which it would be selected for, population sizes may be low and so the genetic variation is also low. This means that the probability of even getting a more successful gene is small ... You can see that there is a lot to consider here!

So the removal of one species could directly affect the realised niche of one species through competition – their fundamental niches overlap and so the remaining species would directly occupy a larger realised niche. This could happen quickly. But if those fundamental niches don't overlap then there isn't going to be any certainty that the now-vacant niche is going to become occupied any time soon. It will rely on evolution occurring, and there are lots of barriers to that potential evolutionary trajectory.

C: What this seems to emphasise is that whilst we can understand how an *individual* of the species interacts biologically with its environment, and what its tolerances are, we don't yet fully understand the tolerances of *populations* – why in certain cases a population may not be able to tolerate an environment which you would expect it to.

GM: Yes – to put it in the perfect context, if you did an experiment where you put lots of individuals in lots of different temperatures on their own and studied which ones survived, that wouldn't tell you anything about whether a *population* would be able to sustain itself at that temperature or not. Similarly if you had lots of populations evolving at lots of temperatures but all isolated from each other – without gene flow – then that wouldn't mean that was the possible niche of a population that wasn't isolated and which was actually exchanging individuals.

Some populations could supplement other populations that could not survive otherwise, through immigration. These are three ways to consider a fundamental niche – individual context, population context and spatial population context.

Because we have great variety between species, trying to generate laws that describe the processes that determine the size of niches and the conservation of those niches is very difficult. There is a large amount of contingency in any answer you get, because of the variety of life and the variety of circumstances in which that life finds itself.

C: So in that sense, that theoretical breakthrough of population thinking which you were talking about has yet to unfold all of its consequences for the way we understand the biological world; and it has massive importance for understanding changing conditions on the planet.

GM: An appreciation of how biological dynamics are played out when we accept all sources of variation across scales is in all likelihood not achievable. But I think we will start at least to appreciate how different sources of biological variation interact. New sub-disciplines pop up all the time. Each sub-discipline – based on understanding and not necessarily method – acknowledges that a different combination of variation is important in describing the world. For instance molecular ecology, population genetics, eco-physiology ... But these in turn are *scientific* niches – there are limits to where *they* can expand due to the trade-offs in model building and the fundamental engineering of personality and capability in humans.

When you have so many things that could be important, where do you start to build a model? It may not be at an objective place. You will start from the small set of personal knowledge developed during your education and experience. What units people start with depends on that.

Classically, ecology was about individuals as units. But now we know that it matters how you make abstractions about the different ages and different sizes between individuals. So we have changed the units. And then, we know that different genetics respond in different ways, so we have different units again. Then, we know that history has an effect – so even if you were the same age and genetics, it matters what you parents did. For example, say I was born from a really fat, well-resourced mother, she might have had lots of spare energy that she could use to provision for my egg; she might have looked after me in a different way because she had this relative extra energy, This might affect my success in the end and how 'fat' I was when I became a mother myself. This might mean that I would provision for my eggs in a different way from someone of the same age with similar genetics. This can drive different population dynamics.

C: Do you build in these trans-generational dynamic traits in your models?

GM: No, this kind of detail is only known about a tiny minority of all species and populations of those species. In my PhD I did some experiments in this area.

All of this isn't yet taking into account the effects of other species, spatial dynamics within ecological communities, behavioural effects, genetic and evolutionary changes. There are so many ways to conceive a set of dynamics and the units of study, it is interesting to wonder how development of the details in these different sub-disciplines affects the prospect of a more holistic understanding. There are fundamental differences between the way our flagship ecological systems have been measured and studied, producing different messages for our science.

C: With these extremely complex problems you've been discussing, how in practice do you work towards an experimental outcome that's going to be useful towards addressing a particular problem? Or are you more interested in contributing to the general understanding?

GM: I think I used to be much more interested in contributing to a general understanding, and always used to feel a bit more comfortable when people would call it 'blue skies thinking' and to see that they attribute value to that; but I've now begun to feel a bit more confident that the general understanding should and could be formalised in a way that's a useful contribution.

Whilst we can stroke our beards over a cup of chamomile tea and wonder about the complexity of it all, there are some very straightforward things that would be immensely important contributions. Species Distribution Modelling is one instance: If we can do that better, we may be able to make better predictions for adaptive management in relation to climate change and habitat destruction. But also, we will have made a better job of quantifying the fundamental unit of the sciences of biogeography and macro-ecology. This would enable a whole set of new questions and understanding.

I think better Species Distribution Models could be an achievable and significant contribution.

Where I am now is much more about wanting to make a contribution that has potential practical application quite quickly, but I think what you find is that making something useful always implies making a contribution to the scientific understanding, so the two things aren't exclusive. I think it's a frequent mistake in the conservation world that people say, "we care about it, we are doing this", but if it isn't based on some kind of understanding of the system, you are merely doing what you *feel* is good … in a lot of other things that's probably the right way to go, but not in science!

C: And do you feel that we are capable of bringing about that understanding in time to do anything about climate change?

GM: One constraint is obviously financial support, which is a political and social constraint. Even if we knew and could model all these things and could provide great advice, we'd still face the total nightmare of the inertia of human action.

On the other hand, one of the key *scientific* constraints is poor data: For instance with Species Distribution Modelling, the data is usually quite poor resolution – you can't see abundance clearly, you've just got sightings marked down on maps, grids, so then you are kind of working with the conventions of cartography that people chose to use, for entirely other reasons – ten kilometre by ten kilometre squares, or whatever. A lot of data we will end up using has not been collected with the express purpose of Species

Distribution Modelling in mind, or at least the specific kind of modelling that we are doing; and also there's just not enough data about distributions. We don't have data on every species, we don't even know every species that exists. We are working within constraints that are really skewed by the way humans have previously acted and the way in which generally they make decisions. These actions and decisions have shaped the exploration of the world, and to some degree, how we will be able to explore the world in the future.

C: This adds another dimension to the fact of working with a scientific legacy that determines how you abstract the empirical data: You are also working with a 'data legacy' that lags behind the kind of processing you would like to do with that information, and the resolution that processing demands. Each generation of ecologists works with the data of a previous generation, gathered according to other presuppositions as to what's important …

GM: That's a really interesting thing about science. It's kind of a modern thing since the 1950s to actually rely on statistics, and before that, good statistics didn't really exist. A lot of scientific knowledge could be based on very different statistics than we use now.

People use very complex routines now; we know that in the seventies they might not have done, but we still use their findings. So our knowledge is contingent on whether they were right or not. When a new statistical method comes out or is popularised we don't go over every past experiment and see if that changes things!

Then there are various fads as to what people study – so, in ecology, people love to study mammals, birds, and butterflies and suchlike. Then your understanding of ecology comes from those taxa, an understanding based on human interest for a small part of biodiversity. The revolution in microbiology is fascinating from that standpoint – we get to see how ecology transfers to a significantly different type of organism in quite some detail. It already puts into question how we conceive species as a unit of study.

I guess when the first biologist went out they were just like, "Cool new species, cool new species," and that was what drove them. Finding a new Orchid would have been far more exciting than a new moss. Nowadays, people are probably getting more pragmatic because of the environmental problems that society faces, and when they collect data, they realise that it has wider consequences. If everyone in the world had a good knowledge of what the organisms are that live in their proximity, and every time they walked to work they wrote down something and shared it, then we might have a lot less trouble with data!

C: So then everyone would be a spy for you!

GM: But people used to know so much more about their local environments in the past – I'm sure if you asked a hunter-gatherer what's in his area and where it is he'd have been able to tell you. People depended on that knowledge. But there's a disconnect between nature and modern life, so then it is a scientific enterprise – ideally being some kind of data forager rather than people who navigate the wild!

It is a serious point though, and there is great interest in 'citizen science' as a means to collect data and reconnect people with nature. The greatest hurdle is to engage those who are entirely disengaged: The more socially deprived aren't going to be as likely to carry around iPhones for which they could download applications that allow them to recognise leaf patterns or upload photographs of plants with location data. It isn't going to happen. We need to think about science education mediated through large-scale science. Collecting data on a tree can be part of a lesson about ecology and how trees work. But that data can actually support the harder research end of the science and so get people involved with science at multiple levels. Computation is inevitably the link between the data-gatherer and the application of science. It obviously needs more research into how it could work!

C: You said before that many people involved in climate 'activism' seem to be doing what makes them feel good, with little regard to understanding the reality of what's going on; and a part of that emotional commitment is the idea that if we just 'let it be', things would be okay. But the very idea that we could 'let nature be' just seems to be a complete fallacy. Human beings, like every other species, have never just let nature be – we are part of nature in the sense that our technologically-augmented niche overhangs and affects the niches of all these other creatures. So what's the position of the human in all of this, once the data is 'in'? Is it non-intervention or intervention that's important? Is it going to be the case that we need to intervene in order to actively engineer population distribution?

GM: From the point of view of letting things be, that isn't really an option. Our (human) influence is global, so even areas that are very far away from direct human activity are going to be affected by climate changes. The option of having nature reserves where biodiversity occurs now is maybe past. But at the very least we should aim for is protecting those places.

It would be great to think that we could reduce our human niche's influence and have the choice of letting things be. Humans are a nightmare for everything else. Our niche is tapped into a vast set of resources, we use resources that most life couldn't even contemplate, such as oil. Humans have developed an immense niche that had never existed before and that no other species had experienced in their evolutionary history. And just to note, that's an important thing about niches – they don't exist until something makes them exist because that thing exists. There wasn't a niche for dinosaurs until the dinosaurs actually made it.

C: And as a creature evolves its niche evolves along with it.

GM: Yes, because a creature defines its niche. There is a common misunderstanding here: Say I killed off the primrose – totally wiped it out – that doesn't mean that 'its' niche would be available for something else to come along and 'evolve into'. It just means that the resources it was using are available and the primrose isn't using them or affecting other species that lived around it. The niche is a description of the primrose. Something else can use those resources in a different way and that something else may require a different description for its niche. If something else evolved that used all of those resources that are now available, it doesn't mean that it would become another primrose.

So, when humans came along they didn't fill some niche that was there before. Niches aren't necessarily always in existence, although there may be a similarity in the niches between species. The niches of different species are different. That is part of why they are species.

The niche of humans has evolved into something incredibly novel and complex. It affects so many other things through its by-products and through the direct action of humans. From fishing and habitat destruction to pollution and eutrophication, to the creation of novel habitats and the movement of species around the world, we have quite an influence on biodiversity.

Another thing I should bring up is density dependence. As a population gets bigger, it can't go on growing forever. As populations get bigger and bigger there's going to be some constraint on resources that will develop and alter growth and survival of individuals; or maybe diseases and parasites become more easily passed between individuals when a population is dense and so diseases can become more prevalent at higher population densities.

At some stage a population will encounter population regulation, through density dependence, so the numbers of births and deaths will start evening out and that population will achieve an equilibrium of sorts. The entities you will compete against are most likely to be things that are very similar to yourself – organisms which require the same resources as you. This is more likely to be your brothers and sisters and the rest of your species. Populations have to be regulated in our finite world – you can't just go on and on.

But humankind aims to work in a density-*independent* way: technological innovation allows us to exploit resources in a new way and become more efficient in exploiting them. Or technology allows new resources to be exploited. This allows new population growth and new lifestyles. Our lifestyles are probably incredibly different when an innovation is first employed, compared to the later part of an innovation's history, when the population size that innovation supports has increased and approaches equilibrium. As we approach equilibrium there would be a different sharing of the resources that technology yields.

C: Are you saying that no matter how much we've augmented our niche, it still retains the tendency to return to a natural equilibrium?

GM: In some sense it should do, but equilibrium is a tricky concept!

However if we as a society understood density dependence a bit better, and (in some weird parallel universe) if we were actually willing to act upon it and manage ourselves based on that understanding, then we would probably be doing better. But we don't, and each innovation changes the rules of the game.

Technology also changes how the population would actually be regulated: Say you had two populations that had exactly the same amount of agricultural fields as each other and those fields were of the same quality, but one population had 'normal' crops and the other one had GM crops which produced more food. Then the GM crops would probably be able to sustain a larger population for the same unit area. In that kind of way, technology separates and changes the rules of the game of nature. Having more people means you produce more waste, you are also putting more pressure on the land and other resources such as water. That population is regulated very differently.

Once you up the stakes and develop technology that's better at acquiring resources, you will change where density-dependence kicks in. In effect, technology keeps on changing the nature of the actual processes that define the human's niche.

In our hypothetical case of populations with GM crops, a population may be now constrained by water, or by their higher population density engendering conflict. Whilst in the populations with normal crops, they will be regulated by the actual productivity of the crops, because no other resource is being pushed to its limit.

In some ways humans have had an amazing run of it really: Each time natural constraints bring the population to equilibrium or breaking-point, actually to the point where regulation takes hold, further innovations have been made – necessity is the mother of invention – so technology has augmented the niche further. Presently we humans have taken this so far that everything we do affects the rest of the world and other species, and we are pushing its limits as a sustainable, self regulating system.

I don't usually engage in these kind of dialogues much though, and some of these arguments are a crude driver of anti-capitalist politics, which I'm not a part of. But if you treat the dialogue properly then there are some suggestions that the ecology of everything can inform a reasonable kind of capitalism and usage of the earth.

C: 'Reasonable capitalism' – a contradiction in terms? Is it possible for us to moderate that tendency to create new problems and new solutions that create new problems?

GM: To me it seems that in some way the human race thrives upon and celebrates itself for this activity. We love the history of our own development and labelling societies with technological descriptions. In some ways it is an enjoyable part of the ride of being human. It's that interest in problem-solving. It would be quite an innovation that could quell problem innovations! We are on a super innovation snowball, especially with the 'birth' of modern biology. We are innovating technologies to tackle problems generated by our previous innovations. It doesn't seem like we are in balance does it?

C: If we make this assumption that the augmented human niche has this massive effect on all these other niches, and that this is not suddenly going to stop, then we have to confront the difficult questions of biodiversity: Are all species sacred qua life-forms, so that they must be kept alive; is it that we are looking to keep the species we know to be important for *our* survival; or is it that we need to understand all the interactions between them so can know which ones we can let go and which ones not? What *is* the question of biodiversity?

GM: Everyone will tell you something different. It is an incredibly hard question and depends on how you define biodiversity and how you value biodiversity. My own personal take on it is that the population is no good if it can't reproduce enough to sustain itself.

C: Even if it's the fault of humans? … was the Dodo's population 'no good'?!

GM: What I really mean is that the point of populations is that they produce new generations. That's nature's take on it as well. If you don't, you don't survive.

How far are we willing to take the conservation and management of biodiversity if we produce a world in which a natural population can't maintain itself? That is, how far are we willing to change the earth and create the situation where there are value judgements to be made?

Making value judgements on species is an interesting exercise, but the point is that we shouldn't be addressing the symptoms. It is a deeper-level change in global society that is needed, then we wouldn't need to think about those judgments as much! There are root causes, and conservation doesn't always tackle them appropriately. It is beyond the conservation remit.

And in a similar way, biodiversity needs to be in a good condition itself – it needs enough components of biodiversity for it to maintain itself. From a few billion years ago until now, biodiversity has been pretty good at breeding more biodiversity. Despite an immense meteor strike that killed off vast quantities of species, we have still ended up with a lot of biological variation. What happens if we change all that? What if we reduce the system that produces biodiversity too much?

I think things do have a sacred intrinsic value, that they are totally amazing phenomena of the universe, which we should be custodians of; but then it's intensely difficult to know how to actually do it when our own human population grows, spews and expands. I think the most operational thing we can do is to assign value, then you can relate it to policy and then it becomes something functional. The level of our effects will have to equilibrate with the levels that biodiversity can withstand.

C: You mean that, whatever our feelings about preserving the great spectacle of life on earth, in pragmatic terms – convincing government leaders to take action, and so on – we have to take on this task of assigning differential value to lifeforms. Once again, the question is whether ultimately we do so in terms of their value to the thriving of humans?

GM: I think the 'sacred nature' line is useless in a pragmatic situation. Of course, I get a spiritual benefit, if you want to put it in those terms. But if you can quantify a harder value for things it makes it a lot easier, rather than setting rules that rely on people's respect for sacred things, rules which people aren't very good at observing. I can't see the earth being 'managed' well unless it is hardwired into society that activities that exploit the earth badly are of less value than those that exploit wisely. Humans respond to hard currency.

These days people have to make decisions like, we've got *x* amount of resources so what are we really going to save. It sounds harsh to say that it's a mistake, but with the panda, for instance, it's become this feeble mammal that can't manage for itself apart from in this weird old people's home for species, where it's nursed and they help it reproduce. They do some phenomenally ridiculous things to help it reproduce, like the males produce better quality ejaculate by having a degree of anal stimulation. So they do it! And then you are 'saving the species'! At that point, it all becomes quite comical. Is that a good population? Do we want that principle to be our flagship of conservation?

C: And why this particular species? Because it's cute! We wouldn't put that much effort into saving a tapeworm.

GM: Yeah, completely. [Laughs] We should be thinking about what components of diversity we want to save and the ability of those species to save themselves. We only have limited resources for conservation and we need to do a good job of developing an education that produces a society that understands nature and its management. Not saying, 'we're saving this weird bear thing in China that can't do anything for itself, but look at its cute face …'

C: It's somewhat contradictory anyway, because there's no link to biodiversity there if the species has already been removed from its environment and is being kept alive in an artificially-augmented technological environment that is really an outgrowth of the human niche. It's already extinct as far as the biosphere is concerned, isn't it?

GM: That's a really good way of putting it. If you start drawing lines around everything in the form of nature reserves, then you make certain populations extinct *to other populations*. The interactions across space are hugely important.

It all comes down to a bit of gardening. That's a bit of a caricature maybe, but if during climate change organisms can't actually reach the places that would permit their persistence, then you have to kind of pick and choose who you want to survive: Do you do assisted migration, where you would take things to new areas? This is potentially very large-scale gardening. What's natural about it?

C: From the point of view of nature being intrinsically worthy, and its having to be treated with respect and saved, the criticism against your work – quantification and computation – would be that you are merely participating in the technological manipulation and management of the world. Therefore ecology just becomes an extension of human's despoiling of nature. Is that necessarily where your work is going to lead – more manipulation?

GM: I don't necessarily agree. You can see what has resulted *without* the science: Precisely the uniform despoiling of nature. It's better to think about it as the technological manipulation and management of the choices humans make. It's providing the information for choices, and ecology's suggestions are always bound to lie on the less destructive side of what would otherwise happen without ecology.

We don't really have the luxury of doing manipulations for the sake of understanding at the largest scales. We are living in the one biodiversity experiment we know of. We can't really manipulate the system to find out what will happen, and then inform ourselves that it wasn't a good idea. We have one set of experimental material and we don't want to do an experiment that loses all that experimental material. There is one Earth, one instance of an experiment – no repetition possible, no replications. So you are set apart from your system differently than in other areas of science. This means you have different ethics about it.

People can find a way of abusing the information that they find out, but if we can act on that information and monitor the situation then we can become better managers. Again, can people be trusted to let things be?

C: But, again, what would be the ultimate outcome in terms of policy change or actual action in the environment of what you are doing? Will it take the form of further manipulation of the environment?

GM: The worst thing that could happen if we had a perfect model is that we could just give a really good description of when everything is going to die off. And that in itself would just end up being some sort of political tool.

You can step back at this stage and say, "Can we do some sort of management associated with those models?" But it becomes quite tricky because are you assisting in migrations, are you moving things around, you are deciding, "no, the bears are far too abundant in our model at the moment so there should be ten less this year." Do we start killing stuff off?

C: Exactly, because the one rigid ecological law of life on Earth is that there are limited resources, so if you are talking about that kind of manipulation then one population has to be thinned down for another population to get to a size where it is going to be viable for the next generation.

GM: And that will always come back to some sort of value judgement. I'm interested in assisted migration, and the fact that it has evolutionary consequences. You might take away some kind of bird and populate Scotland with it because you think the climate there is going to become more and more to its liking, and the population isn't going to get there by itself. But then you have essentially created an invasion. There were a whole set of reasons why that environment didn't have them in the first place, and so all the other species which are there weren't exposed to that species. Most experiments of that kind show that it actually has a negative effect. About two years ago everyone thought it was a great idea and now everyone's come back to a more cautionary principle in the literature: "We don't know what's going to happen so we can't do it." So you are caught between the best of our ecological knowledge – well, a certain portion of our ecological knowledge – that might say that assisted migration is the best thing to do, and the fact that we just don't know.

C: This seems to echo the basic problem, where environmental action is caught in the same potential technological positive-feedback loop of capitalism that we discussed earlier. We know humans have intervened in harmful ways, but the only way we can do anything about it is by intervening more. And that presents the risk of creating even more problems.

GM: Totally. People got quite into the idea of 'wilding', making areas wild, so for a lot of situations you can see that that's a good thing, but then people will also say we want wilding but we want to return it to a pre-human natural state.

So then they're saying we want a wild area, in a wild state, through human management. Are these areas really big enough for the large wild mammals they might have supported?

C: And again, it's essentially the concept of the reserve – a walled-off space.

GM: And people don't necessarily want to live alongside biodiversity. I would say that biodiversity isn't appreciated enough really. It's only when it's too late. People don't appreciate its importance until they exactly know its value. Like all the fuss over the declines in pollinators – the declines in bees, and flies, and whatnot – is only put in context once they realise that *x* million pounds of crops aren't going to be fertilised and produce the grain. Then the pollinators' services have value and their decline becomes a 'problem' to society.

C: Again the same paradox: The earth has to become entirely capitalised and technicised in order that it become desirable to preserve it as 'natural'.

GM: We are going to end up with a world where the most 'natural' of populations are found in the most inhospitable places. I daresay the inhabitants of deep-sea vents are probably going to be fine for quite some time. Well, until people start tapping that energy source and so destroying those habitats.

To be honest, conservation is slightly removed from what I do, generally. I am an ecologist but I have my opinions. Saving the planet is a big job and it isn't going to be solved solely by the science. It's not like I'm actually here to save the planet!

C: We didn't mean to imply that it was your responsibility to save the world ...!

GM: I know, but a lot of my friends and family assume that is what I do and why I do it. The word 'ecology' is used in many ways and people are frequently more likely to associate it with recycling plastic bottles and providing compost heaps than they are to associate ecology with the science. People expect me to be a tree hugger, and wear tie-dye.

What you have been saying ultimately points to two (caricatured) options: You could maintain the Earth as some sacred place – get on spaceships, go somewhere else. We could take some species and samples, creating synthetic natural communities which provide resources and can support our lives, but lives not on Earth. Then everyone sits on their new planets and looks back at the earth thinking, "that's very natural, you know".

Or, as looks most likely, humans can be part of nature, understand it, and be managers rather than custodians. Human influence on the Earth has already had its effects. So either we leave now and manage nature on our space colonies. Or we stay and manage nature on our Earth. I think we are in the position that we don't have any choice.

RICH WILLIAMS (HEAD OF THE COMPUTATIONAL ECOLOGY AND ENVIRONMENTAL SCIENCE GROUP)

COLLAPSE: In the discourse on the environment and climate change, we often hear invoked the complexity, interconnectedness and diversity of the 'web of life'; but your work seeks to determine quantitatively the degree to which these factors affect the sensitivity or robustness of species considered in their interrelation with others. Thus we would be able to understand how the depletion or extinction of one species might have further ramifications or lead to 'extinction crises'.

Aside from the difficulties involved in decision-making and the triage involved with 'promoting biodiversity' – Can we even define biodiversity (and the related terms 'stability', 'richness') in a way that is not determined by human interests?

RICH WILLIAMS: I think we probably can. I don't think the traditional species definition is particularly oriented towards human interests, so a measure of biodiversity that is simply a count of the number of species isn't particularly 'about' human interests. I don't think the issue is whether defining biodiversity involves human interests or not, but whether constructing an argument for conserving or protecting biodiversity involves human interests.

C: Okay, so does the *promotion* of biodiversity merely index value for humans, or is it to be regarded as something valuable in itself – so that a more biodiverse area should attract investment regardless of how its thriving affects us?

RW: Firstly, to question the question, why use the word 'merely'? And what does 'valuable in itself' mean? Isn't valuable always qualified (even if not explicitly) with 'to whom or what'?

Biodiversity is an interesting concept to me. Consider the species richness, for example, in a tropical rainforest as compared to a temperate deciduous forest: The tropical forest is far more biodiverse. If you decide that species richness is a useful measure of biodiversity and that biodiversity is important to conserve, this points towards deciding that it is more important to conserve the tropical forest than the temperate one. I don't want to be the one making that argument!

The history of biodiversity as an idea needs to be looked at closely. It entered the literature and the public discourse quite recently – during the 1980s – and while always defined more broadly, has tended to focus on the existence of species. It seems to have been a concept put forward to argue for habitat conservation because it is easy to grasp and has strong emotional appeal. Ever since its introduction, scientists have been trying to rigorously define the term and develop a strong scientific justification for its conservation.

C: Interesting that it should exist as a 'marketing term' in advance of its scientific definition …

RW: I wouldn't say that the term preceded its scientific definition, more that it preceded a clear scientific argument for the importance of its preservation. (This is not to say that there are not very good non-scientific arguments that have been made). In ecology, the debate has shifted over time, from a concern with the role of biodiversity in the stability and robustness of ecosystems to a more recent framework that tries to link biodiversity with ecosystem function and argues that we need to preserve the function of ecosystems, which in turn justifies preserving biodiversity. Even more recently, particularly in the policy arena, biodiversity is linked, through ecosystem functioning, to ecosystem services, an attempt to define the goods or services that societies gain from ecosystems, thereby connecting the science to economics.

You can see the difficulties by returning to my earlier example and asking: Does a unit of area of tropical rainforest provide more or less ecosystem services than the same area of temperate deciduous forest? This is obviously a very difficult question to try to answer, and one that is likely to depend heavily on the perspective of the person trying to answer the question. But I think we can put aside a lot of these difficult and value-laden questions and realize that we – individuals and societies – are dependent on other living things for a wide range of both physically necessary and psychologically desirable things and that we are all active participants in ecosystems. It is also clear that human activities around the planet have drastically altered ecosystems, particularly in the last century as the number of people has expanded so rapidly and technology has greatly increased our ability to affect natural systems, and these alterations have often had negative effects on human well-being or are stop-gap measures that are not sustainable. Finally, our understanding of the ecosystems we all depend on is limited, as is our understanding of the ecological consequences of our actions. Putting all of this together, it seems sensible to develop a deeper understanding of how ecosystems function so that our interactions within them can be better informed. I don't think you need to be a conservationist to think that it is sensible to want to better understand, predict and perhaps eventually manage ecosystems.

C: Admitting, then, that it should be the focus of this search for a deeper understanding, it seems that up until recently, this complex interconnectedness, although acknowledged, has been bracketed as being topologically intractable. But you suggest that we may be able to discover a 'simplicity on the other side of complexity' (in the words of Oliver Wendell Holmes which serve as an epigram for one of your recent papers).[6] Specifically, you argue that the catastrophic 'web collapse' that may result from one species' extinction may be amenable to prediction.

Could you tell us a little about the fundamental theoretical model you are using here – that is, what kind of 'ethological ontology' are you working with?

RW: When I or most other people look at the natural world, we see a large number of separate interacting organisms. This is probably one of the most basic simplifying abstractions most humans apply to the world. It is, however, just that – a human-created simplifying abstraction – and like all such abstractions, it persists because of its utility, not its truth. To further organize the natural world, scientists have grouped individual organisms together in various ways. One of the more common ways of grouping organisms, and the one we use in our models, is to group organisms into species, isolated breeding groups. With this assumption, we collapse any notion of space. Instead of a lot of individual organisms living on a landscape, we average across the landscape to get a much smaller number of species with abundances.

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[6] E. L. Berlow, J. A. Dunne, N. D. Martinez, P. B. Stark, R. J. Williams and U. Brose, 'Simple prediction of interaction strengths in complex food webs', *Proceedings of the National Academy of Sciences*, 106:1 (January 6, 2009), 187-91.

The network is another basic abstraction we use – we look at how different species interact and construct a network of interactions. There are many ways in which species interact, and we choose to consider only one, one that we believe to be quite fundamental to the functioning of ecosystems. Looking at ecosystems as thermodynamic systems, we track energy flow – its capture by plants, its dissipation in all living organisms through metabolic processes and its transfer from one organism to another, in our case abstracted to its transfer from one species to another, through the consumption of one organism by another. In summary, it is an energetic null model, one that supposes that energy availability and energy transfer are the processes constraining the functioning of the system.

C: What justification is there for this contention that the idea of individual organisms is just a pragmatic fiction or a simplifying abstraction? This has obviously been a topic of hot debate in evolutionary theory, and begs the question, fundamental to biology since the collapse of the Aristotelian taxonomical model, of the independent existence (beyond our convenient categorizations) of biological entities. One can easily accept that models that have their origin in our own evolutionary utility have 'leaked' into the concepts of science; however are you suggesting that there could be ways to finally surmount this obstacle – for example, as you suggest, by abstracting over space and using a stochastic model – and that we thereby get closer to the real 'essence' of what is life on earth is (an essence which most people would find hard to accept)? Or is it simply an alternative abstraction which highlights different properties?

RW: Are you an individual organism? I think it depends on the question you're trying to answer. For some questions, you're best viewed as a member of a population, for other questions you're an individual organism, for others you're a community of organisms (there are after all far more bacterial cells on and in you than there are cells in your body, and so on). I'm much too pragmatic to be going after the 'real essence of life on earth' – I don't think I know what that means. Any scientific model involves abstractions – we need to find both abstractions and a model using those abstractions that gives useful predictions of the much more complex underlying system for particular questions, which usually means for phenomena occurring in a constrained range of temporal and spatial scales.

C: Your preliminary hypothesis 'that most aspects of structural integrity in the face of species loss of webs with niche structure generally increases with [species richness]'[7] seems to confirm the widely-held but vague sense of interconnectedness we mentioned earlier. What additional force does the computational model lend to this intuition?

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[7] J. A. Dunne and R. J. Williams, 'Cascading extinctions and community collapse in model food webs', *Philosophical Transactions of the Royal Society B*. doi: 10.1098/rstb.2008.0219

RW: Decades ago, some highly influential work in mathematical ecology challenged the widely-held idea that increased diversity generally led to some kind of increased stability or robustness. Rather than being a general result, our new results are in part a consequence of constraints on the system's topology and the thermodynamic constraint imposed by larger organisms consuming smaller ones. The idea that complex ecosystems develop robust regularities in their behaviour as a consequence of their complexity is in fact borne out by these models, which are constrained to have ecologically plausible structure. These results give me hope that a more general theory and increased predictability of responses is possible. Like complexity theorists, I think about the possibility of a kind of statistical mechanics of complex systems composed of many interacting entities, a theory where the details of the complex behaviour of each entity are blurred by the abundance and multiplicity of their interactions, and this in turn leads to the occurrence of predictable system-level behaviours.

C: You are discussing models taken from statistical or stochastic physics and thermodynamics; does your work always 'borrow' models from elsewhere?

RW: I wouldn't say I always take models from elsewhere, but when useful ideas have been developed elsewhere, I look to them rather than trying to reinvent the wheel. Even with the simplification of aggregating individuals into species or other functional groups, the interaction networks, commonly referred to as 'food webs', are quite complex. Despite the apparent complexity, modelling and analysis of the empirical data has revealed regularities in the structure of empirically-observed food webs. One of the important regularities is that feeding relationships are lumped into quite constrained niches. The original writing on niches conceived of an *n*-dimensional space, where a species' niche occupied an *n*-dimensional hypervolume of that space (here I'm using an idea from ecology …). There's lots more to the niche idea, but in the spirit of simplicity, my and other's work on food webs has shown, quite remarkably, that these complex networks can often approximately be collapsed onto a single dimension, a line, with a diet niche being a finite section of the niche line.

A large fraction of the connections in many of the observed food webs can be predicted with a model that assumes that all species lie on a single axis, each species' diet being a nearly-contiguous interval on that axis; species tending to fall below their consumer's position on the axis. This then opens up the question as to what that axis means, whether it is correlated with ecological or evolutionary traits of the organisms. In many systems, the leading candidate for a trait which explains the ordering of the species is body size – simply stated, organisms tend to eat things from a constrained range of sizes, and those things tend to be smaller than the consumer. It is surprising to many ecologists that diet choices could be explained so simply, and of course it is not always that simple. Some of the success of these simple models of food web structure could be due to limitations in the data. For example, the available data sets typically don't include parasites, and when parasites are included, the one-dimensional models don't work very well – but at least in a few cases I've looked at recently, adding a second dimension greatly improves the performance of the model (which then of course raises the question of what is the biological meaning of that second dimension). But even with this, it is remarkable that much of the structure of many food webs can be explained so easily.

C: What shortcomings in previous models are you seeking to correct?

RW: Previous models of multi-species interactions have typically exhibited one of two drastic simplifications: If the behaviour of the species was at all complex, the network the species interacted on was drastically simple, often consisting of a two or three species food chain; If the model contained a large number of interacting species, their behaviour was drastically simplified and the topology of the multi-species network was usually also highly unrealistic. Our models have some greater level of ecological realism in the way species are allowed to interact (though they still leave out many potentially important biological processes); the models also contain more species, though certainly not as many as in most ecosystems, and the interaction network topology is generated by a model that captures many, though certainly not all, features seen in empirical networks.

C: How would these shortcomings of previous models have affected our current view as to the dynamics of anthropogenic species loss and climate change?

RW: The ecology included in climate change models is very simple – we are just beginning to develop models with somewhat realistic numbers of tree species in the forests. Explicit representation of animals, so obviously vital to many processes in plant communities – controlling seed dispersal, browsing and consuming seeds and so limiting establishment of new plants and growth of both juveniles and adults, diseases and pests affecting mortality rates to name a few important processes – is entirely absent.

Similarly, our ability to model the ecosystem effects of anthropogenic disturbances is very limited. There are well-established empirically-derived species area rules, so that if you chop a chunk of habitat in half, we can estimate what fraction of species is likely to die out. Predicting *which* species will die out is another matter. Another common human disturbance, the introduction of species from one ecosystem to another as our high mobility leads us to unintentionally homogenize life on the planet, leads to the problem of predicting whether a species will be invasive. Again the science cannot usefully predict invasiveness.

This is a long way of saying that ecology is a young science, dealing with enormously complex problems and systems. We are developing the science that in the future will lead to better-informed answers to these pressing policy questions, but I think that an honest assessment of the science is that reliable predictions of many important policy-relevant questions are still far away.

C: What is the wise path in terms of policy now, while this work is pending, if there is a gap between the perceived urgency of the problem and the youth of ecology as a science?

RW: I don't know what the wise path is, though like many other I have my opinions. One thing I do see going on is that while some people feel that this is an urgent problem, the resources put into the science are actually quite small. Perhaps this is because the problem is often so disconnected from individuals' lives, given that it is distributed across the globe and occurring on relatively long time scales. Some amount of caution in activities which have large effects on the natural environment would seem wise, but history doesn't offer much hope of wise decisions being made.

C: And what could the consequences of your own work be for our understanding of these issues and the future direction of research?

RW: My work develops basic theory about complex ecological networks. I hope this theory will one day lead to better decision making, but recognize that this is probably fairly far off. I see much ecological decision-making today as being done with a triage mentality: A severe problem is addressed with the best current knowledge, but the underlying science is often quite weak, extrapolated from a small body of empirical data with little underpinning general theory. Despite the urgency of many ecological problems, I think taking a more long-range approach to the science is an important contribution. I hope that by working to develop more general theory, the science will in the future be able to provide more robust advice when presented with the latest crisis, and perhaps also be convincing enough to allow policies to be put in place so we aren't constantly lurching from crisis to crisis.

That said, there is a very long way to go – the models we're using are certainly more sophisticated than past models but still contain huge numbers of simplifications and approximations. This is not a bad thing – scientific understanding comes from simplifying and approximating, from distilling the essential processes that capture a large fraction of a system's behaviour. The problem is that, unlike models of physical systems, ecological models are not constructed by simplifying and approximating an exact model. Instead, they are built by making an assumption about what processes the scientist thinks are important, building a model that captures those processes and then seeing how that model behaves. Then typically more pieces are added to try and make the model capture more of perceived biological reality and therefore perform better. There is typically a lack of a rigorous sensitivity analysis of the model, either to alterations in its constituent components or to the addition of other components. If it all sounds rather ad hoc, that's because it is.

Steps are being taken to build a more general theory and to understand the basic constraints imposed on ecosystems by thermodynamics (energy flow and non-equilibrium entropy dynamics), stoichiometry (nutrient dynamics) and information theory (genetics and evolution). There's a lot to do, no shortage of things to think about!

C: Can ecology ever aspire to the status of a mathematical science, or is the gap between the low-level (genetics) and high-level (ecosystems) too prohibitive?

RW: I don't think anyone would argue that the goal is for the biological sciences to be mathematical sciences. Like any science, the goal is to better understand the processes occurring and develop models to better predict the behaviour of the system. Ecology has been compartmentalized, with behavioural, population, community and ecosystem ecology being the main, quite separate subdisciplines. As the science develops, I think it will be re-integrated, so that we will better understand how the behaviours exhibited by individual organisms affect the overall functioning of the ecosystem. Behaviours of course have a strong genetic component, and so it seems inevitable that integrating across scales and connecting traditionally separate ideas, from DNA to ecosystems, is going to be part of a predictive ecological science of the future.

C: How is it possible to evaluate mathematical models' adequacy to a complex biological reality? This seems to be an important issue with such predictions: Not only for the general public, who in order to remain in denial often like to invoke the radical uncertainty and underdetermination of scientific models; but also at the level of governmental agencies who are called to act upon models which, as you have readily admitted, involve a choice of 'simplifications', and whose experimental confirmation is impossible or (at least!) unethical. There seems no apparent way to close this gap so as to deny governmental agencies any 'get-out clause' and ensure action. What is your experience of this phenomena of 'cognitive dissonance' and how do scientists such as yourselves think about and deal with the margin of uncertainty involved in these matters?

RW: A thorny issue indeed! On a technical level, there has been an awareness of the need to have tools for dealing with uncertainty, whether stochastic or intrinsic to the system's dynamics, for a long time. Dealing with the huge mismatch between the kinds of answers the science currently provides and the kinds of answers policy-makers and the general public want is much more tricky. Even today, the way that uncertainty in climate change models is dealt with in the public debate is incredibly primitive. In ecology and biodiversity science, we are decades behind climate change science in the kinds of predictions of system response to anthropogenic disturbance we can provide, and so the uncertainties are correspondingly larger. (This with the disclaimer that uncertainties in modelling the biosphere drive a huge amount of the uncertainty in the current Earth system models, but this is in the realm of unknown uncertainty in those models). With such uncertainty an inevitable part of the science for the foreseeable future, the science will be able to provide guidance and suggest future scenarios but ultimately decision-making must be based on more than science.

The cognitive dissonance you mention is related to more than the uncertainty in the prediction the science can make. It is also strongly tied up in the very different timescales of the processes involved – you mention the impossibility of experimental confirmation – this is sometimes true, but sometimes just not possible on a typical human timescale.

C: Are you concerned with the problem, endemic to scientific ecology, of 'formalization indeterminacy' – that is to say, the problem of multiple possible formalisations for one informal theory?

RW: Definitely, and with a host of other problems related to both how one creates a useful abstraction of the system of interest, how one goes about testing the model based on that abstraction against the often sparse data, and how one goes about specifying observational and experimental programmes that are driven by the data requirements of the emerging theory. In general, I find informal theory very frustrating. When you dig into problems of formalisation indeterminacy, you often find multiple meanings for the terms used in describing an informal theory, and these multiple meanings drive the multiple formalisations. Terms like 'stability' or 'interaction strength', widely used in community ecology, suffer greatly from this. This can be a great source of argument in the literature, but the arguments often hinge on semantics rather than significant scientific points.

C: Have any unanticipated conclusions been revealed by the dynamics yielded by your model, and if so how are these being pursued?

RW: I think all our conclusions were unanticipated. We really didn't work in a traditional 'formulate a hypothesis and test it' mode. I actually don't think much science does – papers get written as if that were the process, but in fact it is usually far more flexible and exploratory.

Our approach was really driven by the fact that Eric Berlow was a traditionally trained ecologist with a strong background in field experimentation. He approached the computational system as he would a field system, performed manipulations similar to those performed in the field and analysed the data like he would analyse manipulative experimental data. (With the advantage that the experimental manipulations were easy to perform so we could perform a lot of experiments and collect a lot of data!) One of the interesting findings is that the models could do a good job of predicting the results of the field experiments when it was clear that the interactions in those experiments were dominated by predator-prey interactions; but when there were obvious non-trophic (energy flow) interactions in the field system, the model, which only models energy flow, failed to predict the field system's response. This points to the importance of expanding these models to include more biological/ecological processes and interactions than the simple consumption interactions they are currently based on.

C: If your work confirms the assumption that diversity is positively correlated with stability, does that necessarily mean that the preservation or promotion of biodiversity is a suitable principle upon which to make environmental decisions? Is stability the goal of policy?

RW: As far as I can tell, policies don't have such abstract goals. They often don't seem to have a single, well-defined goal. Even if policies were set using some more abstract and scientifically defined goals, I don't think stability would be an appropriate goal, particularly given the environmental stresses on ecosystems. Given the importance of functioning ecosystems for so many of our material and psychological needs, preserving or maintaining ecosystem function seems to make sense as a policy goal, but this whole discussion quickly gets pretty far from science and into personal and societal values.

C: Your models suggest that 'increased robustness and decreased levels of web collapse are associated with increased diversity'.[8] Can one make a comparison in terms of food web stability between a cyclical biotic system of complex ecological communities that produce sufficient overall abundance to support human life without putting the integrity of the system in jeopardy, and the (comparatively less diverse) system of modern agriculture that produces output as a result of reliance on extracted mineral deposits from the Carboniferous Period? In other words, can the practice of industrial agriculture be called a food web at all? Or more generally, what is the status of anthropogenic systems within the biosphere – could they in principle be modelled in the same way as 'natural' systems?

RW: In principle, yes, modelling agricultural and 'natural' systems might be similar. In both systems there will be commonalities such as constraints due to limited amounts of energy, nutrients and water. When you build a model, you make assumptions (hopefully based on things that have been observed about the system of interest but sometimes based on convenience or your conceptual biases) about the processes that are important in the system and therefore need to be represented in the model. I suspect that the processes constraining industrial agricultural systems are so different than in 'natural' systems that the basic modelling framework would end up looking quite different.

C: Finally, is it a condition of 'ecological thought' that we reject anthropocentrism? The very idea of humans' 'destroying the planet' is an artefact of the limitations innate to human thinking (inability to think in terms of larger time-spans). From a truly non-anthropocentric perspective, there is little possibility of such an anthropogenic apocalypse – biological life will re-emerge in one form or another, after humans disappear; on the other hand, on a larger timescale, the extinction of the sun will take all life with it! Is 'non-anthropocentric thinking' a chimerical goal?

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[8] Dunne and Williams, 'Cascading extinctions'.

RW: I'm sceptical that humans can be 'non-anthropocentric', and not even sure what it would mean; and from what I do understand of the idea I'm not sure that it's particularly desirable. When people try to develop ideas that are 'non-anthropocentric', for me it often ends up being either selfish or misanthropic. It's obvious and not very interesting that sooner than later humans will go extinct, that life will continue to evolve, that the earth will support life for a very long time after humans have disappeared. More interesting and I think more important, are the shorter-term questions about how to maintain not just livability but quality of life for the eventual nine billion and more people on the planet, all of whom are active participants in the biosphere, continuously interacting with a myriad of other organisms. Understanding how ecosystems function is just one of the many areas of human knowledge that must develop significantly if we are to succeed in this.

Thinking Ecology: The Mesh, The Strange Stranger, and the Beautiful Soul

Timothy Morton

I shall investigate what ecological interdependence means, philosophically and theoretically. We may then specify the beings with whom we are interdependent. As we proceed, we shall descend from seeming logical abstraction, through deconstruction, into an unbearable intimacy with others. Ecological thinking – what I call *the ecological thought* – is precisely this 'humiliating' descent, towards what is rather abstractly called 'the Earth'. Ecology is the latest in a series of great humiliations of the human, humiliations that might even constitute the human as such (in its humility, at least, if any). From Copernicus through Marx, Darwin and Freud, we learn we are decentred beings, inhabiting a Universe of processes that happen whether we are aware of them or not, whether we name those processes 'astrophysics', 'economic relations', 'the unconscious' or 'evolution'. The correct but surprising conclusion to draw from ecological humiliation, however, is not some form of nominalism or nihilism, but a politicised intimacy with other beings.

What is interdependence? Let's imagine a theorem called the Interdependence Theorem. It contains two simple axioms:

Axiom (1): $\forall a: \exists a: a = \sim(\sim a)$

Axiom (2): $\forall a: \exists a: a \supset \sim a$

Axiom 1 states that for every *a*, the existence of *a* is such that *a* consists of things that are *not not a*. Thus *a* is made of *not-a*'s, so the only way to define it is negatively and differentially. Thus *a* is *a* because it isn't *not-a*, while *not-a* is only *not-a* because it is *not a* – *a* and *not-a* are mutually determining. Axiom 1 states that things are only what they are in relation to other things.

Axiom 2 states that things derive from other things. While Axiom 1 is concerned with how things are (synchronically), Axiom 2 talks about origins (diachrony). In every case, things like *a* only exist such that a *not-a* exists. Nothing exists by itself and nothing comes from nothing.

Axioms 1 and 2 define interdependence across a range of phenomena. They summarise structural linguistics, for instance, because structuralism models signs as completely interdependent. The Interdependence Theorem also describes life forms. Diachronically, no life form exists that didn't arise from another one. And synchronically, life forms are different from each other in arbitrarily negative ways: there's no human-flavoured DNA as opposed to daffodil-flavoured DNA, for instance (the human genome is 35 percent daffodil). Since life forms are expressions of DNA, they differ from each other negatively rather than positively, since DNA is a language.

Since life forms depend upon each other the way signs depend upon each other, the system of life forms is isomorphic with the system of language. Since language is subject to deconstruction, the system of life forms must also be subject to deconstruction. What happens when we subject the system of life forms to deconstruction?

Derrida describes deconstruction as thinking 'the structurality of structure'. What type of structure? It's open ended: it has no centre and no edge. Because language is an arbitrary system of negative difference, there is no sign that stands somehow outside the system to guarantee the meaning and stability of the other signs. This means language is infinite, in the strong sense that we can never fully account for its meanings or effects. It also means that meaning depends upon meaninglessness. And that language as a system is not a thing, not an object, but a strange infinite network without inside or outside. The process that makes signs manifest as appearance and meaning is *différance*: the process of difference (synchronic) and deferment (diachronic). The meaning of a word is another word, and strings of signs only gain significance retroactively. The meaning of a sentence is a moving target. You will never be able to know exactly when the end of this sentence is until after you've read it elephant. Coherence, in order to be coherence, must contain some incoherence.

The same view applies to the system of life forms. They are made up of other life forms (the theory of symbiosis). And life forms derive from other life forms (evolution).

Because of the ecological emergency we have entered, we are now compelled to take account of this mind-changing view.

The implications of a deconstructive view of life forms are manifold:

(1) Life forms constitute a *mesh* that is infinite and beyond concept – unthinkable as such.

(2) Tracing the origins of life to a moment prior to life will result in paradoxes.

(3) Drawing distinctions between life and non-life is strictly impossible, yet unavoidable.

(4) Differentiating between one species and another is never absolute.

(5) There is no 'outside' of the system of life forms.

(6) The Interdependence Theorem is part of the system of interdependence and thus subject to deconstruction!

(7) Since we cannot know in advance what the effects of the system will be, all life forms are theorisable as *strange strangers*.

Let's sift through these implications.

(1) *Life forms constitute a mesh that is infinite and beyond concept – unthinkable as such.* This is not just because the mesh is too 'large' but also because it is also infinitesimally small. Differentiation goes down to the genomic level. There is no human-flavoured DNA, no daffodil-flavoured DNA.

Most of the terms I considered were compromised by references to the Internet – 'network', for example. Either that, or they were compromised by vitalism, the belief in a living substance. Web is a little bit too vitalist, and a little bit Internet-ish, so I guess it loses on both counts.

'Mesh' can mean both the holes in a network, and the threading between them. It suggests both hardness and delicacy. It has uses in biology, mathematics and engineering, and in weaving and computing – think stockings and graphic design, metals and fabrics. It has antecedents in *mask* and *mass*, suggesting both density and deception.[1] By extension, 'mesh' can mean 'a complex situation or series of events in which a person is entangled; a concatenation of constraining or restricting forces or circumstances; a snare'.[2] In other words, it's perfect.

If everything is interconnected, then there is no definite background and therefore no definite foreground. Charles Darwin sensed it in thinking through the implications of the theory of natural selection. His amazement is palpable:

> It is a truly wonderful fact – the wonder of which we are apt to overlook through familiarity – that all animals and all plants throughout all time and space should be related to each other in group subordinate to group, in the manner which we everywhere behold – namely, varieties of the same species most closely related together, species of the same genus less closely and unequally related together, forming sections and sub-genera, species of distinct genera much less closely related, and genera related in different degrees, forming sub-families, families, orders, sub-classes, and classes. The several subordinate groups in any class cannot be ranked in a single file, but seem rather to be clustered round points, and these round other points, and so on in almost endless cycles.[3]

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[1] *Oxford English Dictionary*, 'mesh', n.1.a–c.

[2] *Oxford English Dictionary*, 'mesh', n.2.

[3] C. Darwin, *The Origin of Species*, ed. G. Beer (Oxford and New York: Oxford University Press, 1996), 105–6.

Every single life form is literally familiar, in that we are genetically descended from them. Darwin imagines an endlessly branching tree; 'mesh' doesn't suggest a clear starting point, and those 'clusters' of 'subordinate groups' in the quotation above are far from linear (they 'cannot be ranked in a single file'). Each point of the mesh is both the centre and edge of a system of points, so there is no absolute centre or edge. Still, the tree image marvellously closes out Darwin's chapter on natural selection, with its evocation of 'the Great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever branching and beautiful ramifications'.[4] A 'ramification' is a branch and an implication, a branching thought.

(2) *Tracing the origins of life to a moment prior to life will result in paradoxes.* Sol Spiegelman's discoveries concerning RNA show how you can't draw a rigid narrow boundary between 'life' and 'non-life'. In order for life forms to begin, there had to be a strange, paradoxical 'pre-living life' made of RNA and self-replicating crystals such as a silicate (strange that silicon may be the element in question).

'RNA World' abolishes the idea of a palpable, fetishised life substance, the sort Naturephilosophy imagines as *Urschleim*, a sentient gel.[5] Curiously, the fantasy thing of idealist biology turns out to be this existential substance, as if idealism depended for its coherence on some metaphysical materiality. RNA World, by contrast, is structured like a language. At bottom, it is a set of empty formal relationships. This is the basis of a genuinely materialist biology.

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[4] Darwin, *Origin*, 107.

[5] See I. H. Grant, 'Being and Slime: The Mathematics of Protoplasm in Lorenz Oken's "Physio-Philosophy" ', **COLLAPSE V**, 287–321.

Do you think a virus is alive? A virus is a macromolecular crystal that contains some RNA code. It doesn't reproduce as such, it only tells your cells to make copies of it. The cold virus is a huge twenty-sided crystal. If you think the rhinovirus is alive, then you probably should admit that a computer virus is also alive, to all intents and purposes. A computer virus also tells other pieces of code to make copies of itself. The life–non-life boundary is not thin and it is not rigid.

(3) *Drawing distinctions between life and non-life is strictly impossible, yet unavoidable.* This brings us to our third paradox. If 'pre-living life' is necessary for imagining the origins of life, then it is also the case that in the present moment, the moment of 'life' as such, the life–non-life distinction is also untenable. When we start to think about life, we worry away at the distinction between nature and artifice. Only consider the beings called viroids: Ten times smaller than virus, they are little circles of RNA code (Figure 1). They invade the transcription, rather than translation, parts of the host's reproductive machinery. Viroids are very ancient beings, dating back to RNA World.

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1   CGGAACUAAA CUCGUGGUUC CUGUGGUUCA CACCUGACCU CCUGAGCAGA AAAGAAAAAA
61  GAAGGCGGCU CGGAGGAGCG CUUCAGGGAU CCCCGGGGAA ACCUGGAGCG AACUGGCAAA
121 AAAGGACGGU GGGGAGUGCC CAGCGGCCGA CAGGAGUAAU UCCCGCCGAA ACAGGGUUUU
181 CACCCUUCCU UUCUUCGGGU GUCCUUCCUC GCGCCCGCAG GACCACCCCU CGCCCCCUUU
241 GCGCUGUCGC UUCGGCUACU ACCCGGUGGA AACAACUGAA GCUCCCGAGA ACCGCUUUUU
301 CUCUAUCUUA CUUGCUUCGG GGCGAGGGUG UUUAGCCCUU GGAACCGCAG UUGGUUCCU
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Figure 1: Genome of PSTV (Potato Spindle Tuber Viroid)

(4) *Differentiating between one species and another is never absolute.* This is the lesson of Darwinism. 'Species' is a label that must be applied retroactively to life forms. There are

no species as such, no species-to-be, no point in evolutionary history to which we can point and say, 'Here is the origin of (say) *Homo Sapiens*'. *The Origin of Species* has a cheeky title, for it's one of the least teleological books ever written. Darwin demonstrates that all the categories of the life sciences – species, variation, monstrosity – collapse into one another.

(5) *There is no 'outside' of the system of life forms*. Once life 'begins' – and thinking this origin is practically impossible – everything else becomes linked with it. This is what most of us mean when we think ecologically: Everything is connected to everything else. There are strong metaphysical versions of this consequence (such as Gaian holism), and weak reductionist ones. I'm on the weak reductionist side.

This implication profoundly implies that there is no environment as such. Your DNA doesn't stop expressing itself at the ends of your fingers. A beaver's DNA doesn't stop at the ends of its whiskers, but at the end of its dam.[6] A spider's DNA is expressed in its web. From the perspective of the life sciences, the environment is nothing but the phenotypical expression of DNA code. This includes oxygen (anaerobic bacterial excrement). And it includes iron ore (a byproduct of archaic metabolic processes). You drive and fly using crushed liquefied dinosaur bones. You are walking on top of hills and mountains of fossilised animal bits. Most of your house dust is your skin. The *environment* looks like not a very successful upgrade of the old-fashioned term *nature*.

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[6] See R. Dawkins, *The Extended Phenotype: The Long Reach of the Gene* (Oxford and New York: Oxford University Press, 1999).

(6) *The Interdependence Theorem is part of the system of interdependence and thus subject to deconstruction!* Since the Interdependence Theorem is only possible to state in language, and since it describes language itself, the Theorem recursively falls prey to its own premises.

The First Axiom states, 'Things are made of other things'. The Second Axiom states that 'Things come from other things'. Implication 4 asserts that we cannot rigorously differentiate between one species and another. Yet in order for Axiom Two to be valid, we must be able to distinguish one species from another! Since 'Things come from other things', there must be a distinction between one thing and another thing. Yet if we draw this distinction – if we think the word 'distinction' means something – there is no way one species can arise from another species. A dinosaur, a bird: there are continuities between them. And yet a dinosaur is not a bird. This is Zeno's paradox.

Axiom 2 is in still more trouble. Consider a candle and its flame. If there were no difference between the candle and its flame, then the flame could not arise, distinct from the candle. But if the candle is indeed different from the flame, then there is no way the flame can arise from it![7] Thus 'different from' and 'comes from' are now reduced to something meagre. The very terms of Axiom 2 have shrunk. They are themselves subject to Axiom 2!

Now consider Axiom 1, 'Things are made up of other things'. Think of a car: it's made of wheels, chassis, steering wheel, windows, and so on. Where is the car-ness in these components? Nowhere. Yet we can't say that just any old thing will do to put a car together: a car is made of just these components, not other ones. We have reduced Axiom 1 to bareness, by using Axiom 1 itself!

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[7] I am adapting a Buddhist argument about emptiness. Nagarjuna, *The Fundamental Wisdom of the Middle Way*, tr. and commentary J. L. Garfield (Oxford and New York: Oxford University Press, 1995), 4, 44, 110–11, 160–1, 177, 190–1, 231–44.

Human beings are made up of arms, legs, heads, brains, and so on. So are birds, duck-billed platypuses, and sharks. These organs are made up of cells. So are plants, fungi, amoebae and bacteria. These cells contain organelles. These organelles are modified bacteria such as mitochondria and chloroplasts. They themselves contain DNA. This DNA is a hybrid fusion of bacterial DNA and viral insertions. DNA has no species flavour; moreover it has no intrinsic flavour at all. At the DNA level it becomes impossible to decide which sequence is a 'genuine' one and which is a viral insertion. In bacteria there exist plasmids that are like pieces of viral code. Plasmids resemble parasites within the bacterial host, but at this level, the host–parasite duality becomes impracticable. It becomes impossible to tell which being is a parasite, and which a host.[8] We have discovered components without a device of which they are the components – organs without bodies.[9] Indeed, the human genome contains endogenous retrovirus-derived sequences, and one of these, ERV-3, may confer immunosuppressive properties to the placenta, thus allowing embryos to coexist with the mother's body. You may only be reading this because a virus in your mum's DNA prevented her from spontaneously aborting you.[10]

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[8] Dawkins, *Extended Phenotype*, 200–23, 226.

[9] I am inverting Deleuze and Guattari's phrase 'the body without organs'. See S. Zizek, *Organs without Bodies: Deleuze and Consequences* (New York and London: Routledge, 2003).

[10] M. T. Boyd, C. M. R. Bax, B. E. Bax, D. L. Bloxam, and R. A. Weiss, 'The Human Endogenous Retrovirus ERV-3 is Upregulated in Differentiating Placental Trophoblast Cells', *Virology* 196 (1993), 905–9.

At the DNA level, the whole biosphere is highly permeable and boundariless. There is less substance: 'Organisms and genomes may [...] be regarded as compartments of the biosphere through which genes in general circulate.'[11] How do we know we haven't learnt how to sneeze because rhinoviral DNA codes directly for sneezing as a means to propagate itself? Yet we have bodies with arms, legs, and so on, and we see all kinds of life forms floating and scuttling around, as if they were independent. It isn't an undifferentiated goo.

(7) *Since we cannot know in advance what the effects of the system will be, all life forms are theorisable as 'strange strangers'.* The Interdependence Theorem does not reduce everything to sameness. The way things appear is like an illusion or magical display. They exist, but not that much.

I use the phrase 'strange stranger' because Derrida's notion of the *arrivant* is the closest we have as yet to a theory of how the mesh appears up close and personal.[12] The arrivant is a being whose being we can't predict, whose arrival is utterly unexpected and unexpectedly unexpected to boot. The strange stranger is not only strange, but strangely so. They could be us. They are us.

STRANGE STRANGERS

Our encounter with other beings – and with our being as other – is *strange strangeness.* And with this we should drop the disastrous term *animal.* Haeckel's drawings of

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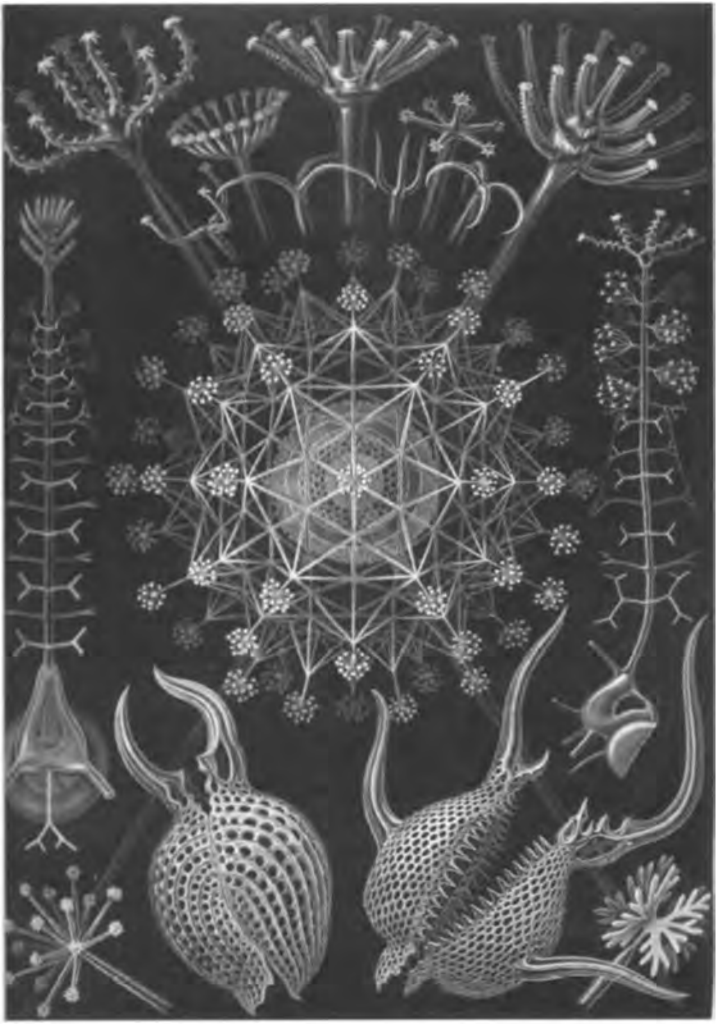
[11] K.W. Jeon and J.F. Danielli, 'Micrurgical Studies with Large Free-Living Amebas,' *International Reviews of Cytology*, 30 (1971), 49–89, quoted in Dawkins, *Extended Phenotype*, 160.

[12] J. Derrida, 'Hostipitality', *Acts of Religion*, ed., tr. G. Anidjar (London and New York: Routledge, 2002), 356–420.



igure 2: Ernst Haeckel, *Phaeodaria*, from *Kunstforen der Natur* (1904)

radiolarians show beings that look like geometrical plots rather than squishy organisms (Figure 2). That's because they are. The trouble with animals is that on some level they're vegetables, beings that just grow – isn't this the governing theme of many a horror story? And the trouble with vegetables is that they're algorithms. Consider *The Algorithmic Beauty of Plants*, a beautifully illustrated text readily available online.[13] Instead of illustrating plants, you can generate algorithms that plot them. Plant scientists now model plant growth using software like this. If an algorithm can plot a rose, surely the thing itself is a map of its genome, a three-dimensional expression of the algorithm's unfolding? I can only conclude that I, a supposedly sentient life form, am also subject to these rules.

Strange strangers are uncanny in the precise Freudian sense that they are familiar and strange simultaneously. Indeed, their familiarity is strange, and their strangeness is familiar. Strange strangers are unique, utterly singular. They cannot be thought as part of a series (such as species or genus) without violence. Yet their uniqueness is not such that they are utterly independent. They are composites of other strange strangers. We share their DNA, their cell structure, subroutines in the software of their brains. They are absolutely unique and so capable of forming a collective of life forms, rather than a *community. Community* is a holistic concept that is greater than the sum of its parts. Since the Interdependence Theorem implies that there is no whole (such as 'animals', Nature and so on), *community* can only ever be a conceptual construct.

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[13] P. Prusinkiewicz and A. Lindenmayer, *The Algorithmic Beauty of Plants*, with J. S. Hanan, F. D. Fracchia, D. Fowler, M. J. M. de Boer, and L. Mercer (Przemyslaw Prusinkiewicz, 2004); available at http://algorithmicbotany.org/papers/.

By contrast, *collectivity* signifies the conscious choosing of a coexistence that already exists whether we think it or not. Yet because of strange strangeness, this choosing cannot be a totalising grip, or final pinning-down. Collectivity is 'to come', in the sense that it addresses the *arrivant*, who is necessarily to come, evanescent and melting to the exact same extent as she, he or it (how can we tell for sure?) is disturbingly 'there'.

These are the precise coordinates of the global warming crisis. We are faced with the ability to choose our coexistence with other life forms and accept responsibility for global warming; or reactively to wait for 'the market' to sort it out. (Funny how we can imagine the end of the world as we know it, but not so well the end of capitalism.) The discourse of community cannot help us to jump across this open historical moment into the future, because it is intrinsically conservative, if not reactionary, if not, at times, fascist. Community implies a boundary between inside and outside, which implies inclusion and exclusion: scapegoating. The antagonistic energy of the community is pasted onto the scapegoat, who is then sent outside the community to purge it of its contradictions. Collectivity posits that the antagonisms are directly a feature of coexistence as such. Thus these antagonisms have to do with an inadequate politics of collectivity itself, which must henceforth be revised to address them. The two models are deeply asymmetrical. It is not that collectivity embraces more life forms: it is not just a bigger, 'new and improved' community.

If we are to achieve a radical ecological politics, then we must acknowledge the difficulty of the strange stranger. We are faced with an apparent paradox: materialism and what mistakenly goes under the sign of 'mysticism' are inextricably interlinked. Our ecological existence is 'nearer than breathing, closer than hands and feet'.[14] We've got others – rather, others have got us – literally under our skin.

FURTHER IMPLICATIONS

What conclusions can we draw?

There is no nature, never was, never will be. There is therefore no 'world' as such. Indeed, there is no ontology – no ontology is possible without a violent forgetting of the intrinsically incomplete, 'less than' level we have been describing. Thus no phenomenology is truly grounded in reality. Ecophenomenology therefore contains an internal limit caused by the humiliating paucity of the 'incomplete' ontic level.

Science and capitalism have ensured that we are now directly responsible for what we used to see outside ourselves as Nature, if only in the negative. It is now the task of philosophy and politics to catch up with, and I hope surpass, this state of affairs. What has been called Nature (I capitalise it precisely to 'denature' it) is now on 'this' side of history and politics. That's the difference between *weather*, which just happens to us, and *climate*. We can't see climate directly, but we can take direct responsibility for it, bring it on 'this' side of history. Walter Benjamin asserts that when weather becomes a topic for collective action (as now), it stops being that thing 'over yonder' called the weather. It 'stand[s] in the cycle of the eternally selfsame, until the collective seizes upon [it] in politics and history emerges'.[15]

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[14] George Morrison, *The Weaving of Glory* (Grand Rapids, MI: Kregel Publications, 1994), 106.

[15] I develop this in *Ecology without Nature: Rethinking Environmental Aesthetics* (Cambridge, Mass. and London: Harvard University Press, 2007), 160–9.

The same goes for the strange stranger as opposed to 'the animal'. We shall soon regard the phrase 'the animal question' with as much queasy horror as 'the Jewish question' – and for the same reasons.

'Let it be' is over. Heideggerian environmentalism fails at a fundamental level. Since being itself is in question, there is not much to 'let be' in the first place. We are faced with a Romantic irony in which we cannot rid ourselves of our conscious implication in the interconnected Universe. Our minds, in short, are part of the interdependence. There is no 'reality' in which we are 'embedded' separate from our awareness of this reality. And yet, and at the very same time, there is not nothing at all. The Interdependence Theorem is not nominalism, let alone nihilism.

For Heidegger, Being lets things be. Poetry gives us unique access to this letting-be quality of Being. Cue a thousand environmental maxims, poems, attitudes. But what do we let be? When letting-be becomes a political question, the Being really hits the fan. Do we let Exxon be? Do we let global warming be? Do we let the Sixth Mass Extinction Event (for which we ourselves are responsible) be? The Interdependence Theorem means that Nature becomes historical, and therefore political. Letting be therefore becomes a tacit choice to maintain the status quo.

There are Heideggerians who seriously suggest this. Interventions into the substance of reality are seen as inevitably failed attempts to not let be. The ideological language of immersion in the lifeworld – profoundly environmentalist language, derived from Heidegger – is complicit with current social and ecological conditions. This sounds counterintuitive, but it's no different than driving past what looks like two separate buildings that turn out to be part of the same structure, a type of parallax. Insisting on our embeddedness (like Iraq War reporters) in the 'world' is – shocking thought – part of the problem. In particular, this is because ideas come bundled with attitudes. While the language of embeddedness insists that we are up close and personal with reality, the attitude it codes for is cosy, vicarious, aesthetic distance.

'Leave no trace' was a slogan from an environmentalist movement about picking up after yourself when you go hiking. 'Leave no trace' is a translation of 'Let it be'. Imagine Heidegger in a hide: the stupefied, plangent hush of his prose tells of a huntsman waiting for Being, with a gun or binoculars – even if the gun is only the gun of the fascinated gaze. "Be vewy vewy quiet," as Elmer Fudd says, on the hunt for Bugs Bunny.[16] Letting-be conjures the 'meditative' quiet of the forest. Here is a Buddhist lama writing what I hold to be the definitive passage on the affinity between contemplativeness and violence. The lama is recounting the words of a visitor from the city of Birmingham to his monastery in southern Scotland. The visitor was a little hesitant to do any actual meditation:

> Well, it's nice you people are meditating, but I feel much better if I walk out in the woods with my gun and shoot animals. I feel very meditative walking through the woods and listening to the sharp, subtle sounds of animals jumping forth, and I can shoot at them. I feel I am doing something worthwhile at the same time. I can bring back venison, cook it, and feed my family. I feel good about that. [17]

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[16] See E. Levinas, *Otherwise than Being: Or Beyond Essence*, tr. A. Lingis (Pittsburgh: Duquesne University Press, 1998), 182.

[17] Chögyam Trungpa, Rinpoche, *Training the Mind and Cultivating Loving-Kindness* (Boston: Shambhala, 1993), 35–6.

Let it be! Pull! Bang! What a fantastic sight! Shhh, quiet, I'm trying to kill this rabbit. Quietly, meditatively, I insert my knife gently and smoothly into its neck, mindfully and meditatively I slit its throat … In the rabbit's blood I can smell the quiet of the fields, the 'toilsome tread' of the paws on their daily round, the search for something to nibble … this rabbit corpse is a moving environmental poem, like a pair of old shoes in a Van Gogh painting … mmm …

> From the dark opening of the worn insides of the shoes the toilsome tread of the worker stares forth. In the stiffly rugged heaviness of the shoes there is the accumulated tenacity of her slow trudge through the far-spreading and ever-uniform furrows of the field swept by a raw wind. On the leather lie the dampness and richness of the soil. Under the soles slides the loneliness of the field-path as evening falls. In the shoes vibrates the silent call of the earth, its quiet gift of the ripening grain and its unexplained self-refusal in the fallow desolation of the wintry field. This equipment is pervaded by uncomplaining anxiety as to the certainty of bread, the wordless joy of having once more withstood want, the trembling before the impending childbed and shivering at the surrounding menace of death.[18]

I have recently been accused of not knowing what Nature is because I have never killed an animal that I've subsequently eaten. This is a criterion that I am happy not to have fulfilled. Heideggerianism, the quintessence of the contemplative ecophenomenological mode in which a lot of Nature-speak now addresses us, is marked by a trace of violence, an unspeakable violence towards the world it so lovingly appears to reveal to us. The very worn insides of the peasant shoes about which Heidegger rhapsodises so beautifully in his essay on the origin of the work of art are made from leather, which is animal skin. A certain kind of intellectuality revels in the anti-intellectualism afforded by Heidegger's language, which demands a passive submission almost taboo elsewhere in the modern Humanities. This passivity finds its virtual analogue in the happy, servile authenticity of the peasant woman, which Heidegger deduces from Van Gogh's shoes. Contemplation here appears deep but not genuinely disturbing: it is a superficial vicarious experience of an imaginary other's suffering. Substitute a gas chamber or Hiroshima human shadow, or a simple pair of Nikes, for the shoes, and this supposed contemplativeness becomes unnerving. You can imagine committing a murder in a beautiful, mindful, Heideggerian way. Aesthetically powerful descriptions of the natural world, then, are not only a waste of time, but might unwittingly aid the 'other side' of the contemporary coin, which sees the world as an exploitable resource or as objects of instrumental reason (the difference between a cow and beef would be the application of this instrumentality).

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[18] M. Heidegger, 'The Origin of the Work of Art', in *Poetry, Language, Thought*. Trans. A. Hofstadter (New York: Harper and Row, 1971) 15–87 (33–4).

Heidegger's contemplative language is so seductive that in countless ecocritical and ecotheoretical texts, he is often the sole representative of a noninstrumental point of view. We cannot ignore this rhetorical mode, and not just because there are many adaptations of it. The Heidegger meme is seductive because it speaks to something profound, something often called spiritual. In order to get over Heidegger, we have to go underneath him.

Ecology is about intimacy. Instead of insisting on being part of something bigger, ecological thinking leads to a different framework: intimacy, not holism. Thus organicism is no longer a workable mode of aesthetics and politics. Organicism believes that form can fit content like an invisible glove, leaving no trace. Organic form is greater than the sum of its parts. Most environmentalisms – including systems theories – are organicist. World fits mind and mind fits world, as William Wordsworth asserted. In the margins of his copy of the poem where Wordsworth laid this out, William Blake wrote: 'You shall not bring me down to believe such fitting & fitted … & please your lordship'.[19]

Desire is inescapable in ecological coexistence. Yet environmentalism as currently formulated tries to transcend the contingency of desire, claiming that its desires if any are natural. Organicism partakes of environmentalist chastity. 'Nature loving' is supposedly chaste (impossible formula! like courtly love, or Neoplatonic love), and is thus slave to masculine heteronormativity, a performance that erases the trace of performance.[20] 'Leave no trace'. If you look like you are 'acting' masculine, you aren't. Masculine is Natural. Natural is masculine.

Organicism is a performance of no-performance. It is 'un-perversion', with all the ambiguity a double negative can muster, a desire that erases its trace as soon as it appears. Organicism articulates desire as erasure, erasure-desire. The curtain rises on a pregiven holistic world. But interdependence is not organic: it's differential. Things only look like they fit, because we don't perceive them on an evolutionary or geological time scale. Sphex wasps paralyse crickets to feed to their young. If you move a paralysed cricket away from in front of the burrow that the Sphex wasp who paralysed her is inspecting (for the presence of grubs), the wasp will repeat the same behaviour, moving the cricket back meaninglessly to the entrance of the hole, without dragging her in.[21] 'Nature' dissolves when we look directly at it, into assemblages of behaviours, congeries of organs without bodies. Nature looks natural because it keeps going, and going, and going … like the undead. And because we keep on looking away, keeping our distance, framing it, sizing it up.

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[19] W. Blake, *The Complete Poetry and Prose of William Blake*, ed. D.V. Erdman (New York: Doubleday, 1988), 667.

[20] See T. Morton, 'Queer Ecology,' (PMLA, forthcoming).

Blake heard the voice of authority in organicism. Authoritarian organicism gains its power by naturalising difference. Nature is unmarked ('leave no trace'). It is established by exclusion, and then by the exclusion of exclusion. We must rediscover what has been excluded from the book of Nature. Ecology must unthink *ecologocentrism*. I mean precisely a version of what Derrida calls logocentrism, the creation of a metaphysical scheme that sets up a sign as a Master signifier that magically stands outside the system of meaning, and guarantees the meaning and coherence of all the other signs.[22] Once this is established, we know what's in and what's out, what's up and what's down, what's marked and what's unmarked. The Interdependence Theorem does not allow this knowledge to congeal.

Perhaps we could give ecologocentrism the slip by saying that Nature is beyond concept. Beyond concept, Nature is, a Nature for which there are no words. But we are already using words to describe this wordless Nature. Thus a negative theology of the environment must fall prey to the deadly logos it wishes to transcend.[23] Thinking you can escape metaphysics by outlining a hyperessential being beyond being only repeats the problem.[24] 'Nature is not unnatural.' A negative theology of the environment is the ultimate chastity – it refuses even to name the non-name, refuses even to non-name it.

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[21] Hofstadter, *Gödel, Escher, Bach*, 360–1, 613–14.

[22] For further discussion see T. Morton, 'Ecologocentrism: Unworking Animals', *SubStance* 37.3 (2008), 37–61.

NO MORE BEAUTIFUL SOUL

Intimacy means we are caught in desire. Hegel held that philosophy wasn't just about ideas, it was about attitudes towards ideas. These attitudes were as yet unthought ideas, ideas that hadn't yet been realised consciously. If, as Donald Rumsfeld has claimed, there are known knowns, known unknowns, and unknown unknowns, there are also, as Zizek adds, unknown knowns – things that we know, but we don't know that we know them: the unconscious, if you like psychoanalysis. Once you realise what your attitude towards an idea is, that attitude itself becomes an idea, towards which you have yet another attitude, which you'll need to figure out – and so on in a progression that Hegel calls the phenomenology of spirit.

Like a vanishing point in a perspective picture, ideas select for certain ways of being understood. Some call this strange feature ideology. Ideology is not well understood, because we think it means belief, which we think means an idea you are holding onto tightly – these two assumptions are themselves ideological, and obscure what ideology is. Attitudes are automated features of ideas – they just pop up when you have them. They aren't subjective states independent of ideas. That's why attitudes are hard to get rid of: they're hardwired into 'that' side of reality, rather than 'this' one. If it were just a matter of prejudice, we'd all have grown up long ago. But as Marx saw, the attitude that sees attitude as prejudice (we call it the Enlightenment) suffers from its own blind spots, having do with illusions of freedom and autonomy.

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[23] See K. Rigby, 'Earth, World, Text: On the (Im)possibility of Ecopoiesis,' *New Literary History* 35.3 (2004): 427–42.

[24] J. Derrida, 'How to Avoid Speaking: Denials,' in H. Coward and T. Foshay (eds.), *Derrida and Negative Philosophy* (Albany: State University of New York Press, 1992), 74.

Nature seems incontestably 'there' – as many have reminded me, because what I need, as a theory guy, is a good strong dose of it to set me straight. In *Environmental Literary Criticism*, Karl Kroeber says that what 'postmodern theorists' need is a night out in a Midwestern thunderstorm, a ritual hazing that now sounds horribly like waterboarding.[25] But is the 'thereness' – more like the 'over-thereness' – of nature a lie in the form of the truth? What attitude is this truth enabling?

Hegel gave the attitude a name: the Beautiful Soul, which he found typified in Romanticism.[26] The Beautiful Soul suffers from seeing reality as an evil thing 'over yonder'. Is this not precisely the attitude of many forms of environmentalism? Ironically, the attitude that *nature* enables is the dreaded dualism, Cartesian and otherwise, from which nature-speak from Romanticism to environmentalism has sought to extricate itself. Nature is 'over yonder'; the subject is 'over here'. Nature is separated from us by an unbridgeable ontological wall, like a plate glass window – plate glass was the Romantic-period invention that enabled shops to display their wares as if they were in a picture frame, and therefore belonged to another order of reality. Plate glass is a physical byproduct of a quintessentially Romantic production, the consumerist. Not the consumer, but the consumerist: someone who's aware that she is a consumer, someone for whom the object of consumption defines her identity, along the lines of that great Romantic phrase, invented once by the gourmand Brillat-Savarin and once again by Feuerbach: 'You are what you eat'.[27]

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[25] K. Kroeber, *Ecological Literary Criticism: Romantic Imagining and the Biology of Mind* (New York: Columbia University Press, 1994), 42.

[26] G. W. F. Hegel, *Hegel's Phenomenology of Spirit*, trans. A.V. Miller (Oxford: Oxford University Press, 1977), 383–409.

This phrase implies that the subject is caught in a dialectic of desire with an object with which it is never fully identical, just as Wile E. Coyote never catches up with Roadrunner in the cartoon. If Wile E. Coyote ever did catch Roadrunner, he would eat Roadrunner, at which point Roadrunner would cease to be Roadrunner and would become Wile E. Coyote. There is in effect a radical separation between subject and object. Yet consumerism implies an identity that can be collapsed into its object, so we can talk of vegetarians, hip-hop fans, opium eaters, and so on.

One style stands out, a meta-style that Campbell calls bohemianism and I call Romantic consumerism.[28]

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[27] L. Feuerbach, *Gessamelte Werke II, Kleinere Shriften*, ed. W. Schuffenhauer (Berlin: Akademie-Verlag, 1972), 4.27; J.-A. Brillat-Savarin, *The Physiology of Taste*, trans. A. Drayton (Harmondsworth: Penguin, 1970), 13.

[28] C. Campbell, *The Romantic Ethic and the Spirit of Modern Consumerism* (Oxford: Basil Blackwell, 1987); 'Understanding Traditional and Modern Patterns of Consumption in Eighteenth-Century England: A Character-Action Approach,' in J. Brewer and R. Porter (eds.), *Consumption and the World of Goods* (London and New York: Routledge, 1993), 40-57. T. Morton, *The Poetics of Spice: Romantic Consumerism and the Exotic* (Cambridge and New York: Cambridge University Press, 2000), 5, 9, 50–1, 57, 107–8; 'Consumption as Performance: The Emergence of the Consumer in the Romantic

This type of consumerism is at one remove from regular consumerism. It is 'consumerism-ism', the realisation that the true object of desire is desire as such. Romantic consumerism is window-shopping, enabled by plate glass, and now by browsing online, not consuming anything but wondering what we would be like if we did. In the Romantic period, reflexive consumerism was limited to a few avant-garde types: the Romantics themselves. To this extent Wordsworth and De Quincey are only superficially different. Wordsworth figured out that he could stroll forever in the mountains; De Quincey figured out that you didn't need mountains, if you could consume a drug that gave you the feeling of strolling in the mountains (sublime contemplative calm, and so on). Nowadays we are all De Quinceys, *flâneurs* in the shopping mall of life. This performance is ever more pervasive: we haven't really exited the Romantic period.

Romantic consumerism can go one step higher than the Kantian aesthetic purposelessness of window-shopping, when it decides to refrain from consumerism as such. This is the attitude of the boycotter, who emerges as a type in the proto-feminism of the Bluestocking circle in the 1780s and 1790s, an attitude which Percy and Mary Shelley, and many others, practiced. The product boycotted was sugar, which was sentimentally described as the crystallised blood of slaves. The boycotter transmuted objects of pleasure into objects of disgust. To display good taste, you have to know how to feel appropriate disgust, how to turn your nose up at something. The zero degree performance of taste would be spitting out something disgusting, or vomiting.

Period,' in T. Morton (ed.), *Cultures of Taste / Theories of Appetite: Eating Romanticism* (New York and London: Palgrave, 2004), 1–17.

The height of good taste is abstaining from sugar, and spice if you are one of the Shelleys, who held correctly that spice was a product of colonialism.

The attitude of the boycotter is that she has exited consumerism, but this attitude is itself a form of consumerism. It's a performance of a certain style of aesthetic judgment. Believing you've exited consumerism might be the most quintessentially consumerist attitude of all. In large part this is because you see that the world of consumerism is an evil world. 'Over yonder' is the evil object, which you shun or seek to eliminate. 'Over here' is the good subject, who feels good precisely insofar as she has separated from the evil world.

Hegel's Beautiful Soul claims precisely to have exited the evil world. Hegel doesn't claim that the world may or may not be evil – what is wrong with the Beautiful Soul is not that it's prejudiced and rigid. The world is not some object about which we can have different opinions. The problem is far subtler than that. It's that the gaze that constitutes the world as a thing 'over yonder' is evil as such. The environmental fundamentalism that sees the world as an essential, living Earth that must be saved from evil, viral humans is the very type of the Beautiful Soul's evil gaze. Ironically then, this environmentalism is not spiritual, if by spiritual we mean transcending the material world, but deeply committed to a materialistic view that sees evil as a concrete thing that must be eliminated.

This environmentalism is a form of anti-consumerism, which puts it at the summit of consumerism, not beyond it. It is the most rarefied and pure form of consumerism. Beautiful Soul Syndrome (BS) plagues it, because it sees consumer objects, and consumerisms (the various styles), as so many reified things 'over yonder', from which it distances itself with disdain. How do we truly exit from the Beautiful Soul? By taking responsibility for our attitude, for our gaze. On the ground this looks like forgiveness. We are fully responsible for the present environmental catastrophe, simply because we are aware of it. No further evidence, such as a causal link that says humans brought it about, should be required. Looking for a causal link only impedes us from assuming the direct responsibility that is the only sane, ethical response to global warming and the Sixth Mass Extinction Event. It's worse than a waste of time to keep trying to convince people that environmentalism is a right way of thinking – a right attitude. The current ecological emergency should have proved to us that the environmentalist attitude – that there is a 'world' that is separate from me, that nature exists apart from human society – is not only wrong, but also dangerously part of the problem, if only because it provides a good alibi while impeding us from doing anything about our dilemma. The message of ecological awareness should not be 'We Are the World' (that awful charity song) but rather, 'We Aren't the World'. And never were: letting go of a fantasy is even harder than letting go of a reality.

Beautiful Soul Syndrome wants to induce the correct aesthetic appreciation of the world. But this aesthetic attitude can never truly become an ethical one. Kierkegaard terrifyingly showed how insidious Beautiful Soul Syndrome is, in his narrative of the seducer in *Either/Or*.[29] Aestheticisation is synonymous with evil because it holds the world at a distance from which to size it up. Thus the attitude that says, 'We need more evidence on global warming before we act' ironically joins the attitude that says, 'If only you could experience nature in the raw, you wouldn't have these evil beliefs about destroying it.' In both cases, violence hides beneath projections of innocence. Both statements come bundled with attitudes of awaiting some compelling, unmediated aesthetic experience issuing from beyond the subject. They are both examples of Beautiful Soul Syndrome: both require a certain aesthetic distance, an evaluative, pseudo-contemplative, 'meditative' stance.

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[29] S. Kierkegaard, *Either/Or: A Fragment of Life*, tr. and intro. A. Hannay (Harmondsworth: Penguin, 1992), 243–376.

If you beat up the Beautiful Soul, however, and leave it bleeding to death in the street, aren't you also a victim of Beautiful Soul Syndrome? However much you try to slough off the aesthetic dimension, doesn't it stick to you ever more tightly? At a certain limit, transcending Beautiful Soul Syndrome means forgiving the Beautiful Soul, recognising that we are responsible for this Syndrome, whether we picture ourselves that way or not. The only way out of the problem is further in: jumping into our hypocrisy rather than pretending to be disillusioned and beyond ideology, without attitudes. This is a test case for our ability to progress in social collectivity. It means dropping various supporting concepts that provide the background against which regular thinking takes place: *nature, environment, world, life*. We can't have our cake and eat it too: that's consumerism, which is Beautiful Soul Syndrome. The only way out is in and down, which is why I call my approach *dark ecology*.

Dark ecology realises that we are hopelessly entangled in the mesh. Dark ecology finds itself fully responsible for all life forms: like a detective in a noir movie, it discovers it's complicit in the crime. Dark ecology is melancholic:

melancholy is the Earth humour, and the residuum of our unbreakable psychic connection to our mother's body, which stands metonymically for our connection with all life forms. The irony of dark ecology is like being caught in your own shadow. Hegel disliked Romantic art because its ironies reminded him of the Beautiful Soul. He describes it in hauntingly environmental terms in his lectures on aesthetics.[30] Environmental awareness is, finally, a sense of irony, because it is through irony that we realise that we might be wrong, that identity might not be as solid as we think, that our own gaze might be the evil that we see.

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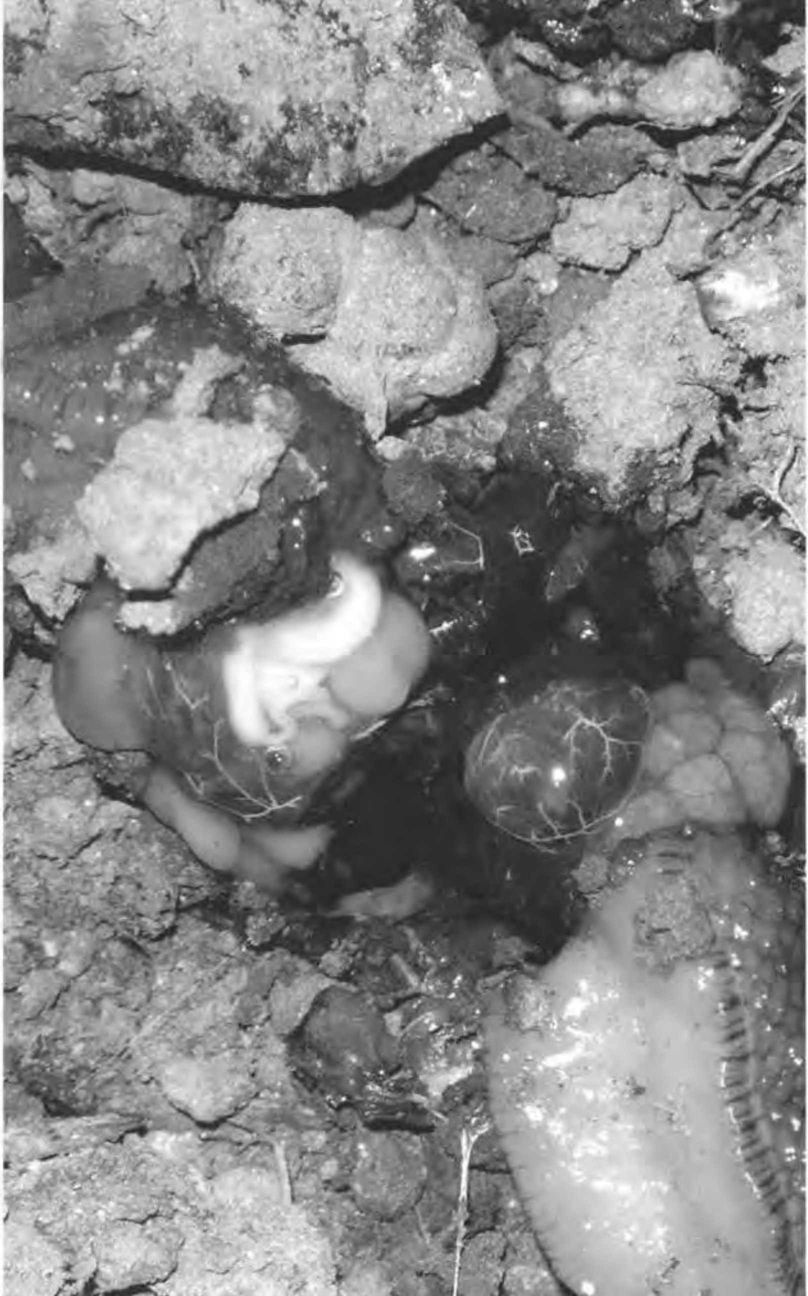
[30] G. W. F. Hegel, *Aesthetics: Lectures on Fine Art*, tr. T.M. Knox, 2 vols. (Oxford: Clarendon Press, 1975), vol. 1, 527.



How Many Slugs Maketh the Man?

FIELDCLUB

FIELDCLUB *investigates the interface between the human and the slug, and the augmentation of the human niche through the development of technospheric devices.*

pp226–229. *Bound Excess Diagram*
pp230–233. *Slug'o'metric Series: How many Slugs Maketh the Man?*

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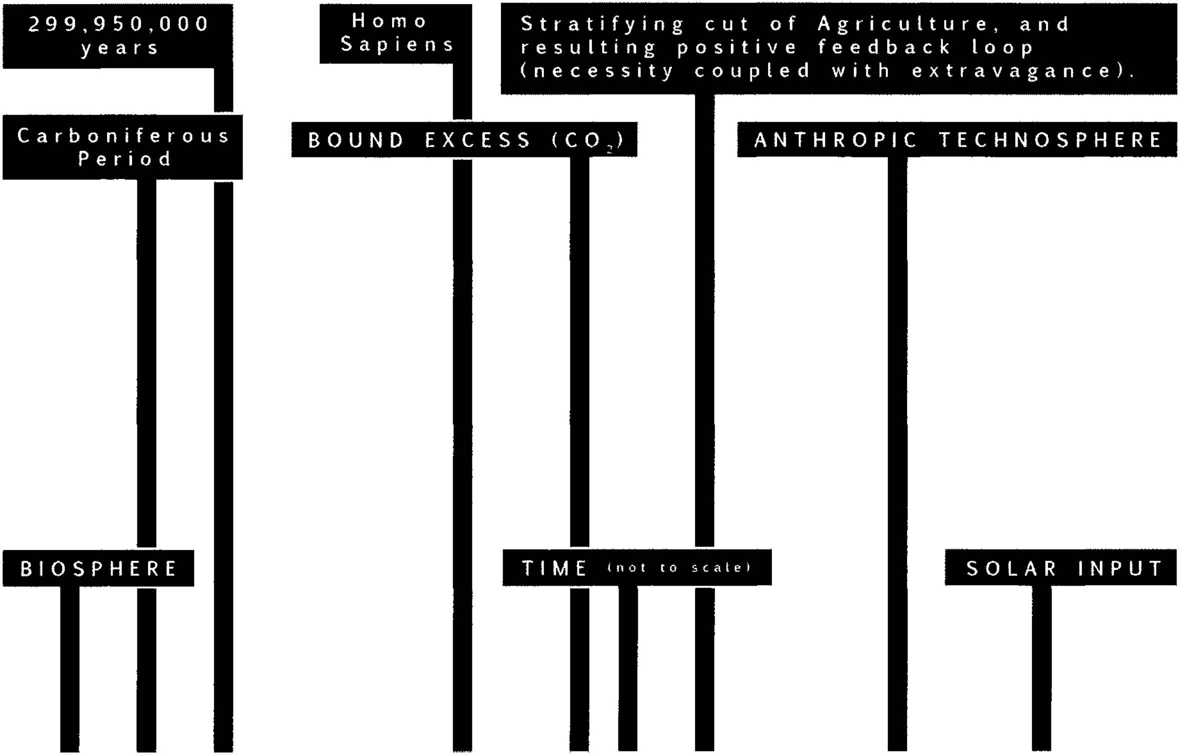
299,950,000 years
Homo Sapiens
Stratifying cut of Agriculture, and resulting positive feedback loop (necessity coupled with extravagance).
Carboniferous Period
BOUND EXCESS (CO_2)
ANTHROPIC TECHNOSPHERE
BIOSPHERE
TIME (not to scale)
SOLAR INPUT

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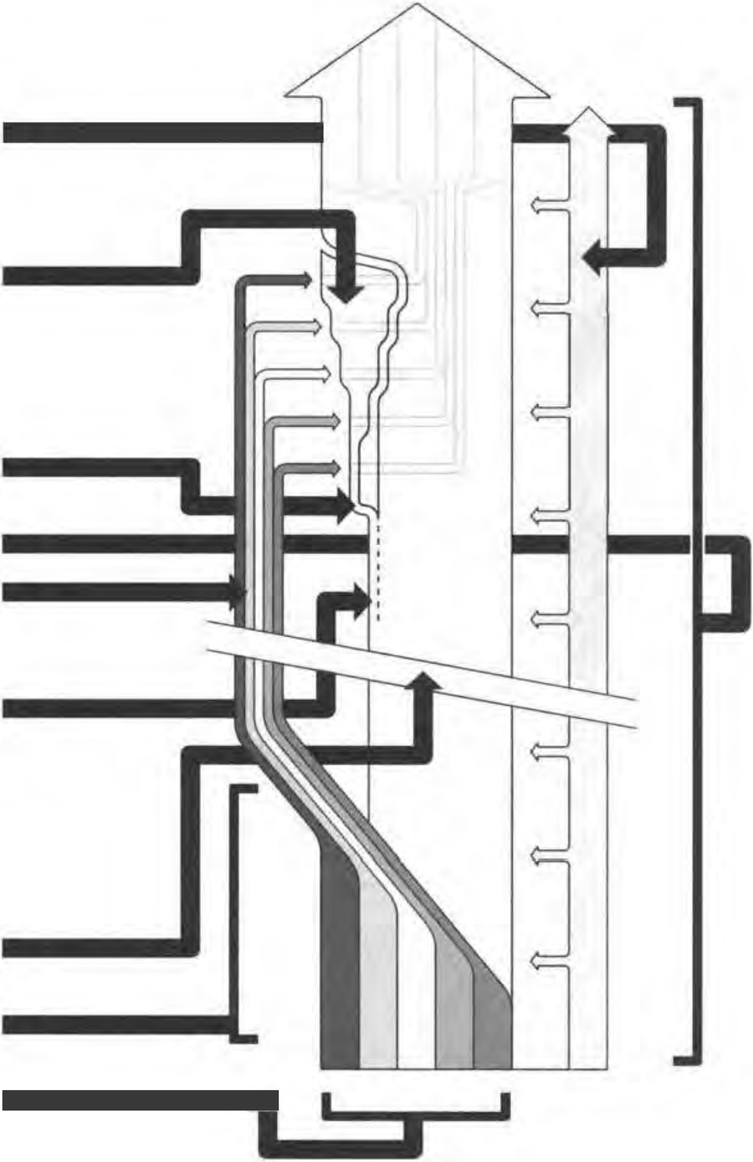
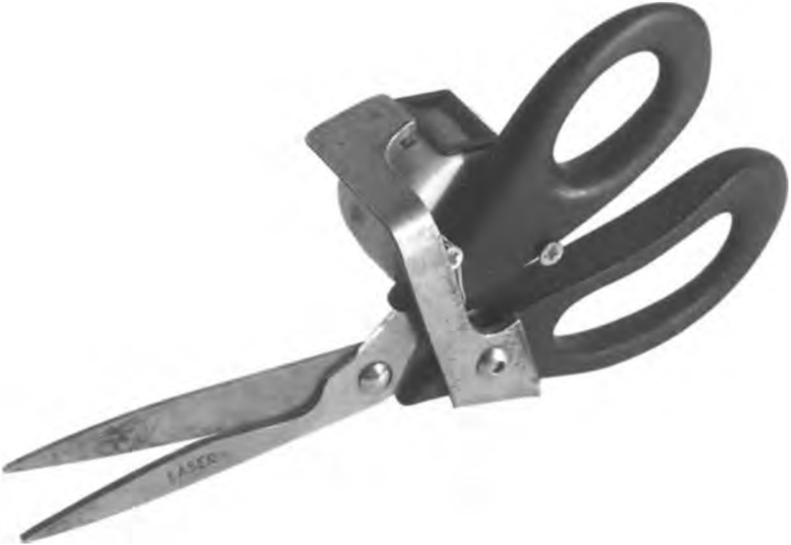
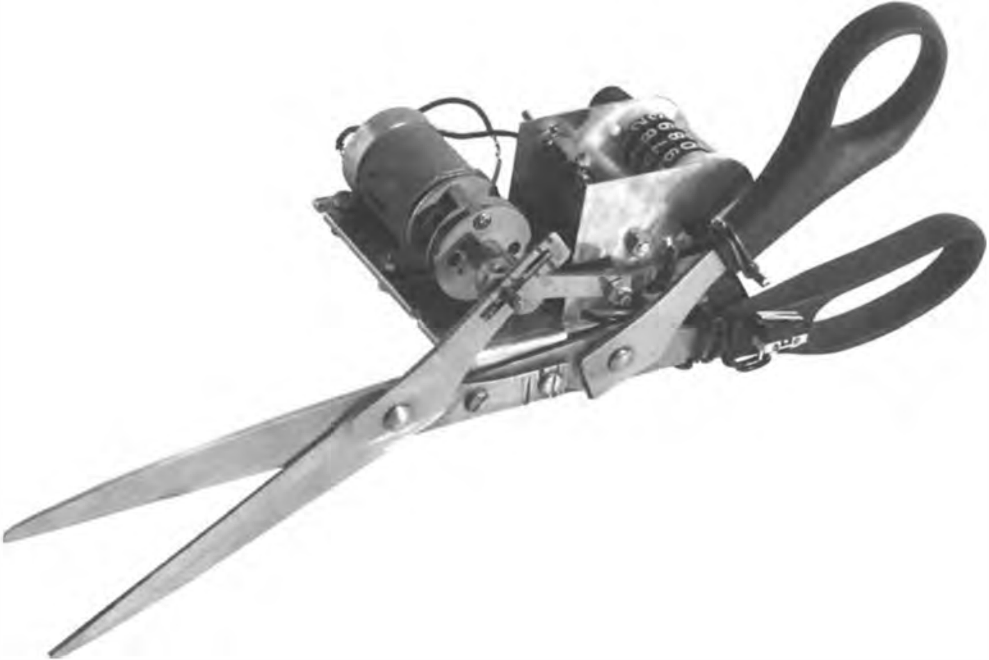
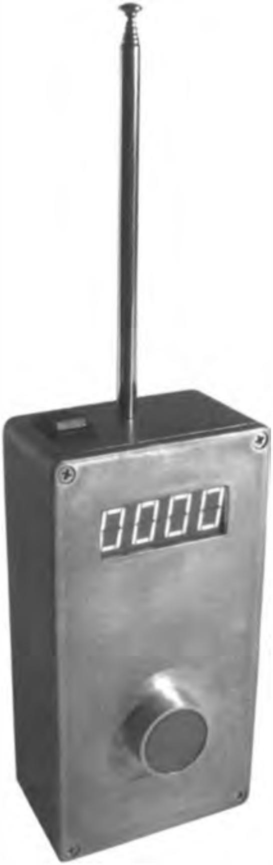


SLUG O METRIC T
2007 - TOTAL 1581

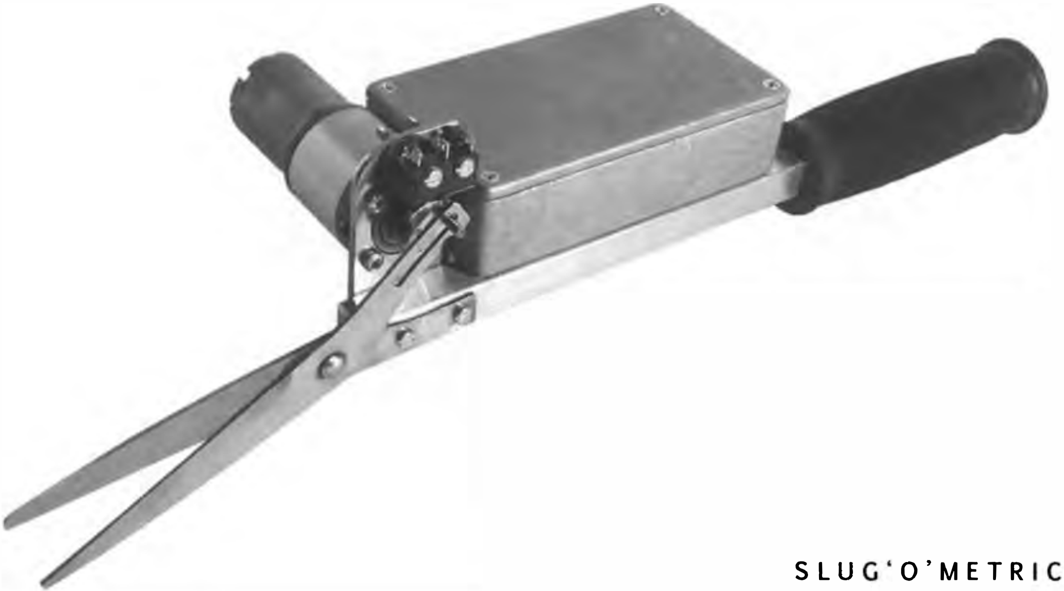




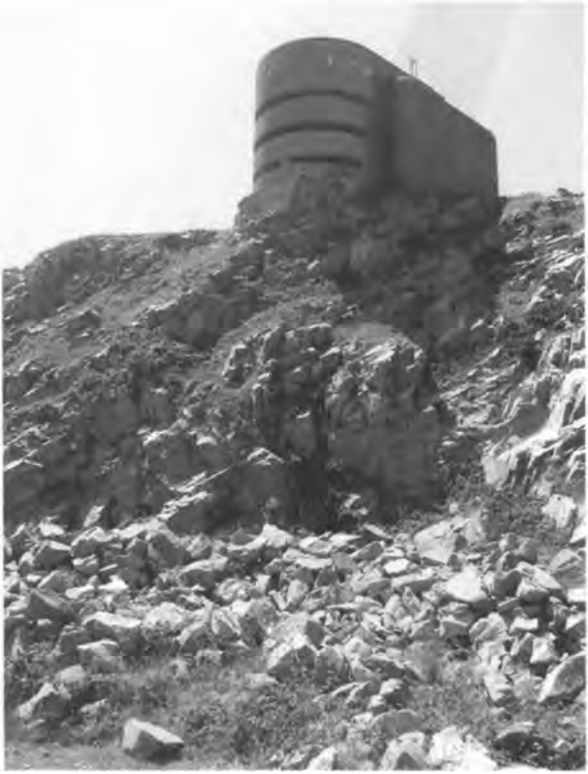
SLUG'O'METRIC II
2008 - TOTAL 968



SLUG‘O’METRIC III
REMOTE ACTUATOR
2009 - TOTAL 456



SLUG‘O’METRIC III
TRIGGERLESS [NON]COMPLICITOR
2009



The 'Odeon' on Alderney, part of the Atlantic Wall.
Photograph © Howard Stanbury 2006

Fossils of Time Future: Bunkers and Buildings from the Atlantic Wall to the South Bank

Owen Hatherley

HOMELAND PROTECTION STYLE

A couple of years before his death, J.G. Ballard wrote an essay for the *Guardian* on Modern architecture, as part of a tie-in with the highly successful *Modernism – Designing a New World* exhibition at the Victoria and Albert Museum. This exhibition can be seen as the moment where the British middle class fully reclaimed modern architecture and design, after an interregnum of post-modernist eclecticism – but, in much the same way that a Labour government was no longer meaningfully a Labour government, this was not the same modernism. Accordingly, a line was established where modernism, as a purist, clean and hygienic aesthetic developed in the 1920s, leapt over the dissonant, mutated, megastructural, 'Brutalist' modernism of council housing and 'comprehensive redevelopment' that occurred after 1945, picking up the thread again in the 1990s, with the Blairite tasteful style of architects like Allies and Morrison or property developers such as Urban Splash, with (this time a more brightly coloured) minimalism once again the reigning aesthetic. Of the many articles in the press celebrating the V&A exhibition, a Modernism that didn't fit the rubric of 'sweetness and light' was explained away briefly as a perversion, a parody, of the original idea. In the process, Modernism was denuded too of its attachment to left-wing politics, and of its close relation to the technological acceleration enabled by total war.

In contrast, Ballard concentrated on a warped Modernism, one that can barely even be described as architecture – the Atlantic Wall that was designed to protect against the inevitable 'second front' in the Second World War, a gigantic construction project designed by the Organisation Todt, the Nazi engineering force that had been responsible for the Autobahn network, and built by thousands of slave labourers. There has long been an urge to find the totalitarian smoking gun in discussions of Modernism, the missing link that connects unfashionable aesthetics and unpleasant politics. So, while the official architecture of Nazism eschewed Modernism for a mixture of monumental classicism and the Teutonic vernacular they called the *Heimatschutzstil* ('homeland protection style'), the suppressed aesthetics of expressionism and functionalism broke out in 1942, in the form of these completely utilitarian structures for the protection of the doomed thousand-year Reich. Built by slave labourers from reinforced concrete and placed along the French coast, these bunkers, blockhouses, observation posts, submarine bases and gun placements were largely forgotten by the 1960s.

It was at this point that Ballard became obsessed with them. He writes, retrospectively:

> Walking along the beach some years ago, I noticed a dark structure emerging from the mist ahead of me. Three storeys high, and larger than a parish church, it was one of the huge blockhouses that formed Hitler's Atlantic wall, the chain of fortifications that ran from the French coast all the way to Denmark and Norway. This blockhouse, as indifferent to time as the pyramids, was a mass of black concrete once poured by the slave labourers of the Todt Organisation, pockmarked by the shellfire of the attacking allied warships.

Rather than eliciting a feeling of relief that the blockhouses were an unoccupied remnant of a finished conflict, they seem instead to be 'waiting for the next war', and appear moreover to have developed outgrowths into the rebuilt British cities, those that were in some cases destroyed by V2s shot from these very bunkers:

> The scattered rubbish and tang of urine made me think of structures closer to home in England – run-down tower blocks and motorway exit ramps, pedestrian underpasses sprung from the drawing boards of enlightened planners who would never have to live in or near them, and who were careful never to stray too far from their Georgian squares in the heart of heritage London [...] Whenever I came across these grim fortifications along France's Channel coast and German border, I realised I was exploring a set of concrete tombs whose dark ghosts haunted the brutalist architecture so popular in Britain in the 1950s. Out of favour now, modernism survives in every high-rise sink estate of the time, in the Barbican development and the Hayward Gallery in London, in new towns such as Cumbernauld and the ziggurat residential blocks at the University of East Anglia.

This list was an roll-call of what Modernism had come to after World War Two, seeing as its 'heroic' era had allegedly died when the Atlantic Wall was built – and more convincingly, when the possibility of a belief in progress had been irrevocably shaken, after the white-walled, antiseptic aesthetics of the 1920s had failed to prevent the atavism and brutality of the 1940s – an 'architecture of death', where thin, smooth rendered walls were replaced by thickly abrasive concrete surfaces. Ballard writes regretfully, almost as an admission of defeat, that this project for the transformation of life was finally capable only of erecting funerary structures, as the transformation in life that it aimed for was not achieved. Seeing as Ballard is on record as loathing postmodernist architecture and the fantasies of old England embodied in Barratt Homes and Poundbury, we should read the following as the lament of someone disappointed in our failure to live up to the modernist ideal:

> I have always admired modernism and wish the whole of London could be rebuilt in the style of Michael Manser's brilliant Heathrow Hilton. But I know that most people, myself included, find it difficult to be clear-eyed at all times and rise to the demands of a pure and unadorned geometry. Architecture supplies us with camouflage, and I regret that no one could fall in love inside the Heathrow Hilton. By contrast, people are forever falling in love inside the Louvre and the National Gallery.

This rather peculiar essay ruminates inconclusively, but it pulls together all the elements of modernism which are most uncomfortable to the shiny Ikea Modernism of riverside luxury flats and glass trading floors. In the process it reminds us of the atavism in modernism itself, the places where, at the fringes of the modern movement, primal impulses and prehistoric building forms recur. The Atlantic Wall is a project as ancient as it is modern, whose forms evoke pyramids, hill forts, and, like Denys Lasdun's Halls of Residence for UEA, where the concrete has a similarly verdant, semi-rural setting, 'ziggurats'. This is an hieratic architecture, one where rationalism is forced into the service of the irrational. Ballard first traversed this landscape fictionally in the mid-1960s, in the short story *The Terminal Beach.* Although the landscape of bunkers and beaches is here rescheduled to the aftermath of a Third World War, Ballard's descriptions are clearly informed by his exploration of the Atlantic Wall. *The Terminal Beach* is what happened when, after lying in wait, the bunkers regained their functions, with the later forms of Cape Kennedy or Eniwetok transplanted onto the Normandy coast. The protagonist, Traven, treats the post-catastrophe landscape as a kind of mental experiment, as if researching the psychic processes that led to the apocalypse, only to find the structures taking him back far further:

> The desolation and emptiness of the island, and the absence of any local fauna, were emphasised by the huge sculptural forms of the target basins set into its surface [...] roadways, camera towers and isolated blockhouses, together forming a continuous concrete cap upon the island, a functional, megalithic architecture as grey and minatory (and apparently as ancient, in its projection into, and from, time future) as any of Assyria and Babylon [...] Here, the key to the present lay in the future. This island was a fossil of time future, its bunkers and blockhouses illustrating the principle that the fossil record of life was one of armour and the exoskeleton.

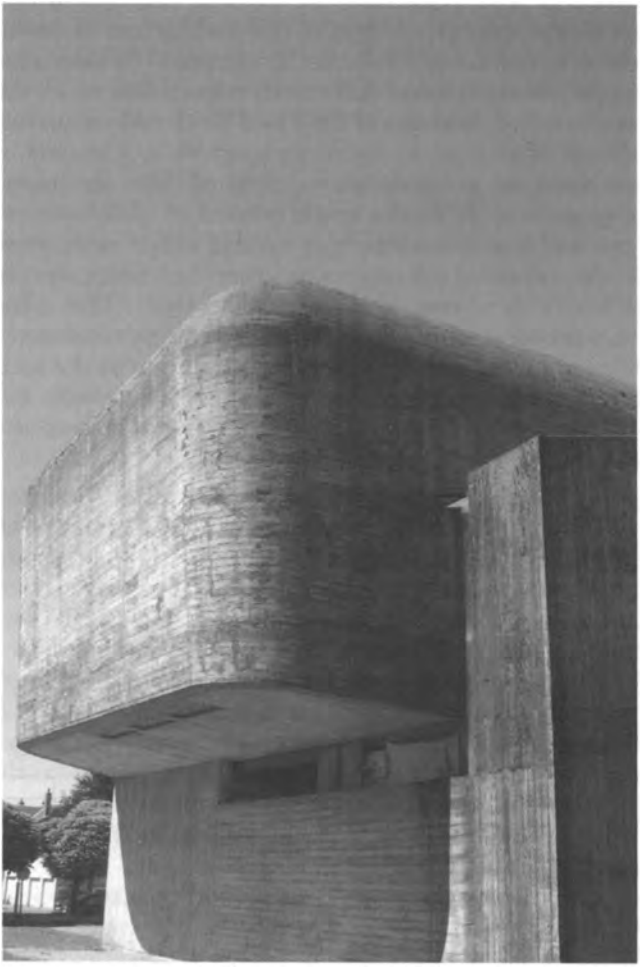
The bunkers recur in the psychic landscapes of *The Atrocity Exhibition* a few years later, where a similar protagonist fuses them with advertising hoardings, television, skyscrapers, the interiors of laboratories, and the prospect of 'sodomising the Festival Hall'. The Atlantic Wall becomes a pop landscape, another part of the media storm that the novel's researcher subjects himself to:

> Partly concealed by the sunlight, the camouflage patterns across the complex of towers and bunkers four hundred yards away revealed half-familiar contours – the model of a face, a posture, a neural interval. A unique event would take place here. Without thinking, Travis murmured 'Elizabeth Taylor'. Abruptly there was a blare of sound above the trees.

BUNKERS AS ALTARS

It's difficult to establish direct links between the Atlantic Wall and the Modern architecture that followed the Second World War, but there is one example where the influence was clear and publicly stated. Ballard's notion of the Atlantic Wall as an ancient formation, something primitive and monumental, was paralleled at exactly the same point by the researches of the (then) young architect Paul Virilio. In 1958, Virilio began a project to collate and catalogue the structures which would be pulled together into the 1975 book and exhibition *Bunker Archaeology*. This book was the first outside the field of military history to give these extraordinary places an extended, historical examination, in a mix of philosophical meditation on their 'meaning' and political investigation of their purpose. Virilio's account was divided under headings in which expected subjects such as 'Military Space' or 'The Fortress' were interspersed with a chapter on the notion of 'The Monument', in which he managed to find an almost spiritual element to this architecture of death, claiming that it could fulfil the 'monumental function that modernist architecture deliberately refused (but which the monumental classicism of the Third Reich had no qualms about)'. Elsewhere, he has as an epigraph to a chapter of his haunting, gorgeous photographs of these structures, a quote from Hölderlin much beloved of phenomenologists and sentimentalists, here making rather more sense in the context of military architecture: 'but where danger is found, there rises also that which saves'. This takes on a double-meaning, in that these seemingly monstrous, ferocious objects are formally dictated mostly by the need for protection, in their attempt to 'save' those inside; but Virilio takes it literally, in that the Atlantic Wall becomes a model for a new religious architecture.

In this he was preceded, perhaps, by Le Corbusier, whose post-war buildings for the Catholic Church – the chapel at Ronchamp, La Tourette monastery – use a bare, shuttered, 'crumbly' and searingly tactile concrete which has more in common with the material of these Nazi bunkers than that which he rendered and smoothed-over into the streamlined perfection of his 1920s 'Purist Villas'. This was little more than coincidence, spurred by Le Corbusier's accidental 'discovery' of *beton brut* after budget cuts in the Marseilles *Unité d'Habitation*, inadvertently creating 'Brutalism'. Virilio traces from this an elective affinity, bringing the latent connections to the surface, heightening their apparently religious aura and their extreme modernity, particularly in the case of bunkers surviving in small towns, which unlike the 'wall' on the beach, could gradually become accepted, quotidian:



Virilio's 'Bunker Church'. Photograph © Jorge Ayala.

> … the sky playing between the embrasure and the entrance, as if each vast casemate were a little ark, or an empty temple minus the cult […] these concrete altars built to face the void of the oceanic horizon […] these solid masses in the hollows of urban spaces, next to the local schoolhouse or bar, shed new light on what 'contemporary' has come to mean. Why continue to be surprised at Le Corbusier's forms of modern architecture? Why speak of 'Brutalism'?

Unlike the post-war rebuilding of blitzed cities along rationalist lines, the Atlantic Wall provided an architectural model for a shattered, traumatised world, and for Virilio at least, a possible model for salvation from this fragmentation and psychosis.

Their very method of construction, to the design of engineers such as Fritz Todt or Ulrich Finsterwalder, suggested the modernity of total war, a science of compaction and impact, where the concrete structure is not a frame, not built from the ground up, but a poured mound, where 'the centre of gravity replaces the foundation'. It is the manner in which the bunker is tailored to protect the human being against modern arms that is the source of its appropriateness for modern design. Far from being an aggressive architecture, for Virilio it is defensive: 'the imposing forms are the consequence of the adversaries' arms, of the fire power of those who rescued us, of our own armies.' The photographs show an architecture which, owing in part to the exigencies of camouflage, manages to be alternately extremely jarring and, in conservative architectural parlance, 'contextual'. While some of the structures seem to be a grotesque metamorphosis of the architecture of the twenties – especially the work of Erich Mendelsohn, with the expressionist curves recalling his

Einstein Tower and the gun emplacements an accidental parody of the ribbon windows of his department stores – others are more archaic. One bunker is disguised as a chapel, another insinuates itself into a barrow, evoking the ceremonial burial grounds of Mycenaean Greece; 'the continuance of the site', notes Virilio, 'conflates funerary architecture with military architecture.' Finally, in 'The Aesthetics of Disappearance', Virilio's photographs show the bunkers overcome by nature, sinking into the beach, overgrown with grass and lichen, gradually becoming earthworks.

The atavism of the Wall is most obviously associated with its part in the Nazi project, with its use of advanced technology in the service of the primal lunacy of blood and soil – but Virilio would adopt its forms for an atavism even more ancient than that of the thousand-year Reich. These bunkers became the model for the best-known of Virilio's architectural works with Claude Parent, in the firm Architecture Principe: the church of Saint Bernadette du Banlay. Make no mistake, this was a direct imitation of the forms of the Atlantic Wall, specifically of the curved observation posts which were some of the most striking of those documented in *Bunker Archaeology*. Designed in 1964, it's an incredibly puritan structure for the Catholic Church, with its bare concrete walls and an unreadable military exterior; but the interior makes Virilio's point about the spiritualisation of the bunker, in that the thin slivers of light which once came through the observation strips, originally just narrow enough to fit the tip of a machine gun, this time illuminate the church in appropriately pathetic fashion, with strips of what becomes in the crepuscular context an especially vivid light, offsetting a concrete which is left without detailing, without any obvious kind of architectural treatment. This church marks the culmination of a bizarre metamorphosis: From a utilitarian, instant architecture designed for emergency into something still, ponderous and seemingly eternal. It is especially extraordinary, then, that another more famous example of the Atlantic Wall making its way into mainstream architecture took place at the hands of architects best known for changeability, in-built obsolescence and bright, jolly optimism – the Archigram group.

MOUND AND GROUND

Archigram was a journal that ran from the early 60s to the 70s, written and edited by a group of architects, many of whom practised for the Greater London Council, and some of whom later went on to design wilfully spectacular 'blobitecture' in the 00s: Warren Chalk, Dennis Crompton, Peter Cook, David Greene, Ron Herron and Mike Webb. Archigram is usually described in terms of what Sam Jacob derisively calls '1960s grooviness: loon pants, lava lamps, men with moustaches and birds in miniskirts'. The journal, and the increasingly megalomaniacal projects featured inside it, are the antithesis of sober, sombre Brutalism – a cornucopia of bright colours and whimsical hypertechnology. The Plug-In City, The Instant City, the Walking City, the Bottery and the Electric Tomato – all of them imagining an architecture of inbuilt obsolescence, where buildings could be used and then discarded like any other consumer good, but where new networks and frameworks could provide a new mobility free from the earthbound mundanities of serious architecture. Now that we are secure in the knowledge that cities will not walk or float (something by no means certain in the late 1960s), Archigram are indulged and enjoyed as sixties 'icons' – The architectural equivalent of Terry Gilliam's animations for Monty Python or (former architectural student) Nick Mason's cover for Pink Floyd's *Relics*, their work (in the words of Sam Jacob) 'beautiful and meaningless like fantasy art. It combined traditional Victorian engineering and Heath Robinson mechanics with a naive trust in megastructures ... Architects look at this frightening vision, smile and think "how crazy, how fun!"'. The possibility that Archigram might have anything to do with something as menacing and unnerving as Nazi defensive structures would seem inconceivable.

Their built work as a collective never extended further than a playground in Milton Keynes and a swimming pool for Rod Stewart (neither of which are extant). However, in the early 1960s half of the group were the principal designers of the South Bank Complex, the Brutalist riposte to the bright, optimistic modernism of the Royal Festival Hall and the remains of the 1951 Festival of Britain. The original festival showed a celebratory, instant modernism which would seem to be a precursor to the seaside jollity of many Archigram projects; yet when the Festival site was prepared for new buildings, the plans were very different. Ron Herron, Warren Chalk and Dennis Crompton, along with John Attenborough, for group leader Norman Engleback, were the 'hairiest' of the many design groups of the Greater London Council. Their South Bank scheme, largely designed in 1960 but worked on until 1967-8, was a combination of the interest in pedestrian circulation and a certain 'anti-architectural' approach – both taken from the 'New Brutalism' of Alison and Peter Smithson – along with a windowless harshness which appears to owe a great deal to the Atlantic Wall. Brutalism was an idea developed in the 1950s by British architects and theorists which involved overturning the purist, rationalist aesthetics that informed post-war rebuilding in favour of a fragmented, impacted approach to building and planning. At first, the material with which it would become synonymous – reinforced concrete – was irrelevant, and its earliest instance, the Smithdon School in Hunstanton, was a work of steel and glass. Brutalism made an architectural fetish of services (water towers, pipes, etc), structural 'honesty' and stark, immediately memorable images – and, in planning, a focus not on towers in parkland, but on walkways, multiple levels, the famous 'streets in the sky' that ran through Brutalist housing schemes. It was an architecture based on a contradiction between designing for people, for sociability and interaction, and a stylishness based on the photogenic, imposing image. The South Bank development certainly featured plenty of walkways and public spaces – the undercroft now used by skateboarders, the many levels now partly closed to the public – but it took the image-making tendency to an extremely stark level: A dissonant, mute form where functions were unreadable from the exterior, without light or the intimation of (internal) human activity. The plan, cutely dubbed 'crumbly', actually involved exploding the usual building form, leaving it as a series of broken shards linked together by the pedestrian spaces – the 'crumbliness' seemed to refer more to the porous, tactile surfaces.

The head of the GLC architects' department, Hubert Bennett, was aghast at the Centre's extremism and added a grid of precast concrete panels in a desperate attempt to give the buildings a 'face' of some sort, leading to Herron, Chalk, Crompton and Attenborough's resignation (they were reinstated after a *Guardian* campaign). On completion the militaristic metaphors of the concrete

Гhe South Bank Centre, London. Photograph © Anne Ward.

forms (not to mention the glass spikes atop the Hayward Gallery) were immediately noted – the review in *Casabella* lamented 'the idea is as exquisite as the deck of a battleship [...] but on closer inspection, it turns out to be rather a sad collection of Second World War bunkers'. Even its defenders have managed to find the structure threatening and redolent of the emergency architecture of the Second World War: Simon Sadler in *Archigram – Architecture*

Without Architecture compares the glinting window of the Hayward Gallery to the slit of a 'pillbox', but claims 'the aggressive imagery of a gun emplacement is tempered by reminiscences of dinosaur movies and comic books'. The latter observation brings us closer to exactly why the Art Galleries and Concert Halls of London's South Bank have such a formal kinship with the Atlantic Wall. Certainly the 'pillbox' gun emplacements constructed in 1940 in Britain lacked the strangeness and complexity of the Nazi structures, so they seem a less likely source. Archigram had always been based on a 'toys for boys' aesthetic of fabulous machines, terrible monsters and available women, one where the science fiction comics they excerpted and reproduced in the Archigram journal could easily be of a piece with World War Two adventures, their horror dissipated by time and commercialism. Nazism might have been just another source of fantastic, malevolent machines to add to the walking cities and mobile homes. There was undeniably an influence from military technology at work in Archigram's imaginary architecture. In *Archigram* 6, a special issue on the 1940s, an editorial by South Bank architect Warren Chalk noted:

> The first half of the forties saw a great inventive leap made out of necessity for survival, advancing technology and mass-production techniques and demonstrating man's ingenuity, courage and investment under the stress and pressure of war. Out of this period came a strange social idealism. The idealism was to fade, but not the technology ...

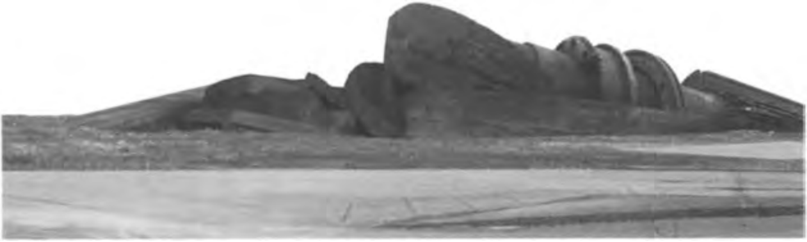
The technology Chalk was referring to was largely 'dry' types of building technique, the easily assembled 'Meccano' architecture which they were trying to continue in the '60s: 'prefabricated housing types [...] part of the 'clip-on/plug-in' heritage'. But what he says could equally be applied to the messier, 'wet' technologies of poured concrete, the heaping of which – whether by slave labourers or contractors – was the common factor in the Atlantic Wall and the South Bank Centre.

Visited today, the South Bank Centre looks distinctly odd in the context of a largely 'regenerated' riverfront. The Royal Festival Hall, into which reaches one of Chalk/Crompton/Herron/Attenborough's walkways, has been given an expensive facelift; the National Theatre which followed the SBC was cleaned up, making its relative classicism all the more clear; and a glass pavilion has been added to the Hayward Gallery. The buildings themselves are as rough as they ever were, however – the precast panels imposed on the complex appear to be rotting, and stalactites hang from the canopies and jutting extrusions; compared with the light modernism of the surrounding area, and the new buildings by Allies and Morrison, it appears ever more strange and ferocious, even down to the heavy, sculpted and weirdly organic metal doors, seemingly escaped from HR Geiger's work for *Alien.* It is in its desuetude that the anti-architectural, extremist ambitiousness of the South Bank complex truly reveals itself. The main reference to the complex in Archigram's written work is in their 1972 *Archigram Annual*, where it is included in a section entitled 'Mound, Ground, and Hidden Delights'. Here the inspiration for the scheme is claimed to be the 'Mappin Terraces', the artificial mountains of London Zoo. Rather than 'buildings', what we have here is a mound, a geological formation rather than a discrete work of architectural design – 'the aggregation of the unlike to the unlike in some amorphous, polyglot organism that is beyond single buildings, the notion of place and ground and artefacts as transient plantings'. The implosive concrete mound of the South Bank Centre seems designed not so much to be clipped on or clipped off, plugged in or unplugged, as to be abandoned to the mercies of nature, to be left as a series of crags which, as in Ballard or Virilio's descriptions of the Atlantic Wall, are ancient and primal expressions of advanced military technology. The similarity between this and Archigram's more famous projects is that they both represent an end-point of architecture. Here it secedes not to mobility or expendability, but instead to geological formations which hardly seem to have been 'designed' as such. Rather than the Instant City, this is the Instant Ruin.

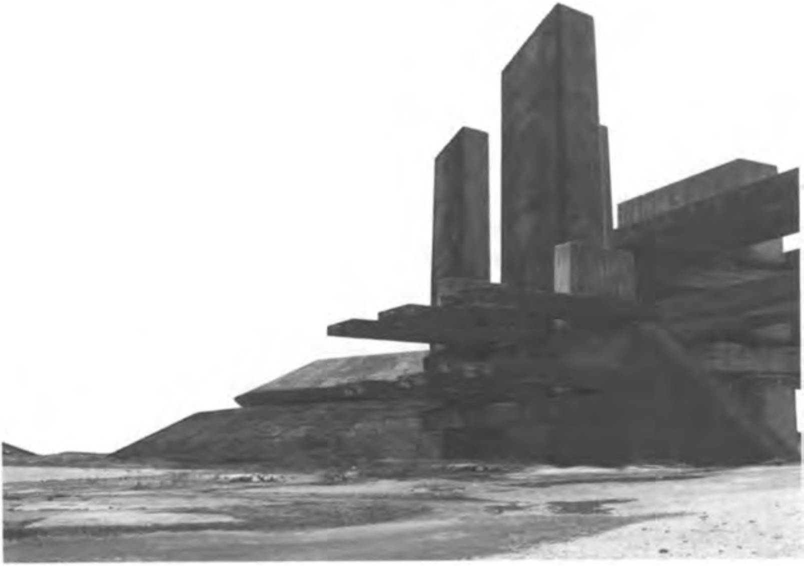
DESIGN BY DESTRUCTION

The resuscitated Modernism of the last fifteen years, though it has a certain amount in common with Archigram's positivistic, high-tech side, excises along with their utopian politics the more troubling elements of their thought. Concrete mounds become the 'sustainable design' of green roofs, walking cities are grounded, becoming PFI hospitals, and the pulp modernism of science fiction and war comics becomes an object for distant nostalgia rather than a similar attention to the apocalyptic pulp of our own time. And although it too may be an object for nostalgia, a complex such as the South Bank, with its series of fragments linked by walkways and cast in a concussive, tactile concrete, is all but unimaginable – in a building with no front or back, where would the tourists point their cameras? Accordingly, the chain of associations which links Nazi fortifications, avant-garde Catholic churches and 1960s arts centres has not continued into contemporary architecture. The fortified landscapes of the 1940s have an obvious commonality with the urban environment created by the War on Terror, whether the buffers in front of the Houses of Parliament, the concrete walls and watchtowers that divide Shia and Sunni areas of Baghdad, or the bunkers and emplacements of the Israeli Defence Force. But little of this spills over into architecture, and finds its continuation more in artistic and political speculation than in buildings.

A particularly troubling example of the former is the work of Nicholas Moulin, who creates exhilarating aestheticisations of blasted, apocalyptic landscapes. Moulin's images of paranoid cities and impossible industrial



structures are a kind of hard surrealism, a singularly unnerving re-imagining of urban space. In 2009 an exhibition of his work in Sheffield showed the inspiration of that city's Brutalist buildings, removed from their historical context and fused together, so that a windowless, militaristic structure such as the city's Electricity Substation is smashed together into the utopian socialist architecture of the Park Hill flats. Three photomontages were produced from components taken from local architecture, under the title *Wenluderwind*. Brutalist architecture was essentially optimistic, an attempt to create an open, socialist city. Yet the only other buildings in Britain to have ever employed so much reinforced concrete were pillboxes and bunkers. In Moulin's images, the difference



Nicolas Moulin, *Wenluderwind 2*, digital print, 2009. Courtesy the artist.

between these two kinds of concrete structure disappears, and the end result is a horrifying but thrilling unarchitecture made up of non-functional, barely even structural planes and fragments, thrown together to create aggressive agglomerations. While the open walkways and pedestrian levels of Brutalist buildings tried to engender community and solidarity, Moulin presents a city without people. The architectural site-spotter might recognise individual components of these compacted forms – the 'free and anonymous' planes of Victor Pasmore's Apollo Pavilion, the 'acoustic mirrors' of World War One, the walkways of Park Hill, the cast concrete patterns of Sheffield's underpasses, the obligatory bunkers – but they become irrelevant in these ferocious landscapes. Here, walkways go nowhere, blocks of flats transform into sheer, faceless walls, formerly functional components become hieratic monuments, girders are topped with spikes, objects are buried in the concrete while weeds crack the surface.

For those of us who admire the spirit of Brutalist architecture, there's something unnerving in the conflation of its pedestrian spaces with the bunkers of the Organisation Todt. The concrete of social-democratic city planning is here part of the same horrifying rubble as Nazi bunkers, or today's concrete security walls. Yet another of Moulin's works, used as the promotional photo for the exhibition, suggests why the utopian and dystopian elements in modernism can be so easily fused. This is an unaltered image of Park Hill, once one of Europe's most famous public housing estates. In the midst of a gentrification project to make it as shiny and unthreatening as any other piece of regeneration architecture, one wing of the complex has been stripped bare, leaving nothing but the concrete frame, and something intended to be teeming with life now appears to have been the victim of a bombing raid. Denuded of its function and its people, this very real structure suddenly looks like one of Moulin's paranoid fictions.

While Moulin presents an amoral view of a modern city become atavistic, there are some architects who have tried to imagine a re-use of military architecture for ends other than awed aesthetic appreciation. For instance, the project *Decolonising Architecture*, by Alessandro Petti, Sandi Hilal and Eyal Weizman, envisages the transformation of Israeli military buildings in occupied Palestine (mostly, the abandoned Oush Grab complex near Bethlehem) into a variety of different forms. A bunker becomes a bingo centre, with a watchtower used as the till, severely confusing the IDF patrol. In another proposal, the bunkers are allowed, as with Archigram's mounds and the disappearing, reclaimed bunkers documented by Virilio, to be taken over by nature. This is done for specific political reasons, in order to prevent the re-use of the structures by the Israeli army or by settlers. One idea entails part-burying them in rubble, another advocates puncturing the bunkers with holes so that they can be used for roosting by the migratory birds that converge on the hilltops. The architects call this 'design by destruction.'

Political Plastic

Interview with Eyal Weizman

In 2003, architect Eyal Weizman co-curated the exhibition A Civilian Occupation[1] *in which work by photographers. journalists and architects was combined to present a revealing account of the role of architecture in the Israeli occupation of Palestine. Censored by the Association of Israeli Architects, the exhibition demonstrated the potential of this provocative new perspective for shifting debate on the occupation from interminable moral polarisation to forensic examination.*

Cutting through the endemic euphemisms and evasions surrounding the debate on Israel/Palestine with a carefully-calibrated assemblage of theoretical analysis, interdisciplinary research and reportage, Weizman's book Hollow Land[2] *expands this project, traversing material and historical cross-sections of the occupation and its territorialities to reveal how the governance of space meshes with disturbing new modes of political and military power.*

Weizman's architectural practice with Sandi Hilal and Allesandro Petti, Decolonizing Architecture, *now proposes direct interventions into formerly colonized spaces with a view to defusing their political charge.*

In our interview with Weizman we discuss Hollow Land, Decolonizing Architecture *and his recent work which extends and develops 'forensic architecture', the evolving theoretical framework that has emerged from his research and practice.*

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[1] See R. Segal and E. Weizman (eds.) *A Civilian Occupation: The Politics of Israeli Architecture* (London: Verso, 2003).

[2] E. Weizman *Hollow Land: Israel's Architecture of Occupation* (London: Verso, 2007).

Collapse: In *Hollow Land* you speak of two distinct senses of the word 'architecture': Firstly you demonstrate that a reading of even the apparently mundane details of architectural projects under the Israeli occupation, reveals political investments, and the use of architecture as part of an extra-military arsenal. But this materiality of architectural structures *per se* embodies, develops and sustains the novel political structures which give the second sense of 'architecture': that of the architecture of the occupation itself, the political process seen as an enterprise of architecture – the construction, partition and organisation of (geographical, municipal, domestic ...) volumes.

We have long known that in being attentive to the practices of architecture and the way that they construct space, we can shed light on aspects of political life; how would you define your distinctive theoretical approach to this problem?

Eyal Weizman: In terms of the second sense, perhaps – in a rather abstract way – it is probably best to think about this question as bearing on the relation between *forces* and *forms*. The assumption is that – although in a nondirect and complicated manner – historical events are registered in material organisation. Therefore we might be able to glean from a forensic investigation of material spaces and traces the history that produced them, that is folded into them. The question is: How are histories inscribed in spatial products? And how can we make the object 'speak' them? So this meaning of architecture is a tuning in to the complicated reciprocal relationship between forces and forms.

The term *forensics* is really important here: Forensics, from the latin source, means *in front of the forum*: it is the art and skill of speaking on behalf of objects – narrating convincing histories from objects, convincing enough to become what we call evidence – to a forum of citizens or judges. Forensics is one of the methods that allows objects (or things) to speak, or a way of listening to them. So there are in this sense two interrelated sets of spatial relations folded into the term 'forensics': one is the relation between an event (or histories) and the spaces in which it is registered, and the other is the relation between the *spatial representation* of history and the forums within which it resonates or which it creates. This forensic dimension of architecture can be understood as an act both of claim-making and forum-building.

And it is the methods for exposing this that I was concerned with in *HL*: A process of 'forensic architecture' that is different from but analogous to, say, 'forensic archaeology', where one engages in a reading of how historical processes become form, and how, therefore, forms or material organisations are diagrams of the spatial, political and military relationships within them.

'Forensic architecture' thus aspires to reconstruct and narrate undecided or controversial events through a close study of the material properties of the spatial/urban realities in which these events are registered; to turn mute spatial products into active material witnesses that can be interrogated (and cross-examined). In this sense, the 'architecture' in 'forensic architecture' designates, not the product of building design, but an expanded field of spatial investigation and enquiry. On the other hand, the adjective 'forensic' can be understood as the very condition that enables architecture to become a diagnostic technique, whereby immaterial forces are made manifest and thus proclaim themselves.

But this process is elusive and contingent. Rather than assuming any straightforward mechanical materialisation of time, or a conclusive, transparent, objective apparatus of truth claims, its reading is inclined towards complex, sometimes unstable, even contradictory, accounts of events. It's more like the murky ground of a 'fuzzy' forensics of probabilities, possibilities and interpretations.

Nevertheless, there is a very simple mechanical way to imagine this relation – and I think that the Wall is a good example, because it could be read as one of the clearest mechanical manifestations of the relation of forces to form.

C: This is the Separation Wall, which serves as an emblem for one of the fundamental contentions of *HL*: that frontiers and borders can no longer be understood as rigid cartographical boundaries separating territories in two dimensions, but must be understood in three dimensions and as elastic and dynamic. Following Danny Tirza, you describe the Wall as a 'political seismograph gone mad', registering not only state and international intervention, but also micropolitical actions.

EW: Yes, you have a construction line of fortification that is elastic, and you have the politics of the Israeli-Palestinian-international political system, on the micro and macro levels: The international community, Palestinian resistance actions, and to some degree the residents of the Wall Zone – Palestinians, represented by human rights lawyers – are all constantly pushing and pulling at the path of this line as it is being built, routing and rerouting it. So that when it 'dries out' – which is the term human rights lawyers give to its state after all conflicts have been registered in its layout

– when it 'solidifies', you can see in every twist, turn and detail of the route itself the material imprint of forces, as they are applied within a particular human and topographical terrain. Now, that's a rather clear way of imagining the relation between forms and forces, but there are many other different ways in which forces are mediated into form, in what is always a complex process, that I hope also to capture or at least to note. Whether or not it achieves it in finished form, the book sets itself the task of thinking this materialisation of time, and it sees matter not only as an imprint of relations, but as itself an agent within the conflict.

The wall is initially a media space. Walls really do not stop flows. They modulate flows across them – differentiating them: money, people, electricity, sewage, water ... it's a system of filters and modulations. And the act of crossing is also always registration, recording, etc. Ultimately, if you want to cross the wall, if you're determined to cross it, you can; there may be a delay but it can be crossed. If not I wouldn't be able to go to work, which is on the Palestinian controlled side of the wall. So its path is seismograph of political forces, and also it registers all things that pass it.

C: An actor as well as a register.

EW: Yes, the Wall is an archive in these two senses of the term: it's an archive of all movements or flows across it, and its own movement (its constant transforming path) is an archive of the formative force fields surrounding it. Because the Wall is one of the objects that registers its environment, environmental forcefield – political environment – it can read this in a forensic sense.

So, you can see the politics in things, politics as it is articulated in the relationship between processes, agents, etc. across the territory. Consequently, if we dare to look at politics as a material politics, then architectural methodology is useful to analyse it. Politics can't, of course, simply be reduced to it; but it is incredibly useful to take it seriously, in terms of that kind of forensic relation.

C: If we refrain from saying that this second sense of 'architecture' is 'more profound' it is because of your refusal to treat 'empirical' architectural details as semiotic epiphenomena, mere *representations* or *signs* of supposedly 'deeper' infrastructural determinants. This seems to provide the key to your conception of the relation between the material practices of architecture and the idea of an 'architecture of the political'. You write of the wall that 'The logic of the late occupation is not represented by but *embedded* and *saturated* within these structures. The Wall itself *reiterates* some of these built physiognomies.'[3] The two senses of architecture, therefore, are intertwined in a variety of ways, through the multiple examples of embedding, saturation, reiteration, that *HL* exposes.

EW: Each material, in each example I'm writing of, has its own characteristics with regard to the way in which it invites politics to participate in it. So on one hand you could say the Wall is equivalent to a sensitive photographic film. But not in the sense that it is a representation. Things are printed, not on it (in a symbolic politics of graffiti) but *in* it; its form is a snapshot of certain changing relations.

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[3] *HL* 153, our emphasis.

But this has to do with the way it is constructed: the modular units which allow certain kinds of transformation, the way in which some material characteristics determine how it sits on the topography itself. So there are so many features through which politics traverses an object. Some of them are underground in the porosity of rock, the flow of water, in what kinds of plants grow on western side slopes, because the rain clouds come from the west, and drain back to the west. Ultimately, what goes into that kind of layout are so many natural, political, artificial, micropolitical forcefields, influences in which the Wall itself participates as an agent, in this kind of complex ecology of things. We must find the language to open up political process to these fields of knowledge. I find that otherwise politics is too often reduced to a kind of intentionality – you always need a culprit ... in whose mind an 'evil scheme' is emerging.

C: Then the heroic task of resistance becomes that of unveiling the ultimate centre, the face of power behind the complexity …

EW: Yes, so a lot of the time accounts of the wall are just boringly simple – Ariel Sharon drawing a line, Israel wants to do this, and so on … but they leave out everything to do with material characteristics. Also the problem of the path of the Wall has to do with the negotiation between security and agriculture: Agriculture is what forms the basis of the Israeli High Court of Justice's calculations of proportionality, i.e. the amount of wheat or olives that can acceptably be traded for security. This kind of negotiation is interesting politically, because it means that the Israeli structures are designed not according to their explicit political rhetoric, but through actual self-imposed moderations that are the only way they can achieve success. The moderation process of the occupation is more interesting than its naked application of power, because it is in this moderation that *calculations* take place: life versus security, water versus control, and, beyond these simple binaries, a whole field of calculations through which the occupation takes shape. This disturbs the simple logic of security, which is very politically determined. The minute this logic is enacted, it becomes a matter of counterbalances – all sorts of other agencies come into the picture: farmers, but also underground water, land consistency, real estate interests, community leaders, topography, environment and environmentalists, latitude, height, old graves – all these things, all these agents.

C: This vision of the multiple agencies involved seems to minimise the role of the state: its agency need no longer be central to understanding the process of colonization. Nevertheless isn't the rhetoric of naturalisation – the notion that the process is in some sense the natural outcome of multiple intersecting forces – precisely that invoked by the State to dissimulate its power behind an 'appearance of disappearance'?

EW: Yes I agree, but it's not a case of disappearance, it's more a case of the *strategic withdrawal* of the state: it appears and disappears. There's a real strong state form, constantly balancing these forces, and then acting visibly and declaring their suspension. Gaza is evacuated – we could say, it's worse, it's still occupied. Nevertheless, something has been done – Israeli settlers, by an act of state, immediately lost the right to live there, their lease on the ground was terminated. So, the power of the state is that it is withdrawn and than reappears. the interplay between chaos and order is extremely useful to it. This might be a particular feature of this colonization: the withdrawal of the state, the appearance of a 'weak state', the creation of a degree of chaos, are necessary means for having acts done outside and despite the law (international law and Israel's own) and outside state agreements and obligations. The complexity of multiple agents and the chaos of the frontier is very much manipulated by this state power. The paradox is that the state must suspend its own laws and rules so as to expand the territory, to land grab and kill, in order to create what it calls 'pacification', upon which its laws can again be applied. That is, the law has to be disregarded (not suspended) to be later enacted only when the frontier is pacified. Think about the American frontier with its genocides – which make way for the 'normal' rules of democracy to apply. This is the reciprocal relation between the frontier and the centre: the centre provides the means, the infrastructure, and when necessary the military support, and the groups are allowed to operate outside state purview.

But the frontier also demands things of the centre – politics as material reality is undertaken in the frontier. The state, which likes to think it's in control of this process, is also more or less dragged behind these processes. It imagines it can control these forces, and sometimes it can, but often the facts on the ground completely steer and shape its politics.

So this poses an historiographical problem: whether the settlement geography was planned or whether it emerged out of this interaction, without any kind of top-down planning and clear political will. This historiographical problem is similar to that of the ethnic cleansing of Palestine in '47-8. How did it happen that at the end of the war there were 750,000 Palestinians outside of state borders – by design or through a collection of contingent singularities?

These debates mirror the *historikerstreit* – the 'battle of historians' – over the Jewish genocide in Europe: To what extent was Hitler a weak dictator – Kershaw's thesis – and the beginning of extermination a process of cumulative radicalisation born out of chaos? Mommsen Bozart and Kershaw's model is that, although we imagine the Nazi state as very organised, bureaucratic, and so on, what happened was born out of bureaucratic and operational chaos: partly through the fact that that the people who could manage state affairs – the Prussian state's highly-trained bureaucrats – were replaced by the Nazis, who had no experience of government, and who started competing for the attention of Hitler; and partly through the nature of Nazi organization, which was kept deliberately overlapping, with internal conflicts and lack of clarity so that each will have a clear relation only to the top rather than laterally.

According to this model, when the killings start in 1940 in Poland, there is a level of ambiguity in the orders to the killing groups, the *Einsatzgruppe*: Each one takes initiatives, tries to outflank the other, tries to out-radicalise to get the attention of the Nazi commanders, and from within this chaos a project starts emerging, before it is fully theorised.

And the same discussion happens around the aforementioned problem of 1948: There is no question that the Zionists pushed the Palestinians, the Arabs, out of the country; the question is how this reality was created. And military historians such as Benny Morris say, in fact it starts with the battle over the roads – certain tactical necessities, some commanders needed to secure roads and didn't want people and houses by the side of the road, and they start expelling some and later they realise that people leave easily, and that they can make them leave … and then slowly that tactic is mimicked by others, until it emerges as a state project of ethnic cleansing and expulsion. On the other hand there are people like Ilan Pappe, who looks for the decision and the organisation in all this, arguing that from 1919 on there was a planned Zionist project of expulsion that was prepared in advance and carried out under orders, from the top down.

Now, the 'cumulative radicalisation' theory is nourished by functionalist approaches to history. And although I do not fully subscribe to that approach, I can see how it might be useful in describing the emergence of the elastic and ever-changing forms of the occupation. This is not to exonerate Zionism – to say that it's a kind of 'natural process' of expulsion. On the contrary. It *diffuses* responsibility, meaning that every unit or cell in the military knows exactly what to do – *without an order*, it internalises ideology, allowing every single soldier or commander to know what is expected of him *without* getting the order, or every member of settlement youth to know what to do. So that in fact, if you want to discuss it in terms of responsibility, of liability, it creates a wide diffusion. It's not a matter of separating decisions and their executors – the politics runs through the body of every soldier on the ground, the decision runs through them. So ultimately, we can think through functional analysis without making this very easy correlation between naturalisation and exoneration. When ideology operates thus, there's no need for speech. But it's not ideology in the modernist sense that we usually understand …

C: And, to go back to *HL*, what part does architecture (in the 'first sense') play in this ideological diffusion?

EW: In the organisation of space that we discussed: how does space emerge, how are the networks of settlements formed, what dictates the path of the wall … ?

Space is not a representation of a politics that would already otherwise exist in the abstract. Politics operates and flows *through* and *in* spatial practice. The architects are only part of a widely-diffused set of spatial practitioners, but without the architectural discourse and practice that was developed around the problem of building in mountain terrain, without the development of serial modes of construction, and without the complex principles that I describe in the book as 'optical urbanism', much of the aggregation of construction would not have been able to take place as it has.

C: There are however also rather straightforward examples of the ideological (in the usual sense) charge held by architecture – for instance the question of the use of nativism as an aesthetics in settlement architecture. In *HL* you describe the construction of dwellings that sustain 'national narratives of belonging',[4] with the cladding of Israeli dwellings with 'Jerusalem Stone' and the omnipresent red roofs. This indicates how strongly such imaginary 'authenticity' can (at least for those who have an investment in it) outweigh historical and geographical fact, thus allowing an architectural cosmetics to speed along the process of naturalising occupation. You emphasise the way in which, with the reducing thickness of the 'facing' required, this became increasingly admission that this was cosmetic signifier that bolstered the 'sacred identity' of 'Israeliness', retrospectively creating historical authentication and a biblically-supported sense of permanence.[5] – this being one way in which political exigencies influenced and promoted debates within Israeli architecture. Another aspect of this which you discuss is the merging of archaeology into architecture, with new buildings being supposedly only renewed expressions of a rootedness in the earth, and thus guaranteeing the discovery of a 'meaning of the earth'.[6]

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[4] *HL*, 26.

EW: In the latter case there is a kind of literalness in which what is archaeologically preserved is extruded into a volume, and that is very much to do with a directly Heideggerian influence, or variations on Heideggerian theory, which become apparent in architectural discourse throughout the seventies and eighties; and if you think of it, it makes a lot of sense. Dwelling replaces living … meaning is brought back into the anonymous environments of modernism, national causes of 'solutions' replace housing solutions. Here a variation of this discourse comes to resolve the embarrassing paradox of Zionism: In a sense, what could be more unrooted than the early architecture of Zionism, the white boxes, the international (often mistakenly called Bauhaus) style, the kibbutz – whose construction on ubiquitous pilotis seem to hover over the surface. So much of the architecture of the colonies around Jerusalem is one of the earliest playgrounds of postmodernism worldwide.

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[5] *HL*, 28-37.

[6] *HL*, 41-5.

Which is what brought to Palestine such luminaries as Louis Kahn and Isaiah Berlin. But I don't know if now the answer to that is a return to abstract modernism …

C: As we have discussed, you see the occupation developing less as the carrying out of a top-down Zionist state project, which would organise space according to a set of pre-given principles, and more through a selective 'laissez-faire' policy, exploiting the 'structural advantages' that chaos presents, that has allowed a multiplicity of agencies – commercial, religious, communicational, infrastructural, economic, pressure-group, legal, etc. – to produce a complex interaction, enacted in part through the organization of space, that tends to justify the processes of occupation.

Much of what you do in *HL* is to try to balance the description of the Occupied Territories as a sort of 'political plastic' which does not respond to a 'single source of power' with simultaneously trying not to yield to the temptation to vindicate this strategy of naturalisation. Can we detect here an isomorphism with Capitalism, which, as we have repeatedly seen, can hardly be combated through a head-on refusal or attack on any set of hardwired ideological principles, but employs and absorbs whatever is available, through a similar sort of 'structured chaos', until it seems there is no alternative to its 'second nature'?

EW: I would say yes – I think that, let's say, postmodern capitalism and the postmodern occupation are close relatives. We just need to historicise this: It is significant that the occupation occurs in '67 – which Chris Marker called 'the real '68' – a time of antistatism, political complexification and fragmentation, and of the introduction of new modes of technological and organisational networks. That mode of capitalism and this mode of occupation are both historical products, and being historical products, are prone to transformation. There is no eternity in any of them. There is a way in which the hysteria of the loss of any ideological alternative articulated by political power has led to this vision of capitalism as eternity – i.e. as nature, outside of history. But I don't see how this idea may survives five seconds of thinking.

C: Isn't the problem vis-à-vis capitalism rather how to overcome its *apparent* natural status and the resignation that it invites?

EW: 'Natural' is being outside history, in a way that came from nowhere, goes nowhere, will remain the same. I think that what we perceive now is a very distinct stage in the history of articulated class, labour relations, trade relations, that articulated this period in that way. There is no historical necessity in that historical product; it is political practice that can make it transform or do away with it.

C: Very well, but another aspect of this isomorphism might be as follows: You have spoken of 1967-8 as a turning point for an understanding of the occupation. How would the shifts happening in this time tie together the emergence of what we might broadly call 'postmodern' philosophy, and the movements that you track in *HL*?

EW: As I said, I agree with Chris Marker on one thing: that '67 is the real '68 – he wasn't referring to the occupation, of course, but it's true, one bleeds into the other, in all sorts of military practices and architectural styles. Part of the settlement project is initiated by Jewish communities from the States that come with a strong tradition of civil disobedience, of protest movements; and they protest against the state, they fight against this ossified labour-run state, their ideal is to break the state apart, and they do it with the zeal and some of the style of the sixties generation. Sharon is a state agent who breaks the state – the frontier man who despises state order and replaces it with action that legislates in retrospect. Sharon appears as, and behaves like, a 68er – with his raids, his kind of trip is going on unauthorised attacks to the desert, shutting off communication, killing, moving, swimming in the sea, you know, whatever, killing hostages, he's in this wild violent orgy. That's the violent face of the antistatism of the sixties and seventies.

C: He inhabits 'smooth space' …!

EW: He's one of the embodiments of '68. So again, it's not like a secondary manifestation of '68, like maybe '68 wouldn't have happened without this world … The other project that exists is third-worldism, which is broken in '67. So okay, I don't want to put Israel at the centre of everything – yes, it's Prague, we saw the tanks coming, we understood the Soviets weren't so good … but the other project – *tiermondism*, that is broken. So, you become NGOs, you become Green, this or that. But this is a moment where those histories are like engines moving each other.

You can't see that kind of face of capitalism as if it's the 'background' to the occupation, or the years of Israel of very significant prosperity at the end of the sixties, which is actually partly the motor of the transformation of the left. I'm going back to what we said at the beginning: It's not something on which it's registered, it's *part* of it, it's creating that. What collapses in '67 is not the West Bank, that's a minor story. Pan-arabism collapse with '67, and this is the loss, Nasser goes – his project is dead, America enters the Middle East and there is huge capitalization – an immediate undoing of political relations in a way that creates a hugely complex market. So again, it's not only what happened in the West Bank – the whole Middle East transformed in '67. Pan-arabism, the utopian social semi-communist nationalism that Nasser invented, was replaced with what only now becomes apparent as liberal pan-arabism, on other kinds of networks. So in effect it's a moment of cultural, economic, technological transformation, and we absolutely have to see the occupation as happening in that moment.

C: Further considering your 'forensic' approach, I wonder whether we ought to try to distinguish it from something like an imagined 'geo-psychoanalysis', aiming to excavate the unconscious material forces at work behind symptoms such as '"separation walls", "barriers", "blockades", "closures", "road blocks", "checkpoints", "sterile areas", "special security zones", "closed military areas" and "killing zones"'.[7] Chiefly because the latter might begin to sound like a species of 'psychogeography'. And indeed you begin *Hollow Land* with a quote from Patrick Keiller's *London*, a film dear to that group of writers that developed this now-popular set of ideas and practices concerning the relation of thought to place. However, the account given in *HL* seems to tell in very important ways against the tenets of this literary creed. Psychogeography often seems to suggest that merely by reconceptualising the spaces around us, by (in the words of your Keiller epigraph) 'revealing the molecular basis of [...] events', we can effect some sort of transformation – and to this extent is essentially a form of magical thinking. But even if understanding the past can help us to 'see into the future', no such kind of interpretive magic is going to transform the circumstances of the Palestinian people. What is the key to preventing psychogeographical insights from descending into a kind of literary indulgence, and transforming the results of research such as yours into pointers for concrete action in the present?

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[7] *HL*, 6.

EW: Yes, I think the book is written very much as a polemic against this and Lefebvrian theory, which situationists and psychogeographers refer to, and which really dominates very much critical spatial and geographical discourse on Palestine. For me, the really big problem with this type of literature is that it perceives space as simultaneously too soft and too hard. It is too hard in the sense that the built realities – the work of planners and architects and builders – is solid, fixed and unchangeable. It is too soft because often it sees the possibility of agency existing in the mere literal subversion of the existing, like a de Certeau kind of walking-is-reading-is-writing ...

So you have the domain of planners, those evil guys who designed Paris top-down. Paris is always the conceptual framework with which this discourse works, and in the West Bank this makes no sense! A hard city, with planners who make straight lines, Paris as a material/political reality has dominated critical post structural discourse, but in applying the spatial theory of Paris to a dynamic frontier you miss its essence of interplay and a certain levelling of agency that operates within it. You cannot solve the problems of Paris on the hills of Palestine! ... And then you have the domain of subversion and resistance, where what is left for our citizens to do is to reimagine, to exist in a playful manner, to walk different paths, and so on. For me this is too soft, and the perception of the planners is too hard. What you do by melting them into each other, by seeing a kind of continuity, an elastic space, you basically put all action on the same level. This levelling is something very important: The Palestinian resistant, the militant, the Israeli planner, the human rights activist, the corporation – the interaction between them is very multivalented, very complex – call it a forcefield, but it is also an *interaction* that produces and reproduces space, and for this you need the constant presence of all these actors. Basically, you have to imagine a different consistency of space: rather than space that is paradoxically too hard and too soft – which can only mean resistance that ends up soft and oppression that is too hard – you need to imagine a common plane, gelatine-like, on which those forces are simultaneously existing and interacting.

Of course, this raises another problem, which we have to acknowledge, a political question: how to think resistance when it becomes one of many formative forces of the making of the spaces of the occupation, playing in this arena and according to these parameters.

Are oppositionary actions merely another formative force in the making of the realities of the occupation, and if so, how can we differentiate between this and effective, meaningful resistance?

I will give you an example of weak oppositionary action that ends up reproducing the spaces of occupation. Recently I went to meet a representative of the Quartet in Palestine. You know, the US decided it doesn't have enough power to influence Israel, so they joined with the EU, the UN and the Russians – they formed the Quartet. These are four powers that could destroy Earth four times over; and they have put Tony Blair at the head of this joint organisation. And this guy is Tony Blair's representative – he is based in the American Colony Hotel of Jerusalem, has a entire floor there. So he invited my partner and I, and we start drawing up visions, and I talk and talk, and at some point I realize that he is somewhere else – he's saying, this is all good and fine but actually … listen, what we can do now is to propose architectural plans to improve the checkpoints, to make them more comfortable. This is what he wanted to talk to us about.

C: The problem is posed exclusively in terms of amelioration.

EW: Exactly, so where is the moment of transformation? The other day the former Israeli Chief of Staff said something really derogatory about Zionist leftwing organisations and human rights groups, said they are traitors or something similar, and the current Chief of Staff said no, without these organisations there would be complete chaos! Which we can understand as meaning that the occupied areas would be ungovernable; and that therefore these groups are also part of the government of the occupation, these organisations are most important for the Israeli project … so at this point you just send back your membership card…!

C: So once you've conceptualised these agencies as interacting on the same plane, how *can* you define resistance *except* as participation in the same game?

EW: If resistance is not complete withdrawal, if it is articulated through some form of action, the question is whether there is a mode of action that might contain the possibility of a break rather than the constant elasticity of material organisation and political evolutions. This becomes a philosophical question which I can only attempt tentatively to deal with. We must think of it in terms of the question of the Lesser Evil, which is the subject of my new book.[8] I here try to engage in philosophical and theological concepts, but only insofar as they emerge spontaneously from the problem of how this interaction on the same plane can actually create a new plane, can lead to a transformation, or a phase transition – that is, something beyond the rules of the game that already exists.

C: The problem recalls the polarisation on the question of the 'event' that we find between Badiou and Deleuze: Very schematically, Badiou excludes the possibility of novelty emerging from the actualised 'situation' or state of things, since the event is precisely something that cannot be read in any of the terms of the situation, and which is drawn out through a *subjective* fidelity to a universal truth that cannot but be seen as 'impossible' in those terms. Whereas Deleuze seems to suggest that an effort made against our spontaneous acceptance of the terms of representation or actuality (the 'image of thought'), might enable one to read the 'landscape' of virtuality itself, and prospect within the infinite resource of the virtual for intense singular points or 'lines of flight' that can be actualised.

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[8] *Il male minore* (Rome: Edizioni Nottetempo, 2009); *The Lesser Evil* (London: Verso, forthcoming 2010).

Of course, the charges which advocates of these positions make against each other are respectively, that of waiting, militating, for nothing less than a decisive miracle; and that of resigning oneself to a piecemeal re-engineering, re-formation, of the existing world.

EW: This bears a lot on the problem; if one is limited to either of these respective 'camps', it is rather clear where it places me, as it seems to me that the necessary transformative event could only emerge out of our political practice. There is thus a double problem, one of waiting for the arrival of a new political field, as the condition of a new life, the other that everything one might do would be already in the name of the occupation, because it is carried out under the occupation, in its endlessness. So we need to wait, or to pray, maybe a god can save us …

I guess one of the ways to complicate this further is to think of the idea of political action in relation to the end, which is embodied in the term that everybody uses, that of the *solution* – the two-state 'solution', the one-state 'solution'. Yes, in fact, these days the politics of Palestine – or the politics on Palestine – is indeed locked between two positions – end versus endlessness – one demanding the 'end of occupation' and the other claiming that no end is in sight and that there is a certain endlessness of conflict. This latter point of view is not about what solution to take – 'this one is *good* and this one is *not good*,' or the details of a solution, but rather about the idea of whether or not a solution is possible at all.

If a solution is not possible, this position goes, we are trapped in an 'endless present', a historical process without culmination. And without a solution we have to be able constantly to manage the conflict. The question then becomes that of finding *means of government* and the technology – much of it spatial technology – with which to manage this 'endless present' …

But we should make it clear that the search for the end was itself always part of the mechanism of the occupation. Every form that the occupation has taken since 1967 has been presented as an attempt to end the occupation. Perhaps the only constant thing about the occupation is that there are always attempts to end it. The geography of the occupation is thus physically shaped by the attempts to end the occupation, or to put it differently, to give shape – territorially, economically, and politically – to its never-ending end. We are constantly on the brink of having the occupation finished (another small push, another initiative…) and all actions on the ground (building settlements/evacuating settlements in Gaza, building outposts/removing the outposts, erecting the Wall/changing the path of the Wall) are undertaken in relation to this impending end ('why don't they let us end it?'). Each of the specific constructs that *HL* unpacks could be understood in relation to the concept of the politics of the (impending) end.

When discussing the end and looking at the ground, we tend to see yet another layer of physical apparati added to the growing piles of destruction. The occupation is finally nothing but its constant end … Therefore we need be suspicious of anyone that runs under the slogan 'end the occupation' – they must have yet another spatial apparatus in mind.

So this is how I would approach your question: It is by changing the frames of this 'end', this 'solution', replacing its terms with others, that we can give rise to another political reality and physical reality. And so, in the context of the research office I co-direct with Sandi Hilal and Alessandro Petti, what we have done is to replace that word 'solution' with a slightly old-fashioned, very banal word, but one we think is right: *decolonization*.[9] Which in fact refers to principles, to values, to a process rather than to an end-state. Decolonization doesn't mean people need to be moved from one place to another, but it rather means a system of inequalities must be undone, and the rest follows. The system in question is related to the land, to the law, to the military, to anything that's structured by colonialism.

In *Hollow Land* I presented *Decolonizing Architecture* as a chapter that deals with a project for the Palestinian ministry. Prior to the evacuation of the ground settlements in Gaza in 2005 I was part of a team speculating on different uses for these colonies/suburbs when in Palestinian hands. Issues of architecture were then at the centre of geopolitical debate, with the main question being how to understand and reuse the single family suburban home. The Americans saw its subjectivation potential, with Condoleeza Rice suggesting that its being inhabited as a suburban home by Palestinians would befit an American agenda that seeks to civilize Gaza by creating a broad-based middle class. In the end, the Israelis opted for destruction, part of the reason being the wish to deny an image of Palestinians living in homes of Jews (demonstrating a certain reversal and thus reversibility of a Zionist project otherwise typified by the opposite). In 2007, I joined together with Alessandro Petti and Sandi Hilal, with a grant from the Hodenschild Foundation, to form a new version of the project, this time on the West Bank. We decided we did not want to work with the Palestinian ministry, which since 2006 is no longer an elected body. So we formed our own organization, which is independent, and we have an office in a house in Beit Sahour, a little town just east of Bethlehem, on the edge of the desert. Initially, we had to change the way that architectural practice works – we turned the office into a residency. There are many volunteers: architects from Palestine, and internationals. And we run it also as an seminar, with readings and lectures. We hope that, and in some cases see how, our designs start to help in setting the stakes: Politicians or NGOs are using it to claim for land or to make a legal suit for various things. Architecture can become a tool in the political process.

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[9] See the *Decolonizing Architecture* project, at http://www.decolonizing.ps/.

To explain the thinking behind this project, let's look at 'decolonization', and the other concept that might start to guide an egalitarian future in the context of Palestine: 'return' (of refugees). Every 'return' of refugees from where they have been expelled is already a return to the (over) built, a displacement from the rural that will seek a return to the urban; there is no longer a virgin landscape to return to, or else the search for the original landscape will entail horrific violence. Like 'decolonization', 'return' suggests a relation of deactivation and reversal, a relation to the past and the future simultaneously; but there is no return to what has been lost, there is only a return to the built, and this return has also an explosive potential to articulate egalitarianism when one thinks about the transformation of realities on the ground.

Therefore, by articulating our political action vis-à-vis that kind of principle, the principle of equality between Israelis and Palestinians across this area, I think this is a much better frame than talking about this state, that state, four states, or whatever. Ultimately that's not what is important. And therefore we think that there are moments of possibility in the present where one can start articulating the idea of equality, seeking to open another trajectory. And these are those moments of the real transformation of the structure of the system itself. But one needs not wait for a miracle to start acting. You show that a relatively small part of the system – say a settlement – can be liberated, even as part of a compromised political process in relation to the politics of the present; when such a colony is unplugged from the political forces that charge it – one may say that it becomes a banal suburb … whereas right now such a suburb or colony is charged with the people who live in it, travel to it, come on the roads to it, the soldiers around it, electronics, and so on. It had power – does the power that exists in the architecture of colonial exclusion remain in it like a residue, when it is unplugged? The problem is also how to use it in a way that does not reproduce, that really breaks, this relationship of power and form. So: articulated differently, inhabited differently. Not in a kind of soft way – 'let's imagine we're in a different world' – but 'how do you build something else from it that is real?'.

This action could be accused of being part of the contemporary politics of oppression, but the question is whether there could be something in excess of this order; what is this excess? What other trajectory is it possible to open by refashioning the colonies, and why is it important? We maintain that by operating with the term 'decolonization', by demonstrating the possible other life that could exist within these moments of liberation, one might open a way to operate in the present in relation to a future that is much further away than the one-state/two-state thing. So it's both immediate and very far.

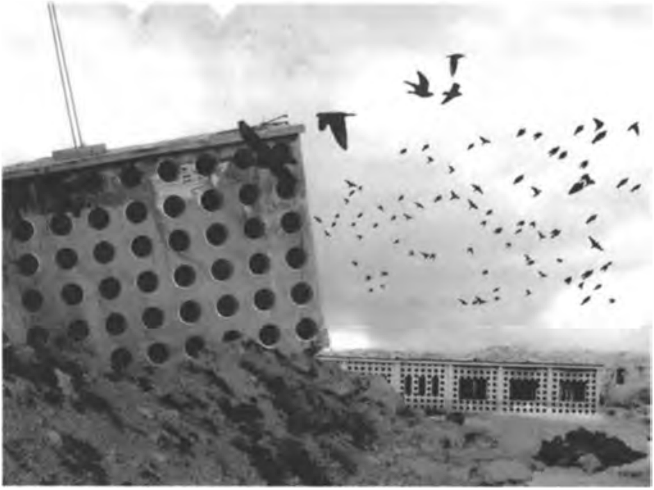
C: So the spaces despoiled by power represent an opportunity in so far as they become depotentiated in terms of the existing politics, and operate within this new political temporality. But does your speaking of 'excess' reflect a kind of materialist principle of hope (immanent, and set against both the hopelessness of the endless present and the redemptive hope of a solution): That (geographical, architectural) matter is ultimately innocent, that matter, at some level, can be decoupled from power? Isn't that a dangerous assumption? Is matter ever possessed of that kind of divine neutrality, beyond temporal political power?

EW: I like your suggestion of a materialist notion of hope. The issue is of course about the residue that is left after this unplugging. This lingering residue is different in each case, with each building and/or military base. The task is to identify this power that remains, this charge, and to attempt to reorient it.

C: The occupation seems to have continually identified geographical and topological contingencies, accentuating amplifying and exploiting them through architectural intervention. *DA* employs similar tactics, but in order to defuse colonial power.

EW: Again, I think you can say that our aim throughout the project is not to simply undo the power and techniques of the occupation but to reorient them.

For instance, we have permission from the Mayor of Beit Sahour to redesign a military base that was evacuated two years ago.[10] It is a beautiful area overlooking the town (obviously) and the desert – horrible but also beautiful. It's like a big fortress where soldiers piled earth continuously into ramparts until the top of the hill started looking like the crater of a volcano. And in there, in this place, by some



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[10] http://www.decolonizing.ps/site/?page_id=210

fluke of nature – you know migrating birds travel through Palestine on the way from Siberia to Africa, because they all travel through what is called the Syrian African crack; it's a kind of navigation and migration route for them. And every year they return to specific hilltops. This is a fantastic spectacle of nature, where for several weeks in fall and spring you have tens, maybe hundreds of thousands of birds circulating in swarms in the air, and somehow landing on those points. One of them is this military base – the Palestinians joke that the Israelis abandoned it because of a kind of 'Hitchcock effect'! And in a sense our claim, the legal issue that we participate in because we designed that site, is not on behalf of people but on behalf of nature. We almost want to say, human rights, its claims and its regime is ridiculous here, it's too late, and anyway it's become part of the language of the occupation itself. So we use birds as the subject of rights in court, something that has rather confused the Israeli authorities. But as you know, this refers to the courts in mediaeval times where animals were standing trial. Our articulation of the idea of return here was a 'return to nature.'

C: An example of real naturalization …!

EW: Or rather, using nature politically ... We're claiming it back for nature, and designing it simply to be abandoned and used by birds. We design not for a construction but for the controlled disintegration of the building, we accelerate or intervene in the process of its disintegration: Decay as a process of form-making in architecture.

My partner Alessandro Petti is a student and a friend of Giorgio Agamben, and the later is sometimes involved in our discussions. He introduced his concept of 'profanation' as a way of thinking the deactivation of the spatial apparatus of exclusion. Sacralisation follows the spatial logic of the separation of the sacred, when a system of exclusion simply moves down from the order of the divine. If the sacred, as a spatial practice, separates and secludes things out of common use, profanation is the undoing of this process. The dismantling of the power that exists. 'To profane' signified a restoration of things to the common use. For example, one of the main interventions was in the grounds of the settlement P'sagot, where our intervention sought to transform parts of this suburban colony into a nucleus of public institutions.

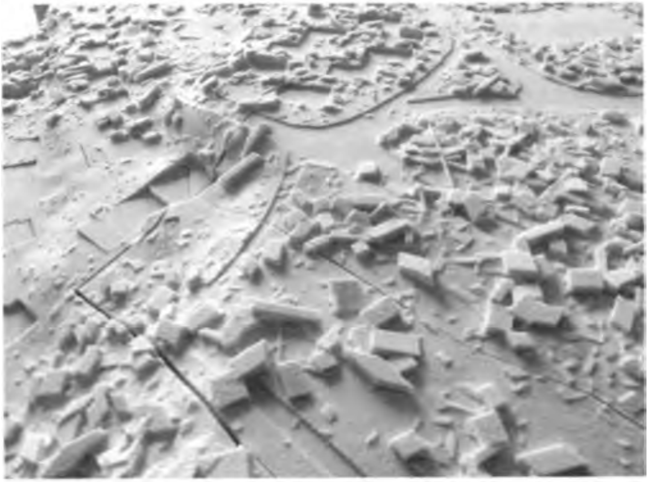
We think that at present, our task as architects must be that of transformation of the existing; and in relation to the ground, it must be articulated in relation to the question of *ungrounding*, a form of construction that creates a different gestalt, a different figure-ground relation, between construction and the landscape.

The question of ungrounding is really that the ground is a certain code, both at the operational and symbolic levels: the code of the city – its operational logic and its ideology is in the first fifteen centimetres. We are not concerned with the changing of the buildings themselves. Architecture has dealt successfully with the problem of this transformation – we know since the sixties that every structure is adaptable to any use – the question that remains, however, is that of the surface itself. It is a 'thick surface' in which occurs the designation of private and public, walk/drive/no walk, the relation between figure and ground, between the object and the surface on which it relies. So that is the challenge architecture is facing. And this is where *DA* intervenes.

C: When you come to rebuild these first five centimeters, what models do you rely on to avoid simply creating new problems by unilaterally imposing a new 'plan'? Which agencies would be involved in the re-territorialisation?

EW: In some parts of the areas we deal with, the regrounding is undertaken in a way that allows for multiple uses. We called it – with situ studio in New York – a 'smart surface' – a single ground surface area that could be used for driving, walking, growing. This is achieved by a variable density of paving elements produced from rubble.

C: This is interesting in relation to the philosophical discourse on the search for grounds, the Kantian task of properly grounding philosophy, followed by Nietzsche and others' repudiation of this architectonic ambition.



Reversing Kant's use of ground as a metaphor for philosophical security, could we could say that it is in fact, this very concrete sense, the ground – the 'first five centimetres' – that furnishes us with certain – political, social – certainties?

EW: Yes, as I mentioned before, the city is not spatially governed so much by its structures and buildings but rather by the way it organises and divides the surface. This is why is it essential to seek transformation not only in the buildings but rather in the ground itself; ungrounding is a certain 'liberation', we feel, from the prescribed order of planning – at least part of it …

C: A key to the nature of the strategy of the occupation is given in one of the epigraphs to *HL*, where Mourid Barghouti speaks of 'the duality of intelligence and stupidity'. This is a proposition with a double-sense, it describes a double obfuscation: You note throughout *HL* that the use of sophisticated theory has been a camouflage acting to evade responsibility for what are, at base, brutal and murderous processes – so that complexity provides cover for stupidity; at the same time, a wilful strategic stupidity and slowness in reacting has also proved useful for allowing irreversible processes to become 'locked-in' which then must be retrospectively recognised (naturalisation). These things take place through very complex processes but, as you show, these processes are quite amenable to a theoretical analysis: so here again, the status of theory is ambivalent – the insufficiency of thought is professed at in order to resist a theoretical purchase on the complex reality of the situation, but theory is used where convenient to provide a sophisticated façade for brutal actions on the ground. Was the application of 'postmodern theory' by the Israeli military ever more than an alibi?

EW: I don't think this question of theory is particular to the military. The people who most often apply theory, at least around me, are artists and architects. And I think sometimes theory does open up new sensibilities, without being translated literally. But theory, in the context of your question, belongs to a shift in sensibility; and military practice and theory produce, they go on producing – in an oblique way, they move in relation to each other. Along with the technological possibilities that were opening up, and the organisational innovations, there were philosophical innovations coming from other sources – early network culture for example. So they find echoes in each other, one language gives rise to a term that starts reorganising things in another system, but usually according to the latter's inner necessities and dynamics. So I think the answer is not to say, this or that manoeuvre is 'rhizomatic' – and that because military academies read about 'smooth space', they started walking through walls – but rather that the necessity to walk though walls, arriving out of military developments, finds the language with which it can be articulated, explained, and thus extended.

Incidentally, I thought I had found the first manuscript about walking through walls in a nineteenth-century military manual of counter-revolutionary practices, but a colleague showed me recently that in Roman siege manuals, this system already existed – In fact, it's a natural thing to do if you're a solider and you're moving through the city. But obviously, what I think happened in this case is, the question was how you co-ordinate thousands of people that are walking through the solid bulk of the city. To do this you need technology, not just theory; but to *imagine* that possibility is a leap.

On the other hand, I write in *HL* that the language of theory was not necessarily used against the Palestinians, but was used in the internal conflicts of the military itself – that some groups within the military created a language that helped them to define a common interest group within the military hierarchy, which then moved into a prominent position, with its disciples being promoted and gaining power; and then fell – just like in academia: It's an organisation – an organisation that kills; but with a similar 'sociology' to any other organisation.

C: Nevertheless, theory was used to sanitise, to bolster the illusion of precision and sophistication.

EW: Of course. In a sense what is otherwise a brutal act against indefensible people, part of the mechanism of oppression, becomes a 'sexy', cool thing. But this is not all that is at stake. I did not appreciate to what degree that article would have an effect in Israel. The officer – Aviv Kokhavi – who was talking about 'the room is your interpretation'[11] threatened to sue myself and the journal that was to publish a translation of this chapter. He cited three alleged mistakes in the article, he took on the biggest law firm in Israel – the one the deals with libel issues for the Haaretz Daily – that the military could afford him, asking that we remove his name from the article. I really wanted to go to court, because I would have liked to have 'interviewed' him again in this context, on issues – the events of that morning – whose exposure might contribute to a better understanding of the history of the occupation. So I wanted to go ahead, but he finally backed off.

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[11] See *HL*, Chapter 7.

Now, his demand was that I take *his name* out, and the editor of the journal – a very important journal in Israel, *Theory and Criticism* – who wanted to publish the piece suggested we might take the name out, and even that it would be better for the critique if the name were not mentioned. But here we realised something very important: although there's an existing group of very good academics and writers, a structural analysis, or a post-humanistic attitude still prevails, where individuals and individual responsibility don't matter, where names are not mentioned. So that in fact you can say practically anything 'radical' in academic organs without censorship, but the problem starts when you marry a kind of investigatory journalism with theory. You can find many theoretical writings on the occupation that mention hardly any names! My work, I think, has these two machines in them, journalism and theory, and I name names.

So this started a whole debate about how to write theory into a political event, as a resistance. When one writes into the event and when one investigates a particular scenario, one must write about people that are still acting, about a crime at the moment it is undertaken, exposing and analysing simultaneously. In this sense, libel suits are in fact the indication as to the effect that this writing is having – nobody cares when you write against 'Zionism' in general, but naming names and places and units and actions intervenes within the system itself.

However, whereas newspapers, obviously, have the means to defend against libel suits, academic journals do not. So we must find new platforms and new ways of writing or ways to secure the legal backing to allow us to write the way that is necessary; otherwise we'd always be put off by the threat of libel. We need to change the way of writing criticism into the event, and for that you need to combine a certain journalistic forensics with theory; to do it differently, you need a different technology of writing opposition. There needs to be an invention of a different way of doing things. Who needs this journal, if they can't take the risk, if they back down at any threat.

C: There's perhaps the illusion that theory can 'intervene' without taking any of the risk that's involved.

EW: Yes, speaking to other academics we are rather immune. We must face the risks, and this involves all sorts of state retaliation and also of course the financial risk of libel. At first, I was willing to go and represent myself, but the journal said, we are also cited on the legal suit, so we have a lot to lose. It's the journalism *plus* the theoretical frame that did it, it was the journalism *in* the theory, and this is what I think is important, that there is something that moves the theory along with it, and it does two different kinds of work simultaneously.

C: In order to be effective and transformative theory needs to rethink the relation between the abstract and the singular – actually-existing objects and people – it's not enough to position 'theory' on a higher plane, leaving it to 'the reader' to apply it themselves.

EW: Yes, it leaves open questions – critical work sometimes tends to assume another convinced agency that will be called to action, rather than taking the action itself.

C: You suggest that even if Israel/Palestine presents us with 'a unique type of political space',[12] nevertheless '[t]he architecture of Israeli occupation could [...] be seen as an accelerator and an acceleration of other global political processes, a worst-case scenario of capitalist globalization and its spatial fall-out'.[13] As you write: 'Exported globally [...] Israeli practices and technologies have connected the uniqueness of the conflict with worldwide predilections to address security anxieties through "circulation management"'[14] Not forgetting, of course, that the situation in Israel/Palestine has had a premier role in stimulating the events at created this climate of fear in the first place. Could you pick apart for us these two terms – accelerat*or* and acceler*ation*: In what ways can the occupation be read as an augury for our future, and in what ways has it materially contributed to actually effecting and accelerating that future?

EW: It's now an established dogma to say that Israel/Palestine is a laboratory for weapons, technologies of population control, software wars, and so on. But the question is *how* does it proliferate: How is it that we've seen bits that look like the Wall in Iraq – exactly the same section – and similarly with checkpoints, etc.

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[12] *HL*, 15.

[13] *HL*, 9-10.

[14] *HL*, 154.

Does a company go out there and sell it? Not always, or not exactly. Sometimes there is a direct transfer, a corporate or military transfer. But most often, actors in distinct places all draw from a single pool of images that exist through the media. Israel/Palestine is, in bytes per square metre or words per square meter, one of the densest places in the world. It has become a formation of the global consciousness. And very often, security officers and resistance borrow through mimicry – it's not necessarily that he was trained by an Israeli, he just exists in the same culture of which those images are part, and which they form. And then again there are other institutional ecologies, in which various levels of relations and ideas are exchanged; ecologies in which the Israeli military is only one of the nodes.

Now what I realised recently, in the next piece that I wrote, 'Legislative Attack',[15] is that the important laboratory here is not necessarily the technological development of weapons, how to kill, how to attack. There's a much more important front where intervention is meaningful and influential. And that is intervention on the level that affects our *perception of what is tolerable*, what is acceptable. And I think from one conflict to another, we push it, it's an elastic line. There is an elastic line that is constantly being drawn with every action undertaken, the line between what is and is not tolerable, what we will tolerate being done to *other* people. The momentary state of (also elastic) International Law is a diagram of the tolerable in this context. I feel that the Gaza attack is now redefining these limits. And the question is really how Israeli attacks themselves legislate laws in space. In a sense violence directed at a gray area of the law shifts the elastic limits of the law, so violence itself legislates. Given an undecided legal issue, if it can be attacked with enough guns, you produce a precedent that might shift the terms of the law. So the violence is directed simultaneously against the Palestinians and against the law. And I think that this is the most significant aspect of the 'laboratory'. People now can tolerate a situation where one state puts barbed wire around a million and a half people and counts the calories in food trucks as they enter and exit, arguing about how many calories a Palestinian man needs and therefore how much potatoes, rice, milk they should let in – basing this on the very minimum that would account for them staying alive. So this is the laboratory. It's like the Milgram experiment, where they asked people to send an electric shock – How much pain do you allow yourself to inflict? How much will be still tolerable – not by the victims, of course, but by others who are watching.

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[15] At http://www.opendemocracy.net/article/legislative-attack.

C: The law conceived as a drawing of the line gives way to something more like the Wall; International Law can be pushed and pulled by the same forces and events that shape the Wall.

EW: Yes, it belongs to the same elasticity that is the hallmark of this occupation.

C: And you take up this question of the 'tolerable' in *The Lesser Evil*, where you discuss the transformation of political questions into matters of accounting in which the justification offered for actions is not intrinsic, but appeals to a 'calculus of harm' in which, a quantitative line having been drawn as to what is 'unacceptable', anything one notch below this (which you satirically symbolize with the number '665', just one short of 666 ...) becomes, given the supposed constraints of the situation, unquestioningly accepted.

EW: In *LE*, I'm much more interested in the very techniques of forensics itself. Here, the relationship between space and law – what constitutes an evidence, how in the last few years a transformation has occurred by which evidence takes a central place, turning into what might be called a material witness – will be unpacked through very detailed and intense case studies. And all this around the background discussion of the moderation of harm.

Addressing the notion and dilemmas of the Lesser Evil emerges out of a set of problems encountered in *HL*. As we discussed at the start of our conversation, *HL* developed a distinct spatial imaginary in which, via the category of elasticity, space is understood as a 'political plastic' – the sum total of forces that operate on and within it – which forces could thus, to some extent, be read by examining it. But within these fields of conflicts, there grew another powerful agency. Besides the military and other state agencies, the wider field of contemporary conflicts includes corporations, the media and, significantly, independent organisations and humanitarian and human rights NGOs. So the immediate question is: What is their role in the production and maintenance of the spaces of colonisation and their mechanisms of control? Furthermore, this was a personal question, since my own work was produced through interaction with various agents within this conflict, including an (already rather cautious) engagement with the human rights organization B'tselem. So a discussion about the notion of the moderation of harm, through the culture of human rights and humanitarianism, was in place. Some theoretical propositions on this issue that were only outlined in *Hollow Land*, and some relatively marginal characters in the spatial drama it unpacked, have been expanded in *LE*. These issues and characters have stepped forward to take centre stage. It is as if the footnotes of a previous work have climbed above the line, to make a new book.

This idiom of the Lesser Evil captures much that goes beyond the issue of human rights and humanitarianism; but for them the idiom functions as a sort of vernacular. It seemed to me that, as a form of political expression, the Lesser Evil has become so deeply naturalised in political speech and culture that it seems to occupy the place previously reserved for the term 'good'. The problem of the Lesser Evil is famously concerned with a necessity for a choice of action in situations where the available options are or *seem to be* limited. The condition by which this choice is articulated affirms an economic model embedded at the heart of ethics – one according to which various form of misfortune can be calculated as if they were mathematical algorithms, evaluated, and acted upon. The problem of the Lesser Evil presents a closed economy, in which one cannot question the system that produces and distributed its evils – it's a system that presents itself as one with no outside. Under its aegis, politics appears as a mathematical minimum problem: how to reduce to minimum the 'evils' generated as the collateral effect of 'necessary' actions.

Of course, the problem of the Lesser Evil has its origin in the classical philosophy of ethics and in early Christian theology. In the latter the problem was articulated through the concept of the 'tolerated sin'. But the question still casts a long shadow on the politics of the present. Recently, it has been continually invoked in the state's effort to govern the economics of violence in the context of the 'War on Terror', and in private organisations' attempt to manouevre through the paradoxes and complicities of opposition action and humanitarian aid.

C: How do these developments relate back to the spatial and architectural concerns of *HL*?

EW: Within these fields, the politics and culture of the Lesser Evil has engendered its own technologies. These 'technologies of lesser evil' are technologies with a distinct spatial dimension, an 'architecture' – that is articulated in the mobilisation and production of new types of spaces, spatial apparatuses and means of spatial analysis.

C: And how has your methodology developed from *HL* to *LE*?

EW: In *LE* I seek to investigate the politics, ideology and culture of the Lesser Evil, both theoretically and empirically, through micro-scale intense forensic probes of three controversies, each of which is also a spatial controversy. Each is concerned with a specific spatial apparatus, technique, or a set of spatial problems, where humanitarian and military logics intersect; and each is narrated through a protagonist (the relief camp as a media space in 'Arendt in Ethiopia', the topographical model as an architectural/legal representation through which a certain legal/spatial interaction takes place in 'Best of all Possible Walls', and the question of the forensics of rubble in 'Only The Criminal can Solve the Crime').

C: These 'protagonists' recall what you were saying about the importance of the embeddedness of journalism within theory, and the importance of 'naming names'. The use of 'protagonists' seems to take this a step further; the purchase of theoretical concepts on the real is secured by their demonstrable 'incorporation' into actual people.

EW: Yes, the new work takes the idea of embodied theory further I hope: three controversies that are each a moment of changing practices around the problems of the Lesser Evil. Perhaps the most interesting one concerns Marc Garlasco, who is Human Rights Watch's 'Expert on Battle Damage Assessment' – their forensic analyst.

His work demonstrates a certain transformation of the methodologies of Human Rights thinking: A shift from a close reliance on survivors to material forensics, a shift from empathy to science. As you know, empathy or testimony were the main trademarks of HR work as this suited an ideology that sought to position individual versus state.

What Garlasco does is to try and read a certain system or order in the chaos of destruction. He is looking at ruins, discussed their form, looking at ways of destruction; he tries to differentiate between bulldozer destruction and controlled blast by engineers, aerial attack, tank fire. He says "I needed to paste together the battle story … to recreate the chaos of 'battle' minute by minute ...".

Now, Garlasco mentioned to me, in full frankness, that "when hiring me in 2003 [HRW] must have known that I was already involved in the killing of about 250 civilians in Iraq." Because before joining HRW as military analyst, Garlasco worked for seven years at the Pentagon. During the Iraq War in 2003 he became 'Chief of High-Value Targeting', which essentially meant he was a military target assassin – for instance, in charge of killing Saddam Hussein and his leadership! A central part of planning these missions was to do with a calculus known as 'Collateral Damage Estimate', which establishes the 'right balance of civilian casualties in relations to the military value of a mission'. "The magic number was thirty," Garlasco explained to me when I met him. "That means that if the computer came up with thirty anticipated civilians killed, the air-strike had to go to Rumsfeld or Bush personally to sign off. Anything less than thirty could simply go ahead." This estimation of civilian deaths was done using software called *Bug Splat*, that synthesised environmental factors such as the size of the building, its construction materials and techniques, the percentage of steel and glass in its envelope, the population density within and around it (varying according to the time of day), weather condition, and so on. These were calculated against factors such as the size and type of the bomb, its fuse and the direction of the attack. So, Garlasco had to study architecture, structural-engineering, and urbanism; the killings he planned were to be undertaken in people's homes. If the aim is to use the minimum sized bomb to achieve the required effect, designing a bombing mission resembles a mathematical minimum problem. Such calculations are part of the very logic of this weapon – a weapon that hits *and* legitimises, a weapon that kills legally.

Garlasco stayed in the war although he didn't agree with it: "Whether you agree with the aim of war or not it is going to happen," he said, "so I wanted to do it in the best way I could … I had a responsibility to the pilots and the civilians." *Responsibility towards the civilians!* "I didn't try to kill civilians," he continues, "I focused on military targets and tried my very best every day to minimise civilian casualties – as required by the Geneva Convention." The question is, of course: Minimised in relation to what? Reduced from what number?

After Baghdad fell, Garlasco left the Pentagon to take the job with HRW. HRW was the organisation that sent him to Iraq for the first time. He had previously only seen the place on military screens. Garlasco's credibility as a former Pentagon expert was used extensively in its press releases and the media, where he was often referred to as 'former Pentagon officer'. And he has become the celebrity HR analyst. He has also been an extremely effective one: in Iraq, on torture, he helped McCain on the anti-torture regulations; he was in Lebanon during Israel's attack, in Georgia during the Russian one, in Afghanistan again and again; his work lead to UN to ratify the agreement on cluster bomb ban.

Now, paradoxically or not, it was his military past that gained him the visibility and credibility he enjoyed as a HR analyst. The Washington Post called him 'the man on both sides of the air war debate' and he was often asked about 'crossing the lines'. *But did Garlasco really cross any lines?* This metaphor might be misleading. Although Garlasco's move from the Pentagon to a human rights organisation was understood by many according to the popular narrative models of a 'redemption story' – like a St. Paul whose sainthood is only as great as his sin – this misses the extent to which, at present, humanitarians and militaries are intertwined in their methods and aims.

Perhaps a better model to consider is the detective genre: like Professor Moriarty in Sherlock Holmes or Dr. Hannibal Lecter – the psychotic killer in whose mind lies the clue to solving and stopping ruthless murders. A genre in which a crime can only be solved by those that can think like criminals, by those that have been criminals.

This was reflected also in his forensic works: the collapse of buildings was the method by which he planned the assassination of the Iraqi leadership, and buildings rubble was also the means by which he would reconstruct the story of an attack for HRW. As he said to me, "my forensics is a reverse engineering of the process of military destruction".

C: With this example of 'embodied theory' it seems we are close to the state of affairs Deleuze described in suggesting that a book of philosophy should be 'like a detective story' (perhaps, in view of your forensic approach, *CSI: Jerusalem!*); and that your protagonists are something like the 'conceptual personae' who, he insisted, inhabit the 'theatre of philosophy' and are necessary to the very functioning of conceptual thought. Only in the theatre of twenty-first century warfare, the dramatis personae are real people who are the avatars of stranger conceptual formations than could be invented by any philosopher, and who reveal the sometimes grotesque structural assumptions within which this warfare is carried out.

EW: But wait, there is more to the story … Finally, although his work has really transformed the capabilities of HRW, on September 15 2009, the very same day of the release of the Goldstone report, HRW announced Garlasco's suspension. A few days earlier some pro-Israel blogs publicised that

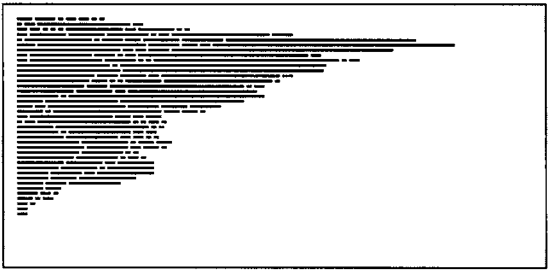
Garlasco collected Nazi-era memorabilia, and accused him of fetishism. Garlasco explained amongst other things that his geeky fascination with militaria (his fetish) only substantiates the fact he is a good forensic analyst. And I think he is right – that forensics is itself a kind of fetish – Fetish not in a Marxist or psychoanalytical sense, but in the sense that reading the event from an object always involves the excess that is within the object. The personal story of Garlasco stands behind the power of his forensics ...

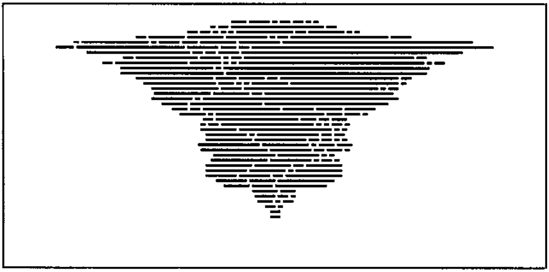
C: Finally, in the postscript to *HL*, you ask how architecture as a professional practice can be expected to 'learn from' Israel/Palestine. Do you see any indications that architecture, in general, is beginning to take its political responsibility seriously – everywhere, not just in highly-heated zones such as Israel/Palestine?

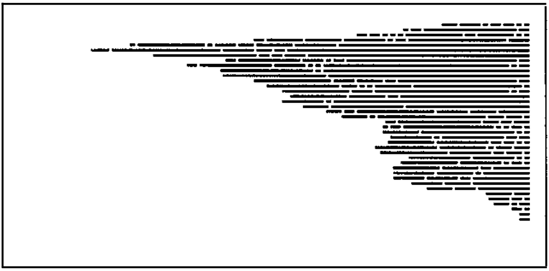
EW: This is an architectural reference, of course – *Learning from Las Vegas*. So it's this moment of postmodernism where architecture needs to break the disciplinary barriers and learn from other things. But yes: I don't say it's because of this book, but there is increased involvement of architects in territorial-political issues, yes. I don't know if that's a good thing yet …

C: If Las Vegas (as well as being the original location for *CSI*) is the theme park of late capitalism, is Israel/Palestine the darkside Las Vegas … ?

EW: Interesting, Maybe the light side! The new Las Vegas …



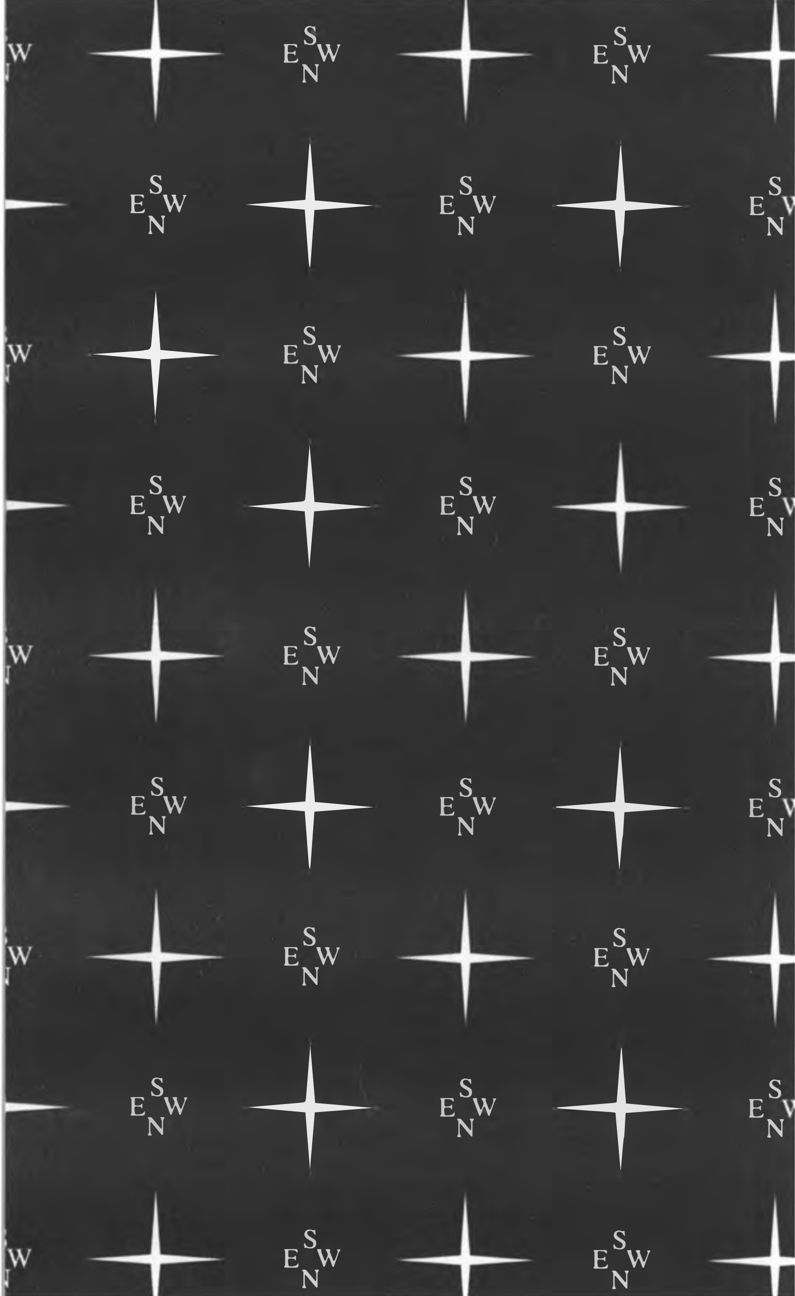




A Given Time / A Given Place

Angela Detanico & Rafael Lain

p304. *The World Justified*
pp306-7. *Disorientation Pattern*
pp308–17. *Ventania*
pp318-21. *Zulu Time*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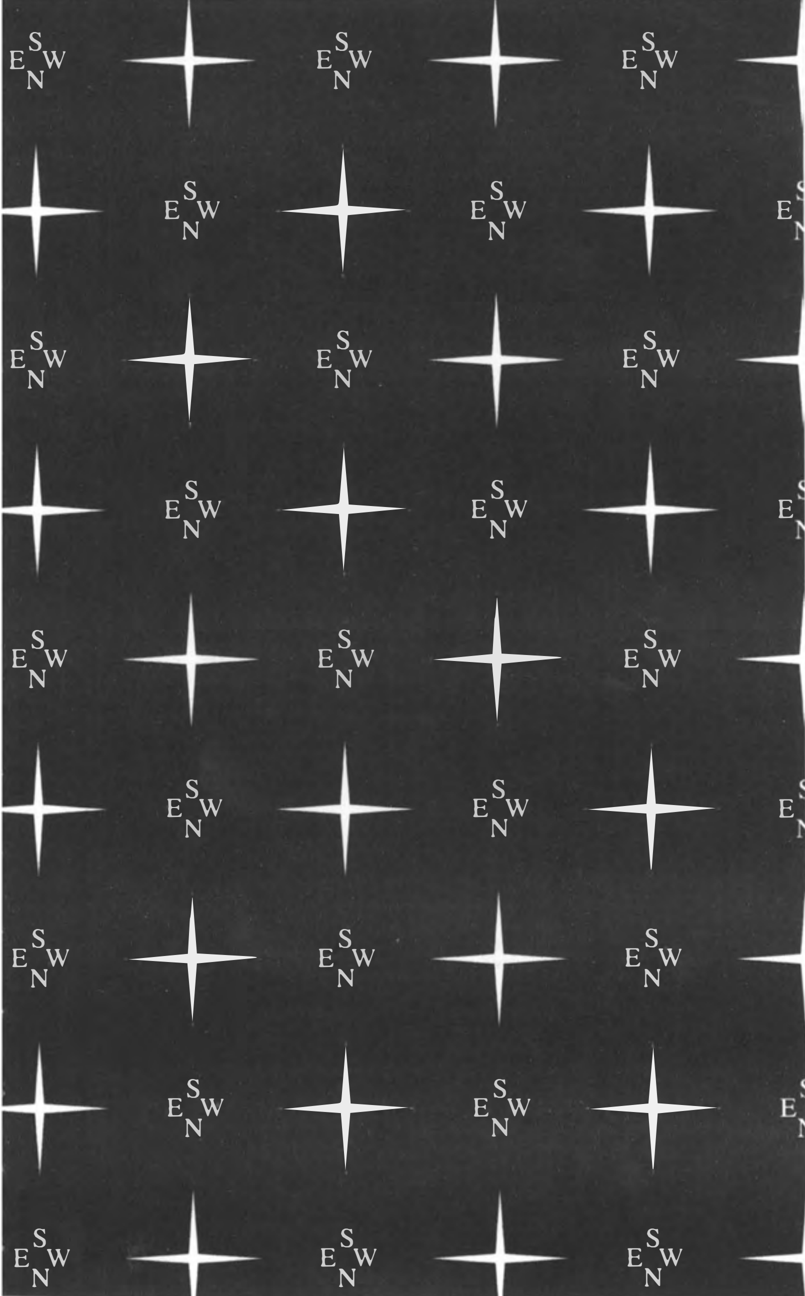
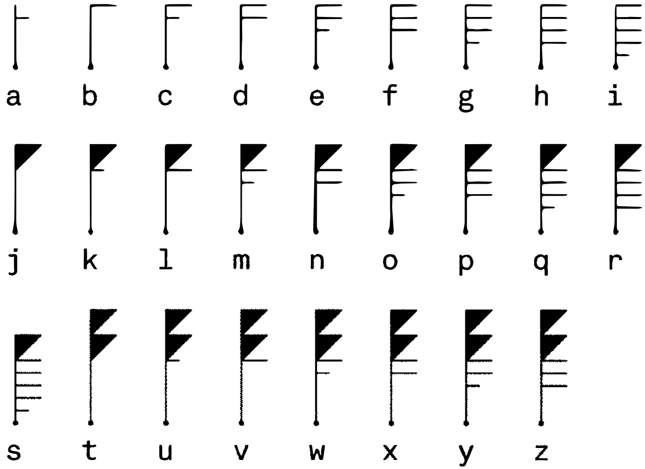




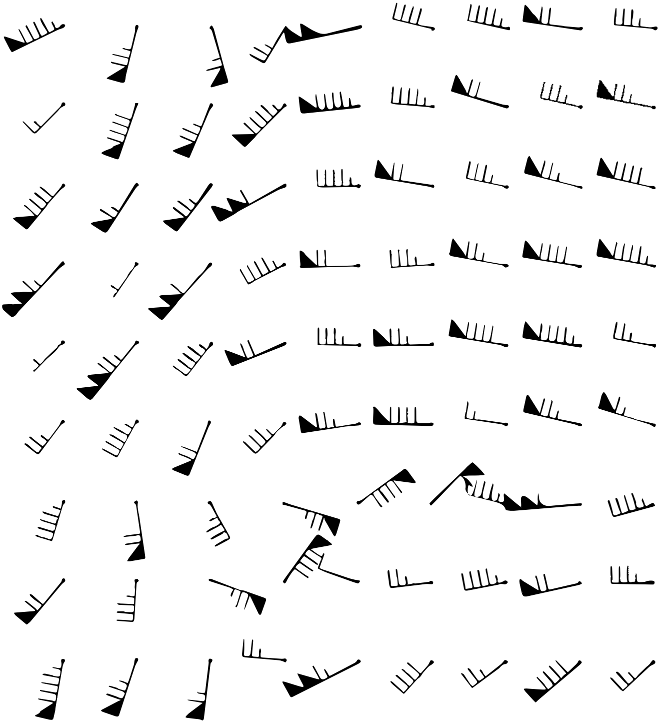
the wind barb system is used in navigation to indicate
wind direction and speed on a 5 knots scale

VENTANIA is a typeface that correlates the wind barb
notation to the alphabetical order

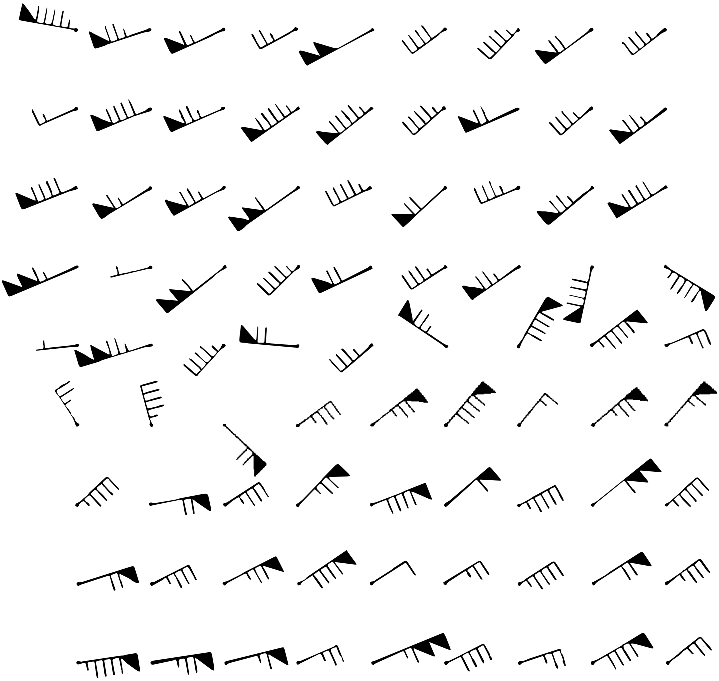
a written text was arranged in a 9x9 grid corresponding
to a given position in the middle of the atlantic ocean

the direction of the wind barbs is updated daily
according to the weather forecast for the region

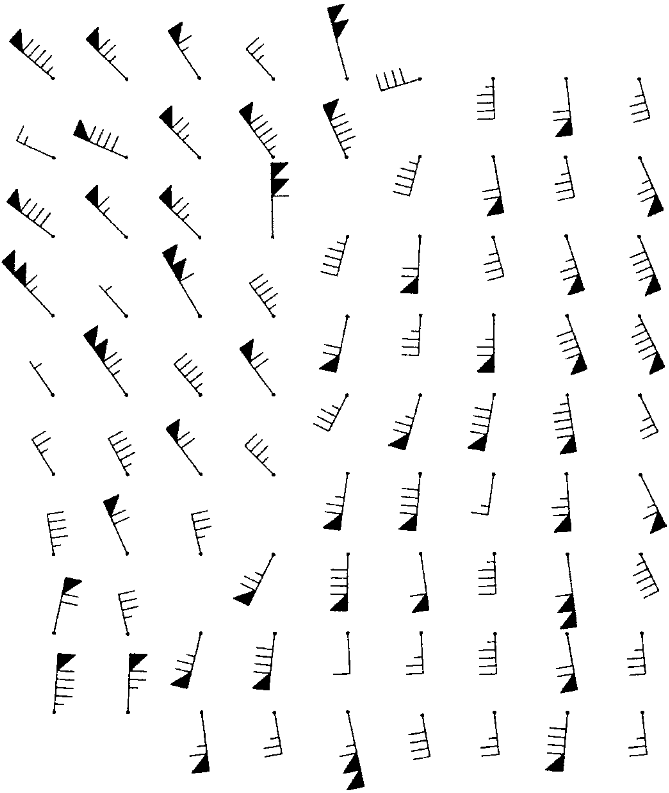
s o m e t h i n g
c r o s s i n g o
r m o v i n g o r
w a v i n g o r s
a y i n g o r s e
e i n g o r c o m
i n g o r l i v i
n g o r b e i n g
s o m e w h e r e



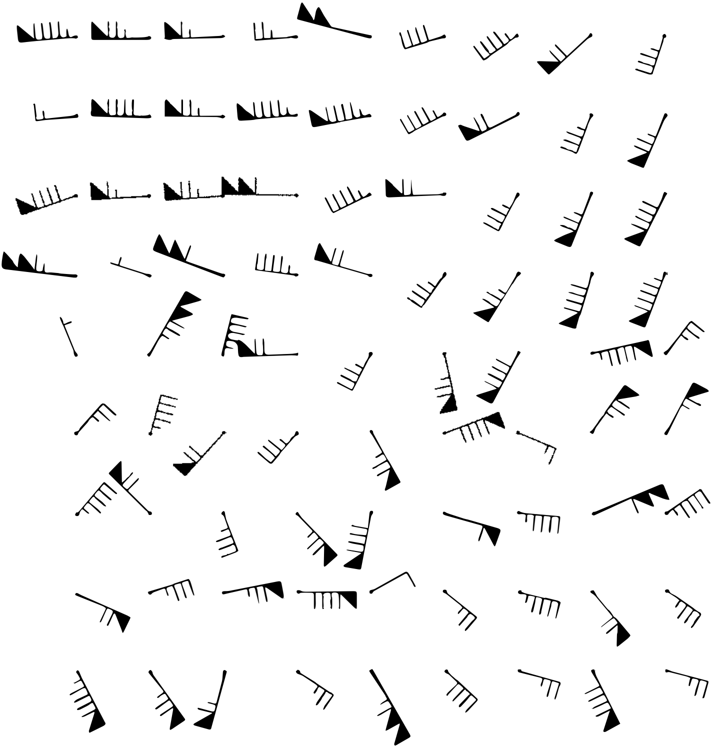
- 01.01.09 - 00h -



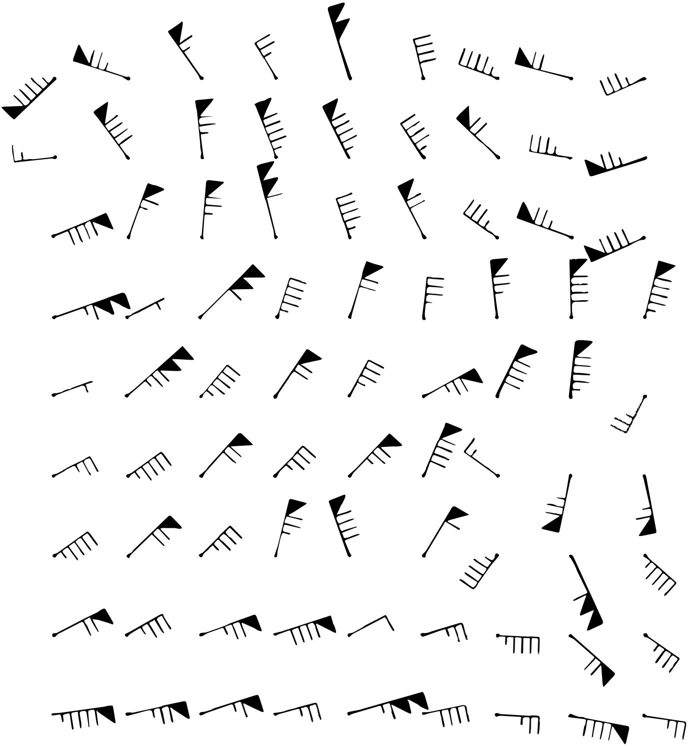
- 08.02.09 - 22h -



- 04.03.09 - 16h -



- 06.04.09 - 11h -



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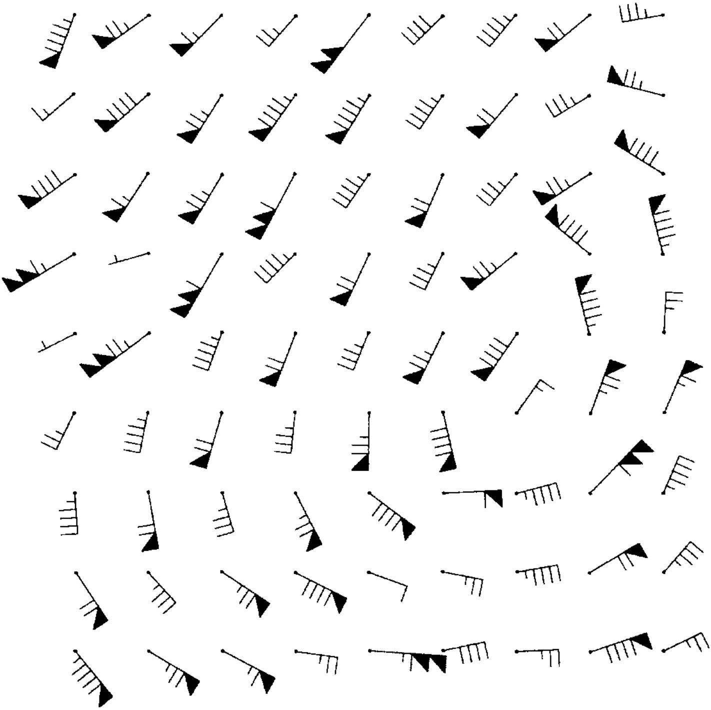

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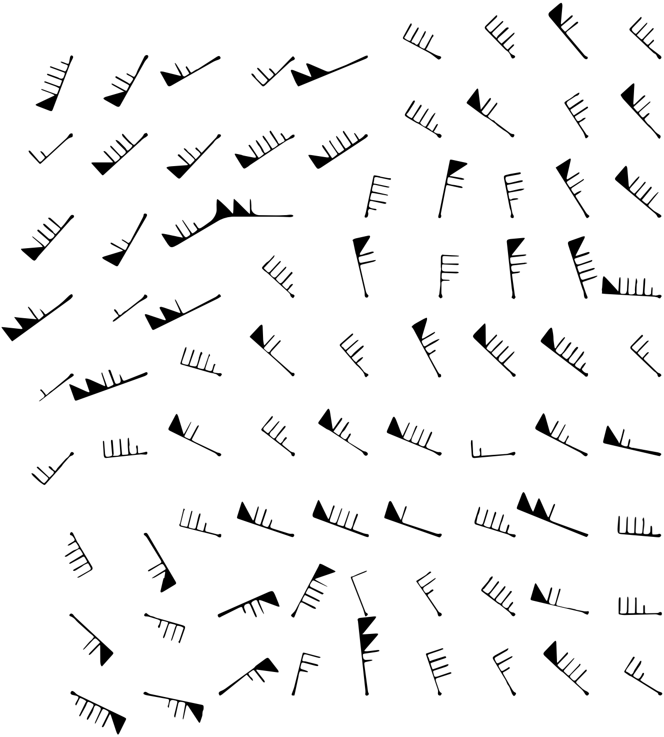

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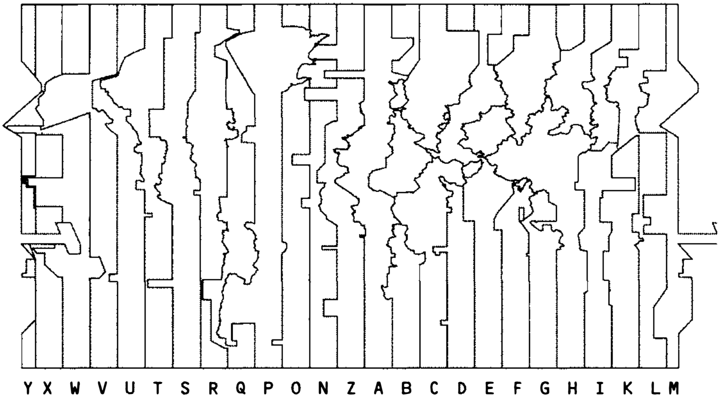
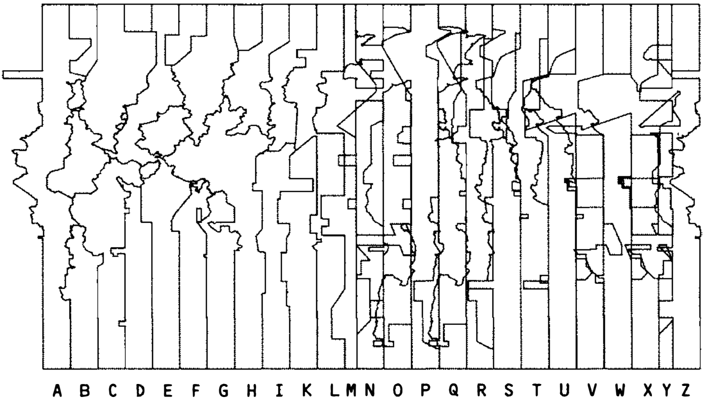
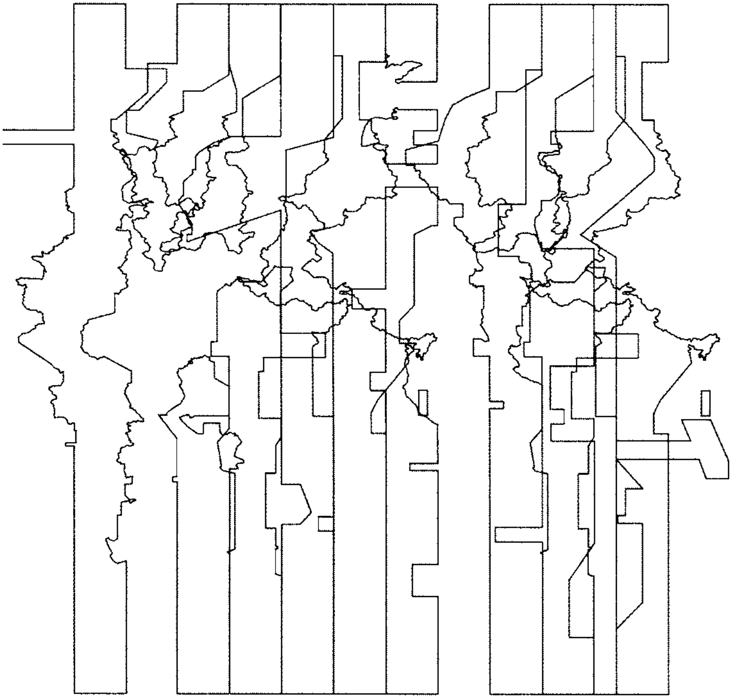


- cartographical order -

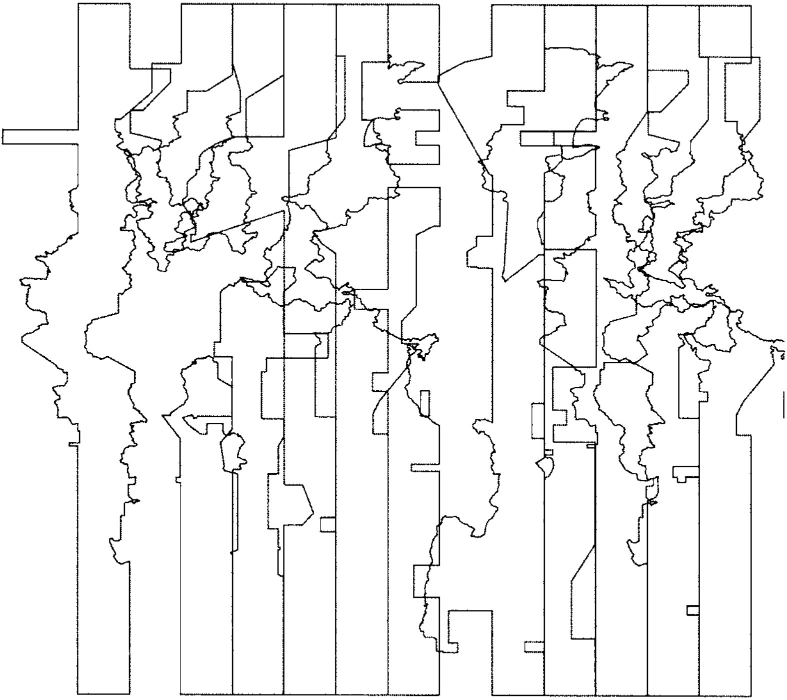


- alphabetical order -

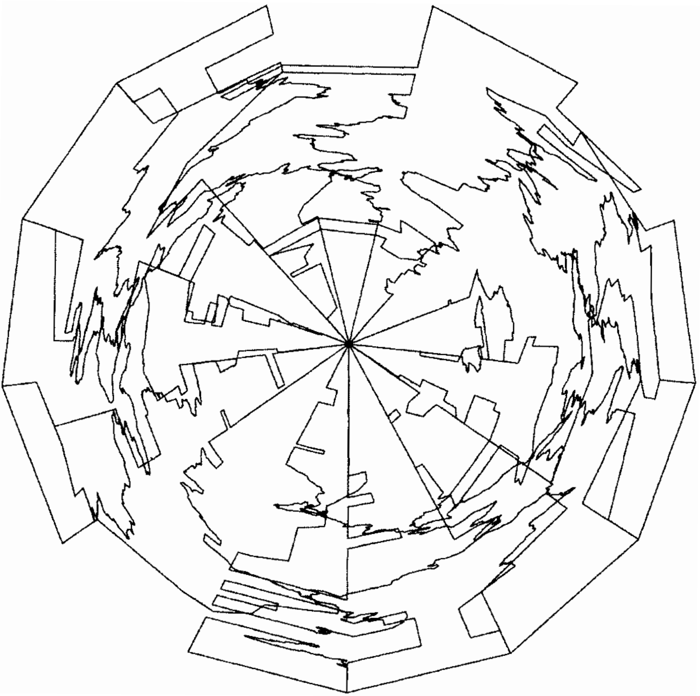
North American astronomer and mathematician Nathaniel Bowditch correlated the letters of the alphabet with the twenty-four timezones dividing the terrestrial globe. In ‘The New American Practical Navigator’, published in 1802, he associated the letters A to M with the timezones situated east of the Greenwich Meridian, and N to Y with the timezones to the west. The zone corresponding to the 180° meridian, through which the international dateline passes, is shared between the letters M and Y, so as to indicate the same hour one day apart. The letter Z, attributed to the Greenwich timezone, the 0° meridian, gave its name to the system, known as Zulu Time, in reference to the phonetic alphabet used in radio transmissions.



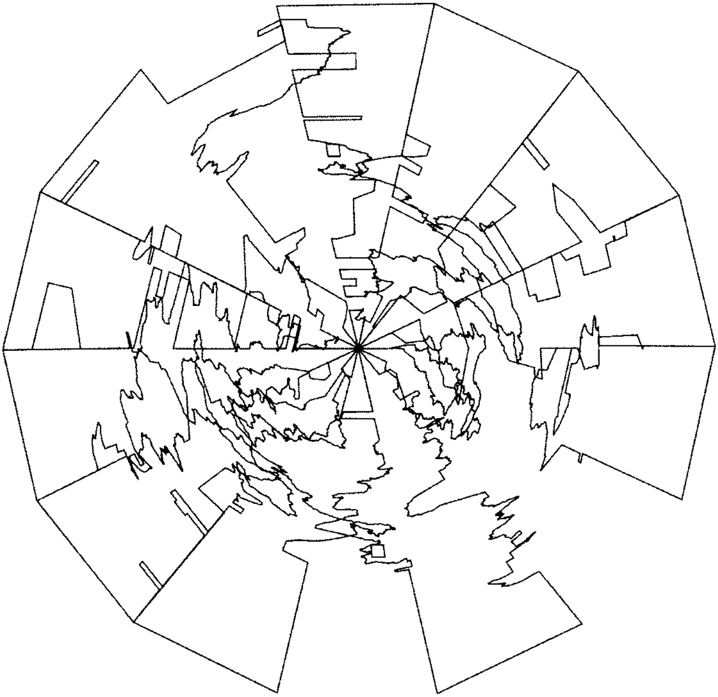
- A GIVEN TIME -



- A GIVEN PLACE -



- A GIVEN TIME (south pole projection) -



- A GIVEN PLACE (north pole projection) -

Introduction to SIMADology: *Polemos* in the 21st Century

Manabrata Guha

> *... a fine enough mesh, at some epsilon, can catch anything ...*
> Martin Libicki, *The Mesh and the Net*[1]
>
> *War is not a theatre, you infidels ...*
> Abdu-Salam Faraj, *Jihad: The Absent Obligation*[2]
>
> *... Terror is not a means of imposing decision upon the enemy; it is the decision we wish to impose upon him ...*
> Brig. S. K. Malik, *The Quranic Concept of War* (1979)[3]

INTRODUCTION

Clausewitz is accorded the honour of being the pre-eminent theorist of war for, with him, the project of theorising war was so comprehensively enframed that what has since followed have been mere footnotes – the addition of details – that only serve to fill in the gaps that Clausewitz's theory did not address. But this reification of the paradigmatic Clausewitzian theory of war also carries with it the implication that the regime of thought that guides our current theorisations on and of war is an archaic one. It is archaic not because one can trace its genealogy to at least the Age of Enlightenment, but because, in effect, its evolution had already come to an end with Clausewitz' pioneering theorisation of war.[4] In more recent times, this state of affairs has been reiterated in a positive light, with the assertion that, while the character of war may change over time, the principles of war are eternal.

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[1] M. Libicki, *The Mesh and the Net: Speculations on Armed Conflict in a Time of Free Silicon* (Washington, DC: National Defence University), 30-1.

[2] A.-S. Faraj, *Jihad: The Absent Obligation*. Quoted in Reza Negarestani's 'The Militarization of Peace: Absence of Terror or Terror of Absence?', **COLLAPSE** I, 53-91: 60.

[3] Brig. S. K. Malik, *The Quranic Concept of War* (Dehra Dun: Natraj Publishers, 1999), 59.

Thus, when questions are posed such as: Are developments in the emerging fields of Information and Communication Technologies and the 'new sciences' rendering the Clausewitzian regime of thought irrelevant? Are the growing experiences in the emerging net-centric battlespace rendering the Clausewitzian depictions of war and combat unrecognisable? Has the so-called Global War on Terror(ism) (GWOT) fractured, irreparably, the Clausewitzian paradigm of war?, more often than not, they are dismissed without a second thought.[5] The principal reason for such a summary dismissal is that, for the most part, they are regarded as fanciful speculations that not only run against the grain of the study of war and its conduct, but also against the fundamental principles that underwrite our conceptualisation and understanding of International Relations and of what it means 'to be political'. But there is no avoiding the fact that such questions are being asked and such doubts are being expressed. These are indicative of the growing uneasiness in some quarters that the integrity of the Clausewitzian theory of war may be increasingly becoming suspect not simply because the character of war has changed, but because, increasingly, our understanding of war, indeed our very imagination of war, is being shaken to its core, and is falling short of our experiences of war.[6]

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[4] See M. Guha, *Re-Imagining War in the 21st Century: From Clausewitz to Network-centric War* (London: Routledge, forthcoming 2010).

[5] See, for example, C. Gray, *Modern Strategy* (Oxford: OUP, 1999) and *Another Bloody Century: Future War* (London: Weidenfeld & Nicholson, 2005), who suggests that nothing like this is likely to occur; C. Coker, *Future of War* (Oxford: Blackwell Publishing, 2004) and R. Leonard, *Principles of War in the Information Age* (New York, NY: Presido Press, 1998), who implicitly and, at other times, explicitly question the continuing relevance of the Clausewitzian paradigm.

Our cue for this essay is taken from a recent assertion made in the context of 'surprise and terrorism', which states that '[s]urprise is only one tactical principle of the terrorist operation but it is nonetheless an essential one. Without it, terrorism would not only be foolishly impractical as a method, but virtually inconceivable as a strategy'.[7] This is an example of how the insistence on employing the well-worn analytical framework of the Clausewitzian martial architectonic to enframe the so-called 'problem of terrorism' leads to a tragic misreading of the emerging turbulent martial landscape. Our central concern in this essay is with the revitalised, and in many ways '(re)new(ed)', emergence of the 'terror-operation' which, to put the matter plainly, has not only cast a corrosive shadow over the Clausewitzian theory of war, but has also allowed us a rare glimpse into a very strange and little-understood battlespace. In keeping with this, given that the current and emergent global security ecology is being increasingly enframed within the context of the GWOT and/or in terms of hyper-violent planetary-scale insurgencies, the *principle* of operations that are invoked to address the problematic of the 'terror-operation', particularly in the wake of the events of 9/11, is called into question. In this way, we draw attention to how the regime of thought that governs the understanding and imagination of war bequeathed to us by Clausewitz – that of a collection of battles tethered within a 'political space' – may be seen to have reached its ideational limit.

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[6] See, for example, Arquilla and Ronfeldt, *In Athena's Camp: Preparing for Conflict in the Information Age* (Santa Monica: RAND, National Defence Research Institute, 1997). See also Leonard, *Principles of War in the Information Age.*

[7] Morris, 'Surprise and Terror: A Conceptual Framework', in *The Journal of Strategic Studies*, Vol. 32, No. 1, 1–27, February 2009, 6.

As an alternative, it is suggested that if we can indeed continue to talk about war and its conduct in the twenty-first century, then perhaps the discussion should be reconstructed in terms of a *polemos* – organised around four protocols – which manifests itself as a violent and searing rash of virally-proliferating clusters of intensive eruptions, ruptures and lesions that irreparably wreck the dominant spatio-temporal and ideational paradigms within which the State's monopoly over the exercise of organised violence has traditionally found its subjective affirmation. This emergent condition, which necessitates a different regime of thought when thinking 'war', we further argue, entails thinking of – and in terms of – alternate modes of martial operabilities – *pure tacticities* – which are mechano-in-organic insinuations of terror, surprise and havoc which, while seemingly event-specific, remain indifferent to, but complicit with/in, the very medium in which they are actuated.[8] The emergent embodiment of such insinuations is the SIMAD – a Singularly Intensive Mobile Agencity of Decay – whose primary counter-tactical principle of operation is 'hypercamouflage'.[9] We will have occasion to discuss the outlines of this counter-tactical principle and the implications that its operationalisation has for our state-centric war-machines.

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[8] Thanks to Reza Negarestani for first suggesting the 'mechano-in-organic' formulation (email exchange).

[9] For a detailed account of 'hypercamouflage' see Negarestani, 'Militarization of Peace'. The acronym SIMAD appears in the work of the futurologist Jerome Glenn.

As we will see, the encounter with the SIMAD takes place in an *intermezzo* – a counter-intuitive and unfamiliar battlespace wherein the standard geo-political map is contorted out of recognition by an always emergent geo-philosophical diagram which, by being radically open to the attractive and densifying magneto-gravitational forces of the Earth, does not adhere to Nietzsche's weightless affirmation of 'being true to the Earth'.[10] Contrarily, such a geo-philosophical diagram plunges headlong into the flows and counter-flows of the earth's forces, thereby stretching them to the edges of their conceptual envelope by 'sounding' the depths of the Earth's surface on which fragile onto-political structures – geophysical and geopolitical edifices – rest. In this sense, the emerging battlespace – the *intermezzo* where/in we make contact with the SIMAD – is a locale in which an ungrounding of the Earth is in process and, as such, is a vertiginous soft spot on the surface of the Earth. In this battlespace, onto-privileges that sustain the traditional geopolitical difference-engines[11] through the logic of their presence corrode, decay and collapse, leading to terrifying

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For Glenn, the acronym stands for Single Individual Massively Destructive. See J. C. Glenn and T. Gordon, *2007: The State of the Future* (NY: World Federation of UN Associations, 2007), 80.

[10] *Intermezzo* means an 'in-between'. In music, particularly in operatic music, it is a 'filler' that fills the space between two acts. In chess, 'intermezzo' is better known by the German word, 'zwischenzug', which is translated as an 'intermediate move' that a player makes in lieu of an expected move, after playing which the expected move is made. This generally results in disorienting the opponent, and is geared to create the conditions for dominating the board.

[11] State Actors, Non-State Actions, Actor-Networks, friends, enemies, allies and levels of analysis are illustrative examples of what I refer to as 'traditional geopolitical difference-engines'.

'envoidings' that fracture, weaken, and turn into sludge the material consistency of the conventional battlespace.

Of course, the 'canon' of military thought asserts that there exists an inextricable relation between thinking (strategically *on* war) and the earth (or alternatively, the coding of territory); this is a central, indeed defining, feature of the Clausewitzian theory of war, say, since the seventeenth century. We will see how the SIMAD distorts, twists and undoes this specific relation between thinking and earth/coding in geo-logical terms. In such cases, even the Deleuze-Guattarian 'nomadic war-machine' fails to gain traction. 'Territory' and the earth become 'slime', which defies the efforts of the post-modern military – a rabidly becoming-out-of-control war-machine that was originally captured and re-deployed as a pliable instrument of the State – to cast its striating and strategising net-centric grids in a bid to establish an era of 'terrifying peace'. This calls for a different way to think about war, thereby signalling the advent of the SIMAD's *polemos*.

I. FRACTURED FRAMEWORKS/ DISTORTED ANALYSES

INSIDE/OUTSIDE THE CLAUSEWITZIAN LEGACY

When Clausewitz wrote his *magnum opus*, he openly registered his desire to write a treatise on war that would serve a dual purpose. Firstly, he wanted to establish a theoretical ground for the study and analysis of war which would 'not be forgotten after two or three years, and that possibly might be picked up more than once by those who are interested in the subject';[12] and secondly, he wanted to 'bring about a revolution in the theory of war'.[13] It is worth noting that on both these counts Clausewitz was largely successful. But the import of Clausewitz's efforts, while long recognised and much appreciated, remains undervalued. This is principally because we fail fully to appreciate what the Clausewitzian theory of war aims to *defend* and instead focus on that which it tries to *explicate*. In other words, to fully register the import of Clausewitz's theoretical efforts, it is necessary to recognise that Clausewitz, quite early in his theoretical exercise, was fully cognisant with the disjunction of thought when considered in the context of war, which he identified as 'chaos on the battlefield'. It is for this reason that we are led to suggest that Clausewitz's principal theoretical and philosophical effort to create and sustain a 'theory of war' was a defensive gesture against this state of affairs. To appreciate this, however, we need to re-visit the Clausewitzian category of Absolute War.

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[12] Clausewitz, *On War*, Ed. & Trans. M. Howard and P. Paret (Princeton, N.J.; Princeton University Press, 1984), 58, 63.

[13] Ibid., 70.

As is well known, Clausewitz discussed war in two guises – Absolute and Real War. Early in *On War*, he presented the 'essence of war [...] as an eruption of force and violence',[14] which he understood as 'true war, or *absolute war*'.[15] For Clausewitz, this 'true war, or absolute war' was nothing but 'a struggle for life and death – a struggle, that is, in which at least one of the parties is determined to gain a decision.'[16] The implicit annihilation that awaited the participants of Absolute War – abiding by its logic of strikes and counter-strikes – was a fact that was not underestimated by Clausewitz. Indeed, he frequently cited the example of the campaigns of Napoleon as being a proximal condition of Absolute War in Real terms. In other words, for Clausewitz, Absolute War – presuming no external influence – was the maximum effort, applied repeatedly, at a decisive point, for a decisive decision, *with a single logical object*: Absolute defeat of an enemy. This 'logic', was in Clausewitz's words, war's '… *natural tendency* […] *in its philosophical and strict logical sense alone and does not refer to the tendencies of the forces* […] *including* […] *the morale and emotions of the combatants*.'[17] Clausewitz further asserted that this logic remained true regardless of whether war was a duel between two contestants, or a hostile engagement between coalitions of nations. Based on the above, it could then be said that Absolute War displays two characteristics: (1) by virtue of being, at the least, co-constituted by 'blind natural force', it is, to some measure, independent of the political because as a pure expression of blind natural force, the 'succession of blows and counter-blows' need have no basis in the political. (2) When this blind natural force does manifest itself within the political, it can potentially 'usurp the place of policy the moment policy had brought it into being; it would then drive policy out of office and *rule by the laws of its own nature*.'[18]

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[14] A. Gat, *A History of Military Thought – From the Enlightenment to the Cold War* (Oxford, UK: Oxford University Press, 2001), 225.

[15] Clausewitz, *On War*, 488-9.

[16] Ibid., 488.

Thus, we find Clausewitz insisting that 'in the field of abstract thought […] it [i.e., war] reaches the extreme, for here it is dealing with an extreme: *a clash of forces freely operating and obedient to no law but their own* […] *an almost invisible sequence of logical subtleties*.'[19] Clausewitz absolutely insists that this 'logic' of war that determines the 'succession of blows and counter-blows' is not simply an in-human logic, but also a non-human one. It is equally critical that we recognise Clausewitz's subtle but simultaneous assignment of two versions of Absolute War – as the 'logic of war' independent of the political *and* as 'the logic of war' at the disposal/service of the political. But Clausewitz's initial assessment of the dangers posed by Absolute War 'in the field of abstract thought' – that is, regardless of whether or not it is subject to the political – remained unchanged. He contended that the logic of war, in the Absolute sense – devoid of emotion, morale and feelings – was marked by *its desire* for the annihilation or absolute defeat of the enemy and thus was dangerous and destructive.[20] Indeed, he also added the corollary that in its 'true' state, this logic – even when manifested within the political – was equally (and more to the point, materially) destructive and, therefore, dangerous – as, Clausewitz claimed, it was in the hands of Napoleon.[21] Thus, it is not surprising to find Clausewitz insisting that any theory of war *must* make room for Absolute War. Indeed, according to Clausewitz, Absolute War *must* be the principle that is invoked to 'form a general point of reference, so that he who wants to learn from theory becomes accustomed to keeping that in view constantly, to measuring all his hopes and fears by it, and to approximating it *when he can* or *when he must*.'[22]

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[17] Ibid., 89 (All emphasis mine) Note that Clausewitz, elsewhere in *On War*, insists that 'war has no logic, it only has a grammar'. This is, to say the least, a most curious statement for Clausewitz is claiming that a 'grammar' is bereft of logic.

[18] Ibid., 87 (My emphasis).

[19] Ibid., 78 (My emphasis).

Clausewitz' recognition of Absolute War as a non-human/inhuman condition also brought in its wake the discomforting knowledge that, in war, the strategic ensemble that thought or thinking forms breaks down into fragments, thereby shattering the logic of sense and sensibility that lends consistency to thinking as a strategic act. Hence the fact – in Field Marshall Moltke's words – that 'no plan survives contact'. This was obvious to Clausewitz as he sifted through history, both ancient and contemporary to him. In other words, Clausewitz realised that while the Realness of Absolute War could not be wished away, Real War was merely a partial manifestation of Absolute War within a geopolitical space, and always prone to morph into Absolute War, especially when in the hands of a 'genius'. Not only did this realisation prove sobering for Clausewitz's theoretical ambitions, it also posed a fundamental problem of ontological proportions: If, as Clausewitz discovered, war is essentially violent, chaotic, an instance where the logic of Reason potentially comes to a standstill, and which is only marginally subject to the space of the political as an instrument, then it remains essentially outside the field of circumscription laid down by Reason. It is at this point that Clausewitz displays his Kantian roots and opts to strategise war itself – a martial version of the Kantian manoeuvre to strategise Reason. To this end, Clausewitz presented Absolute War as a transcendental category grounded, not only on three critical a prioris – blind passion, hatred, and being amenable to control by Reason in the form of the State – but also on one categorical imperative: '*[a]ct only according to that maxim whereby you can at the same time will that it should become a universal law.*'[23] These allowed Clausewitz to develop an innovative theory of war which, while remaining true to the surface of the earth (for Clausewitzian war does play itself out on the surface of the earth), remained outside the specificity of any geospatial territory.

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[20] Nb. Clausewitz, as this study suggests, implies a non-human conception of the 'logic of war'. In this sense, it is outside the framework of Reason. But, as we will see, this is also strictly not the case.

[21] Clausewitz, *On War*, 529-30.

[22] Ibid., 581 (Emphasis in original).

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[23] I. Kant, *Grounding for the Metaphysics of Morals* [1785], 3rd ed., trans. J. W. Ellington, (London: Hackett, 1993), 30.

Thus, by positing an *ex-terra* space inhabited by universal laws, Clausewitz made the operative concept of war, while terrestrially linked, extra-terrestrial. In this way, he was able to strategise the phenomenon of war using universal laws that, while grounded in the concept of Absolute War, prioritised the historical and real-time *experience* of Real War – that is to say, war as experienced by privileged ontological objects like the human, the state, the citizen, and the subject. But Clausewitz remained aware of the potency of Absolute War and cautioned his readers that Absolute War was the 'absolute' and 'real' referent when thinking about war, and that Real War was a fragile construct easily disturbed by the intensity of Absolute War. Thus, for Clausewitz, the key strategic question was: How to keep the disturbances caused by the intensity of Absolute War at bay? Clausewitz's little-mentioned ontological question, of course, remained: How to think when thinking is chaotic at its core?

Following Clausewitz's lead, we have, particularly since the seventeenth century, studied war and its conduct as a command and control problem – both at the geo-politico-strategic level and at the operational and tactical levels. The ground on which these levels stand is the earth, or more precisely, the surface crust of the Earth – the base geophysical material on which Real War is actualised and experienced. Thus, while the uneven surface of the earth may throw up from time to time shadows that interrupt, subvert and dislocate the transcendental logic of Clausewitz's theory of war, the rationally-designed, technologically-enhanced and constantly transforming command and control assemblages that confront such chaoplexic conditions are – especially in the Information Age – well-equipped to penetrate these shadows and hidden spaces and bring 'war to Reason'. Thus, we find that in the context of the emerging theories and doctrines of Network-centric Warfare (NCW) (and their attendant technical modes of being martial) and of the GWOT, especially in the post 9/11 timeframe, we still tend to explain the experience of Real War (unexpected 'terror-attacks' as signatures of planetary-scale insurgencies) in command and control terms. In other words, the most recent 'revolution in military affairs' – which, arguably, is increasingly transforming how combat operations are conceptualised and executed – while introducing us to the haptically-diverse experience of war, nevertheless, has not abandoned its Clausewitzian roots, which lie not on or in the Earth but at some distance from it, but which effectively dominate the surface-area of the earth without accessing its depths. This is most evident when we consider how terror-operations (as the emerging signature of war) are conceptually enframed by mainstream military theorists and strategy thinkers in the twenty-first century.

TERROR-OPERATIONS THROUGH A CLAUSEWITZIAN LENS

In a recent essay, 'Surprise and Terrorism: A Conceptual Framework', Morris advises us that '[i]n the domain of war, adversaries have sought to capitalise on the enemy's surprise and fear since time immemorial.'[24] He further suggests that the element of 'surprise', which he distinguishes from the 'strategic and tactical surprise' that occupies so central a position in State-centric models of war, is the critical tactical enabler of terrorist operations which, when coupled with 'fear', occupies a 'central place in the tactical and strategic repertoire of the terrorist.'[25] Further, Morris asserts, 'terrorists use the gun and the bomb as delivery systems for the real coercive instruments in their arsenal: surprise and shock. Used in this way, surprise itself becomes a potent weapon.' Thus, he claims that:

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[24] Morris, 'Surprise and Terror', 2.

> [i]t [surprise] has enabled relatively small groups of sub-state actors to compel entire governments to action and ultimately change the course of history. Whether terrorists have been strategically successful in this regard is debatable, especially if we define success narrowly as the full realisation of professed political aims. However, their ability to alter the landscape of our security environment and change the way people think and behave is undeniable.[26]

While one cannot fault the operative logic that drives these observations, it is, however, obvious that Morris's effort is geared to render the act of the 'terrorist' into terms that would be recognisable, and ultimately combatable, by State-centric forces. But this is a counterproductive gesture for, while in the first instance it restricts us to thinking about war and 'acts of terror' within the dominant Clausewitzian framework, ultimately it only serves to distract us from the potency and essential indifference of the forces embodied in the 'terrorist'. Before we proceed to direct our attention to these anomalous 'terroristic' forces and the means by which they establish their counter-flows, it is necessary carefully to extract the finer implications of Morris's suggestions. Not only will this help us to establish the limits of the martial imagination within which, we suggest, Morris and much of the strategy and policy-making community is being held captive; it will also help set the stage to discuss the key elements of what we contend is the emergent condition of the SIMAD's *polemos*.

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[25] Ibid.

[26] Ibid.

What is immediately evident from Morris's analysis is that, though he professes to lay a great deal of importance on the element of surprise and valorises it – albeit for analytical purposes – to the point of asserting its central importance as a key weapon of choice in the terrorist's arsenal, he also remains curiously ambivalent about the sustainability of this 'weapon'. This should not be surprising because the regime of thought from within which Morris discusses 'surprise as a weapon' is constrained to consider 'surprise' as a singular instantiation of a 'terrible', or more prosaically, of a 'dramatic' Event, which is engineered to create a temporary condition of strategic, operational and tactical asymmetry between opposing forces thereby conferring the advantage of an operational initiative on the side that 'creates' the element of surprise. In other words, surprise, which is a function of 'time' or, more precisely, of 'timing', is taken to be an extremely fluid and vicarious element which, by definition, remains only transiently viable as an instrument of war.

While in passing we note that this, curiously, applies as much to the dynamics of the conventional battlefield as it does to terroristic operations,[27] the major problem in the consideration of 'surprise' as a 'weapon' is that if we (here following the thread of Morris's argument) are cognisant with the unreliability – in terms of its sustainability – of such an instrument, then surely those who launch and conduct terror-operations would also be aware of such a limitation of this 'key weapon'. And, if this is so, then would it not make sense to ask if our (and, according to Morris, the 'terrorist's') strategy of considering 'surprise' as a weapon – in however transient a form – is indeed valid? In other words, would the 'terrorist', who appreciates (according to Morris) the key tactically-enabling properties of surprise as a weapon – as much as we do – not be aware of the implicit limitations of this 'weapon'? Would not the 'terrorist' also recognise the 'use it *and* lose it' characteristic of 'surprise' as a tactical enabler? And if so, then why would the 'terrorist' consider 'surprise' as a *key* weapon in his or her arsenal in the first place? Thus, despite Morris's exegesis, this assertion – that surprise is a critically coercive weapon of terror – remains unconvincing. But this is not because Morris's insight about the criticality of surprise is flawed: indeed, as an insight into terror-operations in the twenty-first century it is of great value. Yet the framework within which he chooses (or is compelled) to discuss it detracts from its merits.

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[27] Thus, for example, the Nazi invasion of the Soviet Union was a 'surprise' – tactically and strategically – though as Morris suggests the 'strategic surprise' was more a function of Stalin's unwillingness to consider intelligence inputs from various sources – most famously from Richard Sorge – seriously. More pertinent is the 'tactical surprise' that the Wehrmacht achieved at various points (but not at every point) along the invasion front. See, for example, Paul Carell, *Hitler Moves East* (New Delhi: Natraj Publishers, 2008).

While we should avoid falling into the conceptual restrictions within which Morris's exegesis is trapped, we should also not be too hasty to dismiss outright his insight into the role and importance of 'surprise' in the context of terror-operations, especially when referring to the emergent martial landscape. Indeed, if we leave aside the constricted conceptual space from within which Morris conducts his discussion, his identification of the element of 'surprise' should be applauded, for, among other things, it allows us to highlight an alternative version (and consequent implications) of 'surprise', whose vector runs along a completely different path than that which Morris places as a central feature of his 'conceptual framework'. As we will see, there are other ways to think about 'surprise' in the context of terror-operations that – while refusing to be subsumed under the notion of 'surprise' that Morris draws on and which is grounded, for the most part, within our traditional martial imagination – provide a sustainable substrate from which the four protocols of the SIMAD's *polemos* draw their materiality. As we shall see, it is only when considered in this way that 'surprise' truly becomes a lethal weapon, or more precisely, achieves a lethal state of latent weaponization which not only is sustainable, but also forms the kernel of a radically counter-tactical 'concept of operations' for the battlefields of the twenty-first century.

Further, it also appears that Morris remains ambivalent about how to define 'success' in the context of terror-operations. Predictably, Morris seeks to understand 'success' in state-centric terms, which leads him to offer, in this instance, a 'narrow' understanding of the word in terms of the realisation of professed political aims. Inexplicably, however, Morris fails to consider seriously the epigraph – that which opens both his essay and the present one – taken from Brig. Malik's rendition of the *Quranic Concept of War*, which states that '[*t*]*error is not a means of imposing decision upon the enemy; it is the decision we wish to impose upon him*'. It is precisely here not only that the weakness of Morris's 'conceptual framework' is exposed; but also that terror operations – especially in the twenty-first century – pose two insuperable challenges to the Clausewitzian paradigm of thought under which Morris labours and which he leaves unaccounted for.

First, the primacy given to the achievement of political aims and objectives, which drives the teleological engine of the Clausewitzian theoretical framework – the coordination and deployment of a variety of (often state-mandated violent) means towards the achievement of specific political ends – is markedly absent, at least in what Malik has to say about the Quranic Concept of War. Of course, it may be argued that 'terrorist' entities – Al Qaida being one of the recent and foremost examples – have a number of identifiable and specific geo-political objectives such as the ousting of foreign (primarily American) troops from the land of Mecca and Medina; the establishment of Sharia (possibly on a global scale); the establishment of a Caliphate-mode of Islamic governance; addressing of the Palestinian, Kashmiri and other such-like questions – which resonate, albeit tangentially, with state-centric geopolitical aims and objectives.[28] But the suggestion to take these overt 'political announcements' as central defining features that render and explain – particularly in terms of their operational signatures – entities and agencies such as Al Qaida and their more local and particularised affiliates, is not simply misleading, but also dangerous. It is misleading because it is grounded on the premise that the use of terror-operations is the means by which such ends may be achieved. In other words, among other things, the implicit suggestion is that once such goals and objectives are achieved, such entities and agencies would (or may be expected to) call a halt to their operations. Malik, of course, disabuses us of such fantasies by clearly identifying the 'objective' of terror-operations: '[*o*]*nce a condition of terror into the opponent's heart is obtained, hardly anything is left to be achieved*'. From this it should be evident that terror-operations, which may either masquerade or be misconstrued as essentially an extreme form of political action, are in reality, *or more precisely, in the reality of the terror-operatives*, outside the context of the political. Thus, while overtly political objectives may be identified and advertised in the context of terror-operations, the primal motive for such operations is not held hostage by and to any kind of political framework.[29] To us, operating from within a patently sub-political Clausewitzian framework, such a posture is bound to seem either incomprehensible or, at best, a lethal manifestation of an irrational, 'other-worldly', anarcho-nihilistic, hyper-violent militant *mode of operability* which breaks the link between 'cause' and 'effect', thereby defying any reason and logic that we may be familiar with. In the face of such a 'reality' our traditional acts of strategising deconstruct, often violently.

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[28] Kilcullen discusses these and other political considerations in his four models of enframing the 21st Century Security environment – Globalisation Backlash, Globalised Insurgency, Islamic Civil War, Asymmetric Warfare. The alleged political goals of what is termed as Islamo-fascistic terrorism fall primarily within the first three models. See D. Kilcullen, *The Accidental Guerilla: Fighting Small Wars in the Midst of a Big One* (London: Hurst and Company, 2009), 7-28.

Additionally, 'strategic thinking' of the kind indulged in by Morris is also dangerous because to attempt to construe (post)modern terror-operations as being politically motivated (which, by extension, implies that they may be addressed by conventional military means and/or by dialogue or diplomacy) fosters the illusion that 'terror-operations' are necessarily organised around an exploitative principle which, given its shock-value, offers the greatest return at a minimal cost. If we continue to think along these lines we remain susceptible to believing that, when considered in military terms, neutralising the element of surprise would effectively stunt the proliferation of terror-operations, which is effectively what Morris implicitly suggests. Thus, our exegetical and analytical exercises – such as the one authored by Morris – in remaining within the confines of the Clausewitzian universe, tend to ignore the stark warning that Malik issues to us – for, in that one sentence, he disabuses us of our propensity to read terror-operations from within the Clausewitzian regime of thought. It is not surprising, therefore, as Negarestani points out, that Faraj would thunder at us: '*war is not a theatre, you infidels*'!

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[29] We can see one potent example of this in Faraj's text.

Secondly, we should not hesitate to recognise that 'surprise' in the context of the terror-operations of the twenty-first century refuses to be separated either from 'terror' or from 'fear'. Morris implicitly avoids addressing this when he suggests that the 'shock' element of a 'surprise' is the prime generator of the conditions of 'terror' and 'fear', thereby drawing a distinction between 'surprise' as a 'means', and 'terror' and 'fear' as a transient stage, towards the attainment of identifiable political ends.[30] What Morris seems to be suggesting is that 'surprise' is one of the key, indeed indispensable, 'tactical enablers' that allows the condition of 'terror' and 'fear' to be imposed on the enemy for the purpose of some political gain. To support this, Morris quotes from Abu Sa'd al-Amili's work, 'Learning Lessons from the Raids on New York and Washington', wherein the latter suggests that '[t]he blow came as a *surprise* to everyone. This is the essence of the Prophet's wisdom and the soundest application of his advice:

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[30] Morris, 'Surprise and Terror', 5-10.

"*War is deception*".'[31] Further, Morris quotes from Ayman al-Zawahiri's text 'Knights under the Prophet's Banner', wherein al-Zawahiri explains that '[t]he targets as well as the type and method of weapons used must be chosen to have an impact on the structure of the enemy …'[32] From examples like these, Morris draws the questionable conclusion that '… the *manner* in which the enemy is attacked is important in itself …'.[33] Yet it is curious that he does not recognise or acknowledge that by suggesting this, he blurs the very distinction that he draws between the 'strategic and tactical surprise' that is often effected on the conventional battlefield and the element of 'surprise' involved in the Al Qaida attacks on 9/11.

Morris's distinction between 'surprise on the battlefield' and 'surprise' as employed by 'terror-operators' pivots around the fact that on the conventional battlefield, 'surprise' is a means of throwing an enemy off balance, whereas in the context of terrorist activities, it is a weapon of choice, with which to conduct 'psychological warfare'. But this distinction is at best dubious for if, as Clausewitz noted, 'surprise' is '… not only the means to the attainment of numerical superiority; *but it is also to be regarded as a substantive principle in itself, on account of its moral effect* […] [and] when it is successful in a high degree, confusion and broken courage in the enemy's ranks are the consequences …',[34] then the difference between the 'surprise' that Clausewitz refers to and that engineered by Al Qaida on 9/11 is minimal or non-existent: Both point to the same object – creating a debilitating psychological impact on the enemy. Thus we could say that 'surprise' is as much of a 'tactical enabler' for Clausewitz as it is for terror-operators like Al Qaida. But if we say this, then we would be in danger of misunderstanding not only the grounds from which terror-operations, particularly in the twenty-first century, operate, but also the existential grounds or condition that they seek to establish.

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[31] Ibid., 15. See also al-Amili, Abu Sa'd, 'Learning Lessons from the Raids on New York and Washington', in *Essays on the September 11th Raid* (orig. pub. in Arabic by Majallat al-Ansar, English trans. Provided by OSC, 2002). My emphasis.

[32] See Morris, 'Surprise and Terror', 16.

[33] Ibid. Emphasis in original.

[34] Clausewitz, *On War*, 269. My emphasis.

II. THE SIMAD'S *POLEMOS*: A BRIEF OVERVIEW

Accounts that purport to depict the evolution of warfare – from the seventeenth century onwards – generally do so by identifying various 'generations' of warfare. Thus, the First Generation was characterised by static or positional warfare; the Second Generation, also known as 'firepower/attrition warfare', was characterised by an hierarchical command and control system wherein decision-making was centralised and bureaucratised; the Third Generation, known as 'manoeuvre warfare', was characterised by an increasing de-centralisation of command and control – the principle of *Auftsragtaktik* or 'mission command' is the key defining feature of this 'generation' of warfare, which was raised to an operational art-form in the Second World War by the armoured formations of the Wehrmacht; finally, the Fourth Generation of warfare is characterised by an increasing and intense focus on the chaos and complexity of the battlespace. In Fourth-Generation Warfare, the operative 'concept of operations' is organised around the exploitation of the 'fog of war'. The most visible emergent manifestation of this is highlighted in the theories of network-centric warfare (NCW) and in the associated doctrines of 'swarming on the battlefield'.[35] A more recent, and in many ways innovative, account describes the evolution of warfare – within the same timeframe – by organising itself around the metaphors of the clock, the steam-engine, the computer and the network, thereby speaking of the evolution of war as transiting through the mechanistic, thermodynamic, cybernetic and chaoplexic stages.[36] Yet both these accounts remain firmly within the circumscription of the political. In other words, regardless of how descriptive and innovative these accounts are with regard to the history of the evolution of warfare, they do not deviate from the core Clausewitzian principle which instrumentalises war as a tool of politics and a means by which political objectives, in extreme circumstances, may be achieved.

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[35] W. S. Lind, *The Four Generations of Warfare*, at http://lewrockwell.com/lind/lind26.html. Accessed on July 23, 2009. Apparently, there is now some talk of a Fifth Generation of Warfare that works around the following concepts: close-coupled systems, self-organisation, emergent properties (particularly 'intelligence'), stigmergy, and the concept of complexity arising from simple processes. See J. Robb, *Brave New War: The Next Stage of Terrorism and the End of Globalization* (John Wiley: Hoboken, New Jersey, 2007). Of course, the same problem that afflicts the previous accounts of the evolution of war reappears here, albeit in different terms. Regardless of how the 'solution' is framed, Robb's account remains enmeshed with the classical Clausewitzian framework, which subordinates war to the political. It seems that Robb's account is focused on the problems associated with 'globalisation' and sources the 'threat' to global malcontents (mis)using the benefits of globalisation. Thus he recommends the withdrawal of the nation-state from 'national security' activities and letting private individuals and corporations take over that function. Robb apparently does not see the paradox implicit in his recommendations – for all that he is doing is to replace the nation-state system with a corporatism of sorts, which would function in place of the nation-state. It is a classic case of replacing one institution with another, albeit more flexible, institution.

[36] See A. Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* (London: Hurst, 2009).

It is perhaps the allegiance to this foundational principle of modern International Relations, indeed of the concept of the political, which blinds Morris and other like-minded analysts to the existential threat that the nation-state system faces from the terror-operations that we are increasingly becoming familiar with today. In other words, while terror-operations, as Morris suggests, do and have changed the security environment in the twenty-first century, they have also done much more. They have terminally infected the fabric of the nation-state system and, in turn, are compelling nation-states themselves to morph in strange and unexpected ways. While such a change is underway, it should be appreciated that the means by which this change is taking place are not at all revolutionary. In fact, terror-operations in the twenty-first century do not have 'revolution' as an objective, which is also what sets them apart from the traditional and historical theorists and practitioners of anarcho-terrorism.[37] Additionally, this change is imperceptibly gradual and is not, as is commonly (mis) understood, an intervention from an 'outside'. Rather, it is a productive, indeed creative, albeit *intensive,* operation whereby the very fabric of the modern Western industrialised and informationalised state and society (and that of its clones outside the geo-territorial western world) is gradually becoming un-done. As such, therefore, this emergent battlespace is radically different from that which is showcased by the Clausewitzian sub-political category of Real War from which we have thus far derived the analytical and operational principles and tools by which we attempt to understand and contend with terror-operations.

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[37] Some of the more prominent practitioners were François-Claudius Ravachol, Auguste Vaillant, Émile Henry, who, among others, were inspired by the revolutionary and counter-revolutionary theories and doctrines of the Kropotkin/ Malatesta/Nechayev/Bakunin-inspired school of anarchism.

PRECURSOR TO THE SIMAD: THE NOMADIC WAR-MACHINE

In the context of mainstream International Relations, 'threats' to the nation-state are generally alleged to originate from two distinct locales: (1) from outside the State, and (2) from within it. From the 'outside', 'threats' to the nation-state are either posed by other nation-states or by non-State actors, while in the latter case, the threats are local, that is to say, they are systemic in origin. Yet to say that threats to the nation-state originate from the 'outside' would be a misnomer, for the perception and consequent contextualisation of the threat takes place from within the confines of the nation-state, thereby establishing the originary limits of the threat. This is reflected in the Clausewitzian consideration of war as an instrument of politics, which is also how 'Absolute War' is brought to Reason. By contrast, the original Deleuze-Guattarian formulation of the nomadic war-machine, which they placed at a locale external to the State, allows us to (re)consider war from a non-Clausewitzian point of view. In other words, it allows us to engage with war from a site outside the circumscription of the nation-state and its transcendentally-generated geo-territorial map of materiality. In this exteriority, the Deleuze-Guattarian war-machine is 'irreducible to the State [...] outside its sovereignty [...] prior to its law: it comes from elsewhere.'[38] As such, therefore, the Deleuze-Guattarian war-machine is '... of another species, of another nature, of another origin'.[39]

The key to understanding the Deleuze-Guattarian formulation of the war-machine is to understand its

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[38] G. Deleuze and F. Guattari, *Nomadology: The War Machine*, tr. Brian Massumi (New York: Semiotext(e), 1986), 2.

[39] Ibid., 3.

'nomadic' nature while at the same time keeping in mind that 'war' (political war), for the nomadic war-machine, is only of secondary importance. To draw our attention to the 'exteriority' of the nomadic war-machine, Deleuze-Guattari insist that we pay close attention to the 'nomad', who, they assert, has 'a territory'. In other words, we are meant to recognise that the nomad traverses 'paths' which are defined by points or nodes – watering holes, dwelling points, and points of dispersal. These points and nodes are mere transit points which are temporary locales of assembly and dispersion for the nomad. The nomad, unlike other sedentary or even migratory entities, is not attracted permanently to such points or nodes. As Deleuze-Guattari put it, 'the life of a nomad is intermezzo'.[40] In this way, Deleuze-Guattari distinguish the nomad not only from the sedentary, but also from the migrant: Unlike the nomad, the migrant, who is also a 'mover', travels along a path determined between two points. In the migrant's case, however, the points determine the path and the points are the *telos* of the movement that the migrant undertakes. This is *contra* the nomad, whose movement is in itself the *telos*, with the points or nodes being transient points of rest and refreshment. The paradox that the nomad presents, however, is that – according to Deleuze-Guattari – although the defining nature of the nomad may seem to be movement, as Toynbee points out, the nomad actually does not move. Rather, Deleuze-Guattari say, the nomad occupies 'space'.[41] Thus, in Deleuze-Guattari's words, 'the nomad is one who does not depart, does not want to depart, who clings to smooth space left by the receding forest, where the steppe or the desert advance …'.[42] In Toynbee's words, nomads fling '… themselves upon the Steppe, not to escape beyond its bounds but to make themselves at home on it.'[43]

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[40] Ibid., 50.

[41] Ibid., 51.

Deleuze-Guattari's theorisation of the nomad and of the nomadic war-machine is, of course, more complex and extensive than the above may suggest. However, for our purposes, it is only necessary to recognise that the Deleuze-Guattarian model of 'nomadology' brings into sharp relief the functioning of nomadic war-machines and the nature of their relationship with the nation-state and its instruments of war. In summary, the diagram that they draw of this relationship may be sketched out in the following way: (1) War-machines (which are nomadic assemblages) are external to the State; (2) Since the nomad, essentially, occupies 'space', it is the State which intrudes into this 'space' of the nomad, which is where and how the State comes into conflict with the nomadic war-machine; (3) Thus, under specific circumstances, the State is able to 'capture' such war-machines and internalise them. In other words, the State is able to instrumentalise these nomadic war-machines and use them for its imperial purposes; (4) As such, therefore, the State is always predisposed to assume a pre-emptively offensive stance to seek the 'unknown unknowns', for the latter pose the greatest threat to the systemic health of the State; (5) However, in the process of doing so, the State also runs the risk of being enveloped by the war-machine, in which case the State ends up being a mere assemblage of the war-machine. In this form, the war-machine assumes global proportions and is able to create a condition of terrifying peace;

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[42] Ibid.

[43] A. Toynbee, *A Study of History* (New York: Oxford University Press, 1947), Abridged by D.C. Somerville, 168.

(6) This peace is a function of the constabulary role that the global war-machine plays by integrating within itself what were originally the policing and juridical functions of the State into a panoptical device of control and discipline; (7) The principal concern of such a worldwide war-machine is to exercise systemic control of, among other things, the State. In other words, the worldwide war-machine looks to identify any sign or activity that may disturb the systemic balance of the State/war-machine. In Bousquet's terms, the worldwide war-machine seeks to contain, but also to sustain, a chaoplexic condition that carefully calibrates the degree of turbulence allowable within the system. In this way, the worldwide war-machine is able to maintain the productive health of the system by monitoring the productivity (and, one could also add, the vitality) of the constituents of the system. This Deleuze-Guattarian model of the nomadic war-machine which, when captured and re-deployed by the State, assumes the terrifying model of a worldwide war-machine that has run amok, is not merely a piece of speculative theory. In the context of the emerging theories and doctrines of network-centric warfare, their model of the instrumentalised war-machine has taken on a very real materiality. Thus, for example, we can find an uncanny resemblance between the doctrine of battleswarms and the Deleuze-Guattarian model of the worldwide war-machine, both of which – at least in theory – are envisioned not simply in global terms, but on a planetary scale.

In the context of twenty-first-century terror-operations, therefore, if the terror-operator is assumed to be a 'nomadic war-machine', then the State's counter-terror (and counter-insurgency) doctrines are signatures of the domestication of the nomadic war-machine.[44] Of course, there is a viable case to be made that post-modern terror-operators like Al Qaida are not nomadic war-machines. Yet, their operational signatures lead us to suggest that, at the least, they simulate the operational modes of nomadic war-machines. However, this does not negate the State's ability to capture this extra-State war, which it makes its own. Given this, the following question arises: Is there 'a war' that remains outside the ability of the State to make its own – thereby precluding its ability to bring war to a 'reason' comprehensible by the State?

SIMADology

Given that most discussions on terror-operations – within the current geo-politico-philosophical regime of thought with all its attendant anthropocentric socio-political and psychological biases – sink steadily into the morass of an anthropocentric notion of 'terrorism', our intention, as we clarified at the outset of this essay, was to explore the possibility of an alternative regime of thought within which we contend that the SIMAD's *polemos* is gradually unfolding. But to do this, merely asserting the emergence of this polemical condition is not enough. We cannot begin to speak of the SIMAD's *polemos* without explicating the vicious circle that binds the diachronic relationship between the Terror-Operator, and its anterior/prospective actions, which are only retrospectively recognisable as the Event-Terror. Thus, in the context of the SIMAD's *polemos*, we begin by positing nothing less than an absolute annihilation of any residual interstices that may have kept apart the Terror-Operator and the Event-Terror – thereby collapsing them into and onto each other. This, in turn, requires us to direct our attention to an alternate martial space – let us refer to this as a 'chthonic battlespace'.[45]

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[44] One example of the State's capture of the war-machine and its redeployment in the service of the State and its subsequent running amok is the U.S. support for the Afghan Mujaheddin to fight the Soviet Occupation of Afghanistan. After the defeat and withdrawal of the Soviets, these same Mujaheddin engineered a machinic assemblage which turned upon their erstwhile benefactors and locked them into a battle that rages on to this day. See M. Kakar, *Afghanistan: The Soviet Invasion and the Afghan Response, 1979-1982* (London: Univ. of California Press, 1997). See also Steve Coll, *Ghost Wars: The Secret History of the CIA, Afghanistan, and Bin Laden, from the Soviet Invasion to September 10, 2001* (London: Penguin Press, 2004).

Engaging with the chthonic battlespace – which is marked by a tension characterised by flows and counter-flows of forces of intensification and torsional disintensification (envoiding)[46] – is but the first step in articulating an alternate regime of thought wherein the Clausewitzian paradigm of War loses its subjective anchor and objective reality. When considered in the context of the chthonic battlespace, the Clausewitzian 'concept' of Absolute War breaks free from its ideational limits (imposed on it by the experience of Real War) and freely colludes with any and all counter-resistant media to creatively produce a differential calculus of itself, which infects and re-infects not only the resisting medium, but all machinic assemblages that (per)form with/in that medium, while at the same time – with clinical and excessive precision – virally proliferating itself, thereby creatively generating 'milieus of terror' far in excess of any geopolitical sources and levels of terror that we may be familiar with. In this way, the SIMAD's *polemos* assumes a chasmic[47] pertinence, which is both endemic to the regime of thought that generates it, and which is, more terrifyingly, in excess of it.

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[45] The word 'chthonic' is derived from the Greek χθόνιος – *chthonios*, 'in, under, or beneath the earth', and from χθών – *chthōn* 'earth'; pertaining to the Earth; earthy; subterranean. Further, the Greek word *khthon* is one of several words for 'earth' which, typically, refers to the 'interior of the soil', rather than 'the living surface' of the land (as *Gaia* or *Ge* does); or the 'land as territory' (as *khora* [χώϱα] does). Our use of the word 'chthonic' invokes the reference to the 'interior of the soil' that the word *khthon* involves.

[46] Thanks to Reza Negarestani who formulated this excellent phrase (email exchange, July 18, 2009).

In the context of this essay, therefore, the SIMAD's *polemos* is an un-grounding that destabilises any and all territorial limits, including those 'territories' inhabited by the Deleuze-Guattarian 'nomad'. By positing this, we are also suggesting that the SIMAD's *polemos* is 'the ripping of the ultimate horizon of materiality which poses a posterior disjunction to thought and enacts the anterior submission of originary ontological difference to the non-belonging principle of the void.'[48] It is in this sense that the SIMAD's *polemos* is the signature of an ultimate dissolution of materiality. Chasmic Terror, in the context of the SIMAD's *polemos,* then, is in the first instance the disjunction of thought – for in such a theatre of dissolution, thought loses its traction. Thought, in these conditions, is wrecked by a torsional movement that not only contorts it beyond recognition, but also, more importantly, first disinters and then dissolves it, thereby bringing into sharp relief the possibility of a chasmic immaterialisation with its attendant annulment of all ontological privileges.

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[47] In this context, the urge to use the word 'cosmos' or 'cosmic', was very compelling. However, etymologically, it would have been impossible to support. In Ancient Greek, the word 'kosmos' refers to an 'orderly arrangement' (cf. Homeric 'kosmeo', used of 'the act of marshaling troops'), with an important secondary sense of 'ornament, decoration, dress'. Pythagoras is said to have been the first to apply this word to 'the universe', perhaps originally meaning 'the starry firmament', but later it was extended to the whole physical world, including the earth (see http://www.etymonline.com/index.php?search=cosmos&searchmode=none). In this essay, the use of the word 'chasmic' is made keeping in mind the following: (1) It is a derivative of 'chaos', which is itself derived from the Gk. khaos 'abyss, that which gapes wide open, is vast and empty,' from *khnwos, from PIE base *gheu-, *gh(e)i- 'to gape' (cf. Gk khaino 'I yawn,' O.E. ginian, O.N. ginnunga-gap; (2) Hesiod ('Theogony'), describes 'khaos' as the primeval emptiness of the Universe, begetter of Erebus and Nyx ('Night'), which is much closer to what we intend to convey in this essay, as opposed to, say, how Ovid (*Metamorphoses*) – who opposes Khaos to Kosmos, 'the ordered Universe' – uses the word. Further, the Greek word 'tarakhe' stands for disorder, which may be posited as the opposite of the word 'kosmos'. We have chosen to use the word 'chasmic' derived from Hesiod's use of the word 'khaos', rather than from Ovid because (1) the latter's use of the word pits it directly against 'kosmos' and thus may be considered to be closer to 'tarakhe' or 'disorder', and (2) when derived from Hesiod, the word conveys a more open-ended sense. Of course, we also contend, contra Hesiod that chaos is not a signature of 'pure emptiness of the Universe, rather that it is a 'force-plane' that is anterior to even matter, which is also our provisional explanation of Hesiod's assertion regarding the 'primeval emptiness of the Universe' as the begetter of Erebus and Nyx. (see http://www.etymonline.com/index.php?search=chaos).

Given this, the SIMAD is therefore the point or locus where this ripping of the ultimate horizon of materiality is tangibly 'visible'; for it is at that site and in that instant that the curvature of a radically open-ended exteriority – the chasmic – exhibits itself while simultaneously generating an anomalous field or milieu wherein the vastness of the chasmic non-belonging exteriority is expressed by means of a distinct tellurian-originated difference. This expression of tellurian difference is nothing but the signature of an ill-fated, that is to say tragic, complicity of interiorised tellurian energetico-structures – that produces, by means of difference-engines, a spatio-temporal materiality – with chasmic non-belonging exteriority. It is critical to note that this complicity, though tellurian in origin, is absymally virulent – indeed this is what makes the SIMAD and its ensuing *polemos* so hard to pin down, yet so very real. The SIMAD is a passage, a traversing, an emergence, an eruption, which involves – indeed, compels – a tragic but essentially indifferent complicity between tellurian structures and chasmic dissolutions, resulting in the disintegration of all ontological privileges. It is for this reason that even when we speak of 'acts of terrorism', which are instances of tellurian 'terror-events', we cannot do so without reference to breakage, dismemberment, dissolution, incomprehension, stunning affectivity, and ultimately, to death. But, lurking behind our tellurian-specific explanations, what we are actually referring to is this breakdown and dissolution of patently tellurian ontological privileges, caused by seemingly abrupt interventions and of their scattering into the darkest recesses of a chasmic void of non-belonging-ness.

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[48] Reza Negarestani (email exchange, Jun 23, 2009).

The question that begs our attention at this point concerns the implicit difference that emerges as a consequence of our reference to the *tellurian* and *chthonic*. Etymologically, the tellurian refers to surfaces that presume a *terra firma*. It is a material surface, albeit without any depth and, interestingly, it is the implicit plane on which, it is theorised, advanced war machines, such as those proposed by Deleuze-Guattari, express their so-called rhizomatic martial tendencies. But it is important to note that the mobile assembling and dis-assembling that the Deleuze-Guattarian war machines revel in, while seemingly liquid in their movements, are nevertheless restricted to the 'matter' of the tellurian surface; for the '*firma*', in the tellurian context, guarantees the ontological structural integrity of 'matter', which blocks off access to 'depth', that is to say, to the Abyss of non-belonging-ness, and which, while being 'smooth', also retains the potential of 'striation'. The chthonic, on the other hand, is the substrate of the tellurian. It is a liquidly intensive and interiorised chasmic force-plane, which is smooth, free-flowing and open-ended. The chthonic plane is thus an interiorised chasmic horizon – an 'inscape' of chasmic non-belonging-ness. In this sense, it is anterior to matter itself (and thus to all ontological attributes that lend structural integrity) and therefore precludes the possibility of any kind of striation. On this plane, which is seething with unrestrained forces, transitorial assemblages such as Deleuze-Guattarian war machines are irrelevant. They gain no traction. They are unable to maintain their integrity of assembly, however fleetingly. Thus, the Deleuze-Guattarian *concept* of rhizomes, presuming that it is a prelude to the formation of difference-engines, is effectively only possible on these chthonic planes, for the latter allow for a free play not simply on surfaces, but also in terms of a chasmic depth. Given this, therefore, it can be said that tellurian surfaces and structures have as their conditions of possibility the chthonic, but chthonic planes remain without any such preconditions. Indeed, the chthonic chasmic forces, while instrumental in creating the conditions of possibility of matter (and the consequent ontological privileges), are also always-already dissolving such conditions on the tellurian non-planar surface. In other words, the chthonic chasmic forces are always subversive forces which, while engendering differential engines that populate the tellurian surfaces, also continually spike them.

Now, these terrifying chasmic interventions, which in the tellurian context are akin to 'eruptions', cannot be plotted against and within a tellurian matrix, because they are the unfolding of always-already interiorisations of a chasmic exteriority that lurks as a substrate to the tellurian surface and that takes place along and across the continuum of tellurian space-time. Thus, to say that the SIMAD 'intervenes' is not to suggest that it is an invasion from an 'outside'; rather, it is to suggest that the rupture of the tellurian space-time continuum is akin to a cross-sectional cut which, while slicing through the non-planar tellurian surface of exteriority, nevertheless envelopes the tellurian exterior, thereby interiorising it within the chasmic exteriority. There is something very excessive and disturbing about this, for the buckling and contortion that takes place in this envelopment results in a compression and an ultimate collapse of the tellurian space-time continuum into a site and locale of immeasurable density; while equally, and more importantly, it is also a shattering and a scattering of all energetico-structures beyond all tellurian confines. This is the site of the SIMAD's battlespace – the martial *intermezzo* in which strategy decomposes into pure tacticities and where combat has less to do with destruction, and more to do with the alchemy of decay. Thus, it becomes impossible to capture – let alone domesticate – the SIMAD. It is only possible to be complicit with/in it – but on the non-negotiable condition that we also share its non-linear and cross-register movements, which spiral away chaotically beyond any tellurian boundaries into a chasm of non-belongingness. The paradox is that while we are swept up and along by this terrible intervention, equally, we cannot help but contribute to it: in the process, we – as tellurian-specific energetico-structures – become un-done!

When considered from the perspective of the tellurian non-planar surface, the 'intervention' that we have just described is indeed paradoxical: For it is inconceivable that we are both the site wherein the affectivity of the SIMAD is exhibited and a co-constitutive element of the SIMAD itself. However, the paradox becomes, literally, immaterial if we posit that what is played out on this chthonic surface is the liquidity of the SIMAD's *polemos* on and in which we are no longer discrete and resistant energetico-structures negotiating the flows of the molten surface of the chthonic plane, fighting the insinuations of havoc that the SIMAD brings with it. Rather, we are discontinuous ensembles drawing our localised tactical consistencies from the very medium that constitutes the chthonic planar surface. In this way, while we are consumed by the SIMAD's *polemos*, we co-constitute it as well. It also follows, then, that when considered in the context of such chthonic planar surfaces, there are no discrete interstices wherein the politics normatively attributed to terrorism can be played out. Of course, this does not mean that the politics of terror are absent. They are certainly present, but only on the tellurian non-planar site to which we, operating on and within the liquid chthonic plane, are indifferent. But if this is so, then how can we account for the difference between the non-planar tellurian surface and the chthonic planar substrate? Is there not a sharp and distinctive originary difference between them?

To presume a difference between the tellurian and the chthonic is to reinscribe the presence and uninterrupted operation of a difference-engine which produces difference *qua* matter in the first instance. We have already suggested that such difference-engines only exist on the tellurian surface, which provides them with enough traction to be able to produce and proliferate difference *qua* matter. But equally, chasmic interventions subvert the output of these tellurian difference-engines (difference *qua* difference and, by implication, difference *qua* matter). Thus, while in the tellurian context, matter is indestructible, or irreducible, in the chthonic context, its (that is to say, matter/difference's) production is always-already a signature of its dissolution. As a pertinent aside, it is this force, on whose vector the dissolution of matter/difference is contingent, that Ferenczi indicates when he speaks of 'the complete dissolution of connexions and a terrible vertigo' in the context of the Ego.[49]

This vertigo, which is one of the signatures of an asymmetric dismantling of difference-engines, is a terrifying indicator of the SIMAD's passage involving chthonically interiorised chasmic forces through and beyond tellurian surfaces (and the implicit exposure of the interiorised chasmic horizon of a non-belonging exteriority, or that which we have referred to as the 'inscape' in the chthonic context) carrying along with them shattered tellurian energetico-structures (difference-engines), which rapidly decompose into ever receding fragments and grains within the chasmic void of non-belonging-ness. As a consequence, these interventions, by spiking the tellurian-specific difference-engines, bring about an ungrounding of the non-planar tellurian surface while remaining faithful to the creation of a 'new earth'. This is the passage of the SIMAD.

Considered in this way, then, it is tempting to understand the SIMAD as a very distinct and specific kind of a difference-engine – one that, while traversing along and across the tellurian surface, only plays the role of dis-integrating it. In light of our discussion thus far, it would appear that the SIMAD is a difference-engine engineered and empowered by chthonically-interiorised chasmic forces that arrive from unidentifiable locales of non-belonging and transit through to other such locales of non-belonging.

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[49] S. Ferenczi, *Final contributions to the problems and methods of psychoanalysis* [1930] (London: Karnac Books, 1994), 222-3.

This would also account for our inability positively and effectively to enframe the SIMAD within a matrix of comprehensibility and would confirm the essential indistinguishability that we have previously attributed to it. If we give in to this temptation, however, we would be grossly misunderstanding the SIMAD.

The SIMAD is not a difference-engine, though it can masquerade as one when in hypercamouflage mode. Instead, the SIMAD is an *intensive mechano-in-organic insinuation (pre-shock and after-shock) of the passage of chasmic forces that riddles any battlespace constructed on the tellurian surface with 'hotspots' – sites or locales of eruption and escape (Levinas would undoubtedly refer to these as sites and instances of 'excendence')*.[50] It is *intensive* because, while on the tellurian surface, it appears as a pure and transparent spatio-temporal dynamism originating from within the enveloped void hidden within the surface of the earth. It is *mechano-in-organic* because, identified in the tellurian context as a fleeting agenticity originating from a locale of non-belonging-ness, it is primordially machinic but also takes on a progressively solid and organic form as its evolutionary cycle cuts through the tellurian surface. It is an *insinuation* because, on the tellurian surface, it leaves nothing more than an aftershock as traces of its terrifying passage. As such, therefore, the SIMAD brings into sharp relief the post-vital, that is to say the post-Evental, status of tellurian battlespaces.

Now, the theory of NCW which, when considered in its abstract – albeit perversely grotesque – form closely approximates the Deleuze-Guattarian conception of a 'worldwide war machine that has run amok', posits that the key to its efficient operability is its ability to 'sense and respond'. This it proposes to do by progressively collapsing the links between the 'sensor' and the 'shooter'. The ideal condition, implicit in the theory of battleswarms, is the meshing of the 'sensor' and the 'shooter', which allows for the prosecution of what is termed Just-in-Time (JIT) Warfare. Indeed, it is precisely this lack of distance between the general's map-table (screen) and the battle that, in the first instance, allows Just-in-Time War to be imagined. In other words, the viability of the JIT concept of operations rests on the ability to operate in Real Time. But, as we have seen, when played out on a tellurian surface, the map-table is a 'map' that plots the Event-Terror *after* its instantiation – that is to say, retrospectively. In other words, what is reflected on the general's map-table is a trace (or alternatively, an after-shock) of the Event-Terror – it is, in this sense, behind Real Time.

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[50] Acknowledgment to Reza Negarestani for the phrase 'mechanorganic insinuations of sheer havoc', which I have slightly modified to read 'mechano-in-organic' (email exchange, Jun 23, 2009).

The strategic ensemble that the theory of NCW assembles is the most recent – that is to say, a postmodern – difference-engine that has emerged on the tellurian surface. Little wonder, therefore, that some of the leading theorists of NCW who lay a great deal of emphasis on the theory and emerging doctrine of 'battleswarms' would choose to understand the doctrine in terms of a 'seemingly amorphous, but […] deliberately structured, coordinated, strategic way to strike from all directions, by means of a sustainable pulsing of force.'[51] There are two implicit assumptions underwriting this emergent 'concept of operations': Firstly, that battleswarms – comprised of myriads of small, dispersed, networked and highly lethal mobile units – would disintegrate in battle; but also that they should be able to speedily reform to co-constitute a fresh battleswarm to deal with a 'new' threat. And, secondly, that under ideal conditions, the 'seemingly amorphous, but deliberately structured' form is held together by a 'sustainable pulsing of force'. The latter assumption is an interesting one, for it in turn presumes that these post-modern theorists of war have not only recognised the high intensity and multivaried forces that their technophilic battleswarms would have to contend with – that which we have previously identified as chthonically interiorised chasmic forces – but also that, eventually, there would arise the possibility to halt and effectively combat these 'unknown' forces.[52] The reference to the 'sustainable pulsing of force' is even more interesting, as it points to the implicit difference-engine that is operative within this net-centric 'concept of operations', which is designed (or perhaps destined) to function as the organising principle of battleswarms. This latter aspiration, we should not fail to recognise, is in keeping with the Clausewitzian tradition. Whereas Clausewitz attempted to contend with chaos and uncertainty in the context of war, and particularly on the battlefield, by instrumentalising (or alternatively, strategising) the genius, chance and uncertainty, and by theorising the very concept of war in a very specific way, his post-modern disciples, it would seem, are opting for a more technologically-grounded method to achieve the same end. In the latter case, the only way this can be achieved is if they somehow succeed in effectively sealing off the tellurian surface from the terrifying chasmic forces, which would entail a scenario that eerily echoes the

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[51] Arquilla and Ronfeldt, *Swarming and the Future of Conflict*, (Santa Monica: RAND Corporation), (PDF version available at http://rand.org/pubs/documentedbriefings/2005/RAND_DB311.pdf), vii.

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[52] The most recent attempt to articulate this has been Bousquet's *The Scientific Way of War*, wherein he used the term 'chaoplexic' to highlight the emerging model that such efforts of containment would deploy.

Deleuze-Guattarian vision of a 'worldwide war machine, which […] reforms smooth space [and] […] claims to control, to surround the entire earth.'[53]

What remains unaccounted for by and in this post-modern battlespace, which is possible to construct only on tellurian surfaces and which maintains its ideal objective in terms of spanning the entire tellurian surface, is the subversiveness of the chasmic forces – represented by the SIMAD – that confront it. This subversion – the dissolution of the materiality of the tellurian surface and of all associated energetico-structures – then, is the counter-tactical 'concept of operations', which is fleetingly instantiated by and as the SIMAD. Recognising this, albeit perhaps not in these specific terms, the tellurian-specific project of net-centric militarization attempts to 'humanise' the SIMAD (as a 'terrorist' or a 'terror-operator') thereby creating a distance (difference) between 'it' and the Event-Terror such that, to paraphrase Libicki, 'a fine enough mesh can be cast to catch "it", or indeed, anything'. The failure to do so, as is evident from our more recent experience of war in the twenty-first century, is becoming increasingly terrifying and, as such, it heralds the polemological condition that the SIMAD brings in its wake.

III. THE FOUR PROTOCOLS OF SIMADOLOGY

Based on the above, we are now in a position to articulate a rudimentary set of protocols by which the SIMAD operates:

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[53] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, Trans. Brian Massumi, (London: Continuum, 2003), 421.

First Protocol: The object of the SIMAD's polemos lies not in the perpetuation of war, but in the instantiation of a creative chemistry of decay.

Under the Clausewitzian model, war – which has been the exclusive preserve of the nation-state – has two critical centres of gravity: a geo-spatial locale and a psycho-social locale. Thus, Clausewitz was able to say that if either of these two centres of gravity of an enemy is dislocated, it is possible to impose our 'will' onto the enemy. Counter-intuitively and paradoxically, SIMADs work to sustain *and* decay both the geo-spatial and psycho-social centres of gravity of their targets of interest. Indeed, the continued presence and maintenance of such centres of gravity is critical for the SIMAD for, paradoxically, they are the very sources of nourishment of the 'agenticities' of the SIMAD. The first principle of SIMADology, therefore, suggests that the most conducive environment for the efficient conduct of operations is a state or condition of an 'uneasy' peace, which can be calibrated by the SIMAD between greater or lesser degrees of fear, surprise and terror which involves a weaponization of the chemistry of decay and dissolution. In this way, SIMADs seek to retain the ability to calibrate the condition of peace, thereby keeping the target's systemic health in a state of perpetual decay and consequent perturbation.

Second Protocol: SIMADology *eschews the 'theory' of strategy and wholly focuses on pure tacticity.*

SIMADs refuse to engage in operations that are strategically constructed and developed. Rather, they seek micro-local and vermicular opportunities wherein they exhibit their purely tactical stance. This suggests that there is a very high degree of contingency in the SIMAD's *polemos* and that the ecology within which SIMADs operate is a critical co-constituting element that determines the nature of operations that are engaged in. Thus, all attempts to strategise the SIMAD's *polemos* are always externally imposed onto the 'agenticity' of the SIMAD. In other words, while the agenticies of the SIMAD do not strategise, the resistant environment that they operate in seeks to strategise their actions – generally, by attempting to 'profile' such activities. It is interesting to note that this foundational principle in itself plays a key role in dislocating our attempts to deal with the polemological condition that the SIMAD creates. In other words, while we, from the outside, may strategise the SIMAD's actions, SIMADs themselves are astrategic. Thus, whatever strategic pattern-creating tools we use, the 'maps' they generate are always 'fictions' for they are only artificial overlays that we create over patterns that we draw, which are always post-Evental. As a consequence, they lend us no further insight into how and in what manner the SIMAD's *polemos* unfolds. The occasional successes we may enjoy serve only to further delude us into believing the 'full-ness' of what is, in reality, our own vacuous construct.

Third Protocol: All damage, however small and seemingly insignificant, is considered primary damage.

In the context of the SIMAD's *polemos*, all damage is primary and no damage is collateral. This implies that the operating environment of the SIMAD is an omni-dimensional field of targets and that all shapes, forms, structures, ideas and matter that constitute that environment, regardless of their normatively assigned value, are targets of equal value for the SIMAD. Thus, there is no distinction made between a 'higher value' target and a 'lower value' target. When considered in the context of geo-spatial targets and psycho-social targets, therefore, everything is 'fair game'. Targets are identified not in terms of 'value' but in terms of their ability to generate 'fear', 'terror' and 'surprise' that can sustain and prolong the chemistry of decay that the SIMAD fosters. Moreover, the operations that rely on such a targeting principle are not graded in greater or lesser degrees; nor do they necessarily have to be violent, though they always exhibit a latency of violence.

Fourth Protocol: SIMADs don't inflict (damage)*, they infect.*

SIMADs infect systems and structures rather than inflicting damage on them. As noted above, chasmic chthonic forces – embodied as the SIMAD – work to dis-inter the materiality of the tellurian surfaces by continually spiking the difference-engines that populate the tellurian surface. This spiking of difference-engines by the SIMAD, however, is rarely, if ever, revolutionary. Rather, it is evolutionary. This is primarily because SIMADs insist on reducing the 'matter' of tellurian-based structures by deploying a 'decaying' mechanism – a kind of *necrosis* that brings to mind the Aristotelian description of the torture methods employed by the Etruscan pirates, which involved tying up an offender to a rotting and blackening corpse. What followed such a practice was an almost philosophical chemistry of decay by which a living body was turned inside/out at a vermicular, albeit infinitesimal, level.[54] The reported outcome of such a procedure involved the living body becoming progressively blackened, or negrified, and rotten, to the point where both 'bodies' were eventually reduced to a dark mass of slime. This, as Negarestani puts it, 'signaled an ontological exposition of the decaying process which had already started within.'[55] In a startlingly similar fashion, the SIMAD is a signature of the ontological decay of the tellurian surface for the SIMAD performs an almost vermicular function as it rends the tellurian landscape. The slow and imperceptible reworking of the ontological chemistry of the tellurian surface by the SIMAD thus spreads like a rash or a lesion which slowly tears away at, or more precisely, de-materialises, the fabric of the tellurian surface thus exposing the liquid-like substrate of the chasmic chthonic forces on which the tellurian surface rests. In this way, the SIMAD – by invoking the principle of decay – undermines the tellurian surface and all structures and difference-engines that exist and operate on it. If, as we contend, this is the nature of the emerging *polemos* of the SIMAD, then the problems associated with developing a counter-terror strategy and doctrine for the State (which, we should not forget, is a patently tellurian structure) increase exponentially for the problem associated with the fourth protocol of the SIMADology is nothing less than the following – how to contain (and reverse) a process of ontological decay?

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[54] Reza Negarestani, 'The Corpse Bride: Thinking with *Nigredo*', **Collapse IV** 129-60: 131; See also Negarestani's 'Undercover Softness', present volume.

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[55] Ibid., 169.

IV. THE SIMAD'S COUNTER-TACTICS OF HYPERCAMOUFLAGE[56]

Morris is right on the mark when he points out that despite his implicit doubts about the sustainability of the 'weapon of surprise', the security landscape has changed, thereby leading him to assert that there has been a concomitant change in the way how people think and behave.[57] Yet, based on how Morris sets up the space of confrontation – sub-state actors versus 'entire governments' – in this 'changed' security landscape, his 'conceptual framework' does not convey the radical changes that have taken place in the global security environment.[58] Thus, it remains for us to ask: how and in what way has the security landscape so radically changed and, more importantly, what are the counter-tactical principles that the SIMAD brings to the foreground?

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[56] The term 'hypercamouflage', to the best of my knowledge, was first coined by Reza Negarestani in his essay, 'Militarization of Peace' in **COLLAPSE I**. It should be noted, however, that the Soviets did have an operational principle that they termed 'maskirovka' (literally: camouflage, concealment), which was most effectively used at the Battle of Kursk against the Wehrmacht in July-August, 1943. It is also alleged that the principle of 'maskirovka' was used, under Russian guidance, to conceal Saddam Hussein's air-defence system in and around the Baghdad area. Of course, there have been other famous instances of the use of the principle of 'deception' and 'concealment' in warfare. The Allied deception of the full extent and deployment plans during the Normandy landings in 1944 is a case in point.

[57] Morris, 'Surprise and Terror', 2.

[58] If we follow Kilcullen's analysis of the accidental guerrilla, we find that one of the key issues at stake, which make the prosecution of the GWOT a problem is that nation-states find themselves in confrontation with groups and actors who reside within nation-states that are allies and friends. In some cases, this hosting of such groups is fully supported by the State in which they reside. The prime example in this instance is the case of Pakistan, which is both an ally to the United States, but has also – via its intelligence agencies (the ISI) – supported, funded and facilitated various groups that have carried out terror-operations directly and indirectly against American interests within and outside the American 'homeland'. See Kilcullen, *The Accidental Guerilla*.

Reza Negarestani's reading of Faraj's polemical terroristic text, *Jihad: The Absent Obligation,* provides us with a valuable insight into a radically post-modern counter-tactical principle of martial operability – 'hypercamouflage' – which, we contend, is the key defining feature of the martial operability that the SIMAD exhibits.[59] Negarestani suggests that Faraj's notion of *Taqfiri*-ism – set in the context of a version of militant and subversive Islamism, which counts among its proponents Sa'id Qutb, the Egyptian theorist of Islamic Revivalism – is supplemented by the doctrine of *Taqiyya*, which is contorted out of 'its [...] defensive and devout function in the dawn of Islam [...] [which originally was] a justified concealment of true beliefs in situations where harm or death will definitely be encountered if true beliefs are declared (the wider meaning of *Taqiyya* being "to avoid or shun any kind of danger").'[60] Faraj's militant and subversive bent, in Negarestani's reading, takes this notion of *Taqiyya*, weaponizes it, and recommends its deployment as a supplementary mode of operability to the already militant terroristic *Takfiri* system. The consequence of this exercise is the emergence of the 'shadow terrorist', whose principle weapon of choice then would be a latent state of weaponization, but which would remain indiscernible to the keenest of eyes. Thus, as Negarestani puts it:

> ... the cover of camouflage can never be penetrated or disrupted, and...[t]he Takfiri's favoured mode of warfare is to program a new type of tactical line which totally blends with the enemy's lines in such a configuration that it introduces radical instability and eventually violent fissions into the system from within.'[61]

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[59] See Negarestani, 'The Militarization of Peace'.

[60] Negarestani, 'Militarization of Peace', 57-8.

[61] Ibid., 55.

It will be evident at once that this vision of a battlespace, or in our context, of war, is radically different from the one that draws its inspiration from Clausewitz. There are a number of inferences that we can draw from this description of the battlespace of war. Firstly, the act of disappearing into the enemy is not a strategic act, rather it is pure tactical. It is eminently evasive and it is geared to meld (*melt* + *weld*) with the systemic elements of the enemy. This melding, ideally, is so refined that it becomes difficult, indeed impossible, to extricate the entities that have so fully merged within the system of the enemy. Secondly, as a consequence of this, the tactical principle of 'surprise', which plays such a critical role in Morris's 'conceptual framework', transforms itself into a systemic principle, which draws its sustenance from the very system within which the entities merge. Third, 'surprise' then is not an intervention from the 'outside'. Rather, it is, as Negarestani puts it, more akin to 'violent fissions into the system from within'. What ensues, therefore, is a radical destabilisation of the system, whose structural disabling is calibrated not by those elements legitimated to control the system, but by these mysterious entities that have disappeared within the system. The outcome of this, of course, is that the tactical initiative shifts from the system and its controllers (those who regulate and monitor the system's stability) towards the invisible malcontents that have infected the system. This calibration does not necessarily have to take the shape and form of 'visible' and 'public' Event-Terrors such as 9/11, the bombings in Khobar, Bali, London and Madrid, or the most recent indiscriminate shootings in Mumbai; it can even take place by mere insinuations. Thus, the deliberate leaking of (false) information pertaining to possible terror-strikes, the deliberate and calculated betrayal of the foot-soldiers – the raw recruits – to the keepers of the system, are all methods by which the calibration of the system takes place. Moreover, as a consequence of this, when the system attempts to correct itself, more often than not, by overcalibrating itself – the shooting of the Brazilian national in London is a stark example of this – it only serves to create further fertile conditions for the anomalous infectious agents to virally proliferate their infection of the system.

The policing of such an infected system, therefore, becomes a problem of gigantic proportions, for the key question that the policing agencies have to ask themselves is not simply: Who is the agent that is infecting the system?, but also: What does this agent look like? And, since the question is posed in this way, the technophilic response of the system is to reduce its constituents – individuals – to a computable and calculable entity, as is gradually being achieved by means of biometric identification cards, chips and passports. The objective of the system, therefore, is to create periodic pan-sensorial 'snapshots' of itself, by means of increasingly intricately-linked biometric databases, such that the health of the system may be monitored, and 'infections' that can or may destabilise the system contained, isolated and/or destroyed. Further, although the point is not central to our concern in this essay, it is worth pointing out that the key flaw in such an approach to security is that its operative assumption is that the infectious entities within the system have as their objective the collapse of the system. This is a tragic misreading of this security problematic given that for the infectious agents, the objective is to keep the system at a very precise tipping point which hovers between self-destruction and absolute consolidation –

a 'chaoplexic' condition – which is paralysing and terrifying. It is precisely in this way that 'surprise' and 'terror' come not only to be weaponized within the system, rather than at a locale outside it, but also to form the substrate on which the biopolitical model of the post-modern state manages itself. In other words, 'surprise', 'fear' and 'terror' become hypercamouflaged by being indiscernable elements of the system.

As discussed above, the passage of the SIMAD from among and between us is a process by which the dismantling of ontological privileges takes place. This dismantling and disintegrating of ontological privileges may seem paradoxical since the SIMAD, as an insinuation of havoc and disaster, tears down such privileges and throws 'matter' into the darkest recesses of the chasmic void, but at the same time engenders difference-engines on the tellurian surface. But we should be careful to recognise that this paradox is only apparent, because we, as tellurian-specific energetico-structures, are only able to discern (or, more commonly, insist on discerning) the passage of the SIMAD from within a tellurian-specific perspective, while not recognising and realising our essential complicity with and as the SIMAD. And, it is precisely in this way that the SIMAD executes its counter-tactical principle of 'hypercamouflage'. For it – that is to say, the SIMAD – rests within the tellurian difference-engines and energetico-structures. *In other words, SIMADs, in the first instance, reside in us.* Thus, to appropriate the Deleuze-Guattarian phraseology, the more arborescent the tellurian structures, the greater is the degree or revolutionary impact of the violence that the passage of the SIMAD entails, while by the same token, the more flattened or rhizomatic and assemblage-like the tellurian structures, the more evolutionary and less violent is their fate.

In the context of our discussion of the SIMAD and the chthonic battlefield, then, these mysterious 'agencities' are signatures of the passage of chasmic forces that relentlessly tear apart the tellurian structures with which we are more familiar and which, tragically, determine the mode and manner of how our state-centric counter-terror operational plans are conceived and deployed. In light of our discussion thus far, it will be evident that our attempts to deal with this emergent situation are worse than inadequate. Even the principles and doctrines of NCW which – despite Peter Singer's contention that they miss the point of 'future war'[62] – constitute perhaps the most advanced theory of war and combat that has seen the light of day since Clausewitz, suddenly finds itself unable to come to grips with the SIMAD and the *polemos* that it brings in its wake. Ultimately, however, this failure is one of imagination rather than of our capabilities. In other words, not only does our current imagination of war fall short; we repeatedly fail to comprehend the existential threats that our more familiar tellurian structures – the nation-state being the most visible example – are increasingly beginning to contend with.

CONCLUSION

As can be expected, insinuations such as these reside outside the pale of the martial imaginations that are deployed on tellurian battlespaces, which is also why we have yet to find an effective counter-tactic to the SIMAD. Instead, and at the cost of repeating ourselves, what we have proceeded to do is to step up the production and proliferation of difference-engines, thereby developing a model of global security governance by which means we strive to harden the tellurian battlespace to a degree that we assume can withstand such chasmic interventions.

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[62] P. Singer, *Wired For War* (London: Penguin Books, 2009).

In a recent study of the 'accidental guerilla', David Kilcullen marks precisely such an effort. While the ethnographic descriptions in Kilcullen's study are interesting enough, nevertheless, when he begins by seeking to understand the GWOT as 'a form of globalised insurgency, with a vanguard of hypermodern, internationally oriented terrorists […] making use of all the tools of globalisation [while at the same time seeking] […] to organise, aggregate, and exploit the local, particular, long-standing grievances of diverse [...] social groups',[63] we already know (1) the nature of the terrain on which he is seeking to operate and (2) the strategic remedies that he will eventually offer at the end of his study. It is clear what Kilcullen is attempting. Firstly, he is intent on establishing a global tellurian battlespace, which is the space in which the GWOT is fought. Therein he proposes to establish smaller discrete battlespaces which, when considered in net-centric terms, are high-resolution magnifications of sections of the much larger and wider global battlespace. Following this, Kilcullen, taking cover behind the subjectivity implicit in traditional ethnographic studies, proposes to construct another battlespace with an even finer resolution, such as Libicki's original formulation of 'the Mesh and the Net', imagined as being fine enough to catch anything may be realised. In the process, however, Kilcullen is unable to provide us with a single clue as to how to halt the slow but steady seepage of terror, fear and surprise that oozes from the chthonic battlespace and wreaks havoc onto and into the tellurian one – for, despite the identification of such 'accidental' guerrillas, the bombings continue, the tellurian battlespace keeps getting ripped apart and the energetico-structures that are the 'matter' of Kilcullen's study keep getting infected with the non-belongingness of the void.

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[63] Kilcullen, *Accidental Guerilla*, xiv.

Studies and policy recommendations such as Morris's and Kilcullen's thus fail to recognise that the tellurian logic that drives a statement such as the following: '[t]he dynamic interaction between the modern international system of nation-states [...] and [the] two discrete but often interconnected and loosely cooperating classes of nonstate opponent – terrorist and guerrilla, postmodern and premodern, nihilist and traditionalist, deliberate and accidental – may be part of what gives today's "hybrid wars" much of their savagery and complexity',[64] is an essentially flawed one. Flawed not simply because of the manner in which the groups that such studies and analyses identify and differentiate as postmodern and premodern are falsifiable, but because they fail to recognise that embedded within these very groups is a kernel of the chasmic void and that the resistance that they offer on the tellurian battlespace (which is all that Kilkullen can recognise) is itself a signature of the passage of the SIMAD.

Thus, Morris's, Kilcullen's and other suchlike analytical studies, whilst otherwise engaging accounts of 'post-modern terrorism' and of 'the accidental guerrilla', betray a fealty to a patently Clausewitzian imagination of war and consequently, when considered in the context of the chthonic battlespace, remain insufficient in their imagination to contend with the SIMAD and the virulent *polemos* that it beings in its wake. It is, therefore, little wonder that Kilcullen (whose analysis and 'recommendations' may be proposed as being representative of the state-centric response to the terror-operations in the twenty-first century) would close his account of the 'accidental guerrilla' by enumerating a number of interesting conclusions and recommendations, which he contends would aid us in combating terror-operations, or what he refers to as 'hybrid wars' in the twenty-first century:

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[64] Ibid., xv.

> 1. This will be a protracted conflict.
> 2. We need to take a measured approach to national mobilisation.
> 3. We need to disaggregate and distinguish between enemies.
> 4. We need to use military force extremely sparingly.
> 5. The role of government agencies needs to be limited.
> 6. Non-military means need to receive greater emphasis in national security.
> 7. We need to emphasise the primacy of virtue, moral authority, and credibility.
> 8. We need to rebalance capabilities.
> 9. We need to rein in unsustainable spending and consolidate.[65]

Some of these recommendations leap out at us for what they imply in the context of our discussion: Firstly, there is the overall and implicit edge of palpable paranoia in these recommendations. Does this betray a fear of the envoiding that we have suggested lies within the energetico-structures that populate the battlespace that Kilcullen is familiar with? Secondly, there is the recognition that this 'battle' will be protracted – amazingly, Kilcullen suggests a 50-100 year timeframe! Whether the structural foundations of the nation-state, which are being constantly eroded and/or morphed by the chasmic forces that we have referred to, in addition to information and communication technologies, will be able to retain their integrity over such a period remains surprisingly unquestioned. Indeed, it remains an a priori assumption that the nation-state will be able to retain its current form and structure, albeit with a few minor adjustments. This is reflected in a number of Kilcullen's recommendations, such as the need to consolidate; the need to conserve resources; the need to rebalance capabilities, etc. Further, Kilcullen sets out the basal features of the nation-state – moral certitude, virtue and credibility. By positing this, as is perhaps evident, Kilcullen attempts a reinscription of the subjectivity of the nation-state, thereby making a valiant effort at reinforcing the tellurian non-planar surface on which energetico-structures such as nation-states thrive. Most interestingly, Kilcullen also makes a direct reference to the production of difference-engines whereby a disaggregation and distinguishing of 'enemies' can take place. In the context of our discussion, and when considered in light of the post-9/11 global security scenario, this should not be surprising for, if our thesis that difference-engines are continually spiked by the SIMAD's insinuation of a chasmic envoiding holds true, then this recommendation of 'disaggregation and distinguishing' – at least in the sense in which Kilcullen means it – is stillborn. Thus, only when we begin to recognise and appreciate the ensuing implications of this radically different notion of the *polemos* that the SIMAD brings in its wake, will we be able to account for the gradual and imperceptible morphing of what today passes as the post-modern face of the global insurgency that seems to have gripped the world of nation-states.

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[65] Ibid., 284-7.

And finally, to appreciate the passage of the SIMAD, we need to break the transcendental logic of the Clausewitzian architectonic of war within which theorists and practitioners of war like Morris and Kilcullen offer their analyses. As we have seen, the tellurian battlespace is one which is artificially constructed by the Clausewitzian theory of war in a bid to keep the terrifyingly Real prospects of Absolute War at bay. As a consequence, in order to avoid chthonic magneto-dynamic attractors – the SIMADic insinuations of disruption, wreckage and distortion – the transcendental logic of the Clausewitzian architectonic of war expresses a false fealty to the earth, for it hovers like an 'ultimate horizon' that attempts to enwrap and smother the earth within its tenuously constructed net-centric war-machines whose generative principle is engineered by the production and sustenance of difference-engines. These Clausewitzian war-machines do not originate from the earth; instead they arrive from a transcendental plane virally proliferating on and across the tellurian battlespace. Bringing with them a strategy of stratification, these tellurian war-machines have as their first order of business the object of establishing a plane of logistics across the tellurian non-planar surface. The ambition is stark: To Determine the Future of a New Earth. However, the mysterious liquidly molten chthonic plane, while not overtly spiking this surface ambition of tellurian-specific war-machines, churns the tellurian surface by means of an infinitesimal vermicular process, breaking apart the plane of logistics on which the Clausewitzian theory of war is grounded. Thus, the SIMAD, riding the anomalous vectors of chthonic magneto-dynamic flows, ungrounds the tellurian surface. Consequently, the Clausewitzian plane of logistics contorts into a cesspool of constantly wrecking difference-engines, resulting in the fragmentation of associated energetico-structures, which are hurled into the deepest recesses of a terrifying chasmic void. To presume that these fragments are pushed into a space exterior to the earth would be a tragic misunderstanding of the advent of Absolute War. On the contrary, the void is chasmically in-depth with the earth – that is to say, it is in complicity with the chasmic Abyss that Nietzsche steeled himself to stare back at when it glared balefully at him. This glaring back and forth is not a 'confrontation' or a combative stance between us and the SIMAD. On the contrary, it is the signature of a sub-surface movement – a complicity of visions between the chasmic void of non-belonging-ness and ourselves, where we are nothing but chasmic envoidings in deep cover or in a mode of hypercamouflage as tellurian-specific difference-engines and energetico-structures. In other words, in the Age of Simadology, we are the SIMADs. We are that which decays *and* the agents of decay. We are expressions of the terrifying envoiding chemistry of decay.

Undercover Softness: An Introduction to the Architecture and Politics of Decay[1]

Reza Negarestani

Amongst philosophers and theologians of the Middle Ages, few did not make at least a tangential remark on a particular or general aspect of decay and putrefaction. Whether in the context of theological quandaries concerning the world of beings or in the context of philosophy and the science of the age, mediaeval thinkers touched on putrefaction as a problem too intimate with the world of beings or the *explicatio* of the universe to be brushed aside on emotional or rational grounds. Yet even among this rot-frenzy of the Middle Ages, there are only a handful of passages that directly focus on the implications of omnipresent problems which decay and putrefaction give birth to. One such passage can be found among the pile of proto-scientific works on impetus theory ascribed to the German theologian and mathematician Henry of Langenstein, also known as Henry of Hesse the Elder.

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[1] This essay was extensively developed from a seminar originally given at The Centre for Cultural Studies, Goldsmiths, University of London, in May 2007. Whilst the arguments and analyses are different, the fundaments are still the same. I could not have written this essay without engaging commentaries provided by Robin Mackay, Ray Brassier, Eugene Thacker, Nick Land, Mark Fisher, Eyal Weizman, Susan Schuppli, and Luciana Parisi, who chaired the seminar.

Henry poses a ludicrously bizarre yet metaphysically troubling question regarding the possibility of the generation of one species from the putrefying corpse of another species: that of whether a fox can spontaneously be generated from a dog's carcass. Even more grotesquely unsettling is Henry's strong suspicion that 'it is not clear whether all men are of the same species or not, and so too with dogs and horses; [since] corpses which had been of the same species when living might differ in species from one another when corrupted.'[2] For Henry of Langenstein, putrefaction creates a differential productive field in which natural evolution is transmogrified into a sinisterly putrid inter-species production line. The so-called beloved creatures of God, in this corrupt scenario, are so unfortunate that they might be the festering fruits of rotten dead worlds and corpses. It is not only that forms of different species can overlap in decay, but that, according to Henry of Hesse, following the scholastic polymath Nicole Oresme and his theory of qualities or accidental forms, in putrefaction one species can uniformly or difformly deform in such a way that it gradually assumes the latitude of forms associated with other species. These deformities can progress to such an extent that one species might engender an entirely new species, an unheard-of thing, a universe whose reality can only be speculated upon. The gradational movements of decay – its vermicular liquidation across all latitudes and longitudes – thus create fields of differential deformity wherein the rotting corpse of one species or formal category interpolates between all other known species. In other words, gradients of decay or the blurring movements of rot

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[2] L. Thorndike, *A History of Magic and Experimental Science*, Vol III (New York: Columbia University Press, 1934), 485.

calculate latitudes and longitudes peculiar to other species by interpolating other forms between them. These interpolated forms are in fact derivatives of the initial form of the decaying species, putrid or thawing forms which are derived as the process of decay differentiates or gradually subtracts from a formation or structural framework. This is suggestive of an affect without the positivity of affirmation – a becoming devoid of desire but driven forward solely by the creeping power of thawing forms and their differentiation across the latitudes of forms already taken by other bodies and entities. In this sense, *we can say that in putrefaction the universe is calculated; yet even more importantly, the universe that is sensed or speculated, whether as an idea or a materialized form, is the calculus of an infinite rot* – this is the belated epigraph from which we shall begin our investigation into the architecture, mathesis and politics of decay:

> The world has its origin in putrefaction.[3]

THE CORPSE OF WORLD POLITICS

> The whole world is full of corpses.[4]

If political systems are constituted of formations – both in the realm of ideas and in concrete structures – then, like living species, they also are subject to the troubling deformities brought about by the process of decay. In fact, Henry of Langenstein's formula of decay as a weird interpolating or extrapolating differential dynamism calculating the entire universe through the putrefying gradations of a corpse finds its most refined expression in politics and on socio-political grounds. The power of differential interpolation or weird affective dynamism lends the idea of localized or isolated decay a universal twist. What is rotting is indistinguishable from the wholesome remainder: not only can the decaying part generate the healthy parts through differentiating into their forms and ideas, the healthy parts themselves may indeed be the gradients of a decaying part. That is to say, in decay the origin qua the ideal shrinks more and more toward nothing and becomes unrecognisable, whilst the idea is spewed forth from the differential subtraction of the ideal. To put it differently, in putrefaction, it is not the decaying formation that is derived from an idea, but the idea that is differentially or gradationally formed through putrefaction. The idea, accordingly, is a deteriorating husk belatedly formed over an infinitely shrunken ideal. It is in this sense that the most proper form of a political formation – its idea – can be the product of a process of decay feeding simultaneously on the unidentifiable corpse of the ideals of that system along with the putridly amalgamated forms of other decaying systems.

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[3] This remark is associated with the Friulian miller Domenico Scandella, also known as Menocchio, who was declared a heresiarch by the Inquisition and burnt at the stake. See C. Ginzburg, *The Cheese and the Worms: The Cosmos of a Sixteenth-Century Miller* (London: Routledge & Kegan Paul Ltd, 1980), xi.

[4] From *Sweet Movie* (1974) written and directed by Dusan Makavejev.

The process of decay constructs the idea only as a byproduct of the differential regurgitation of a shriveling body which is in the process of becoming less and less, without ever finding the relief of complete annihilation. This is to say, once again, that the troubling aspect of decay has to do more with its dynamism or gradation than with its inherently defiling nature: The most proper form of a formation such as a political system is not enveloped, as an origin or a priori ideal core; it is rather unfolded as a form which is differentiated a posteriori from the putrefaction of that formation or political system. The ideas of the wholesomeness and decaying (whether in regard to design, function, economy or ideas) of socio-political formations, accordingly, are posited as the latter products of a putrefying system. Yet this is not where the scenario of rot ends. Decay does not result in an equivocation between putrid and wholesome; it rather constructs *both* ideas as its gradationally proper forms, so that what is considered wholesome can in fact be seen as a rotten derivative of an initial construction that has limitropically diminished. The reverse of this scenario is not only possible but is even more prevalent: through putrefaction, the system or construction can assume forms and ideas associated with those systems or constructions which have – whether rightly or wrongly – been assumed wholesome.

The obvious, yet gullible, objection is that such an investigation of the politics of decay is not a universally or globally-relevant political issue or project, because a discussion of political rot is supposedly relevant only once one makes assumptions about the Middle East or the Balkans. In other words, in order to speak of political decay and its mechanisms, one has to provide an example such as Dubai or Bucharest – otherwise the problem of decay is not that relevant. If this is not a blind and oversimplified identification of world politics, it at least indicates a failure to understand the mechanisms at work in decay. Not only because a rotting political formation can germinate other forms which might overlap revolutionary, emancipatory and civilised political formations, but also because Western political formations and civilisations might indeed be the degenerate forms of an already rotten and limitropically decomposed Middle-Eastern or Balkanese socio-political formation. In this sense of putrefaction and rot as persisting and creeping, political decay casts a morbid shadow on the question of relevancy (or irrelevancy) and swiftly neutralises the idea of a 'localized rot'. There is no decay whose swollen and slimy nodules of rot – its differentiated forms – have not already interpolated themselves between all known and unknown forms in the softest and smoothest way possible so as to disguise the deterioration or putrefaction of the whole. These are just a few of the numerous conclusions to be drawn from a politics of decay; conclusions that hardly any political system or agency – despite testifying to the current fetid atmosphere of world politics – is ready to admit. The reason for this ironically passive stance, frequently espoused by both the right and the left, is that such conclusions overthrow certain presumptions about the fundaments, ideas and concrete formations of socio-political systems and agencies. What putrefaction changes, mimics and hollows out is not only the surface of a system but also its essential interiority, all the way down to its inner ideals, fundaments, axioms and so-called necessities. It is this spontaneous threat against the interiority of the system or formation from within that no political system or agency is willing to acknowledge, for it is exactly the admission of such a resident threat – the chemical evil of decay – that casts doubts on one's political agenda or the legitimacy of an emancipatory socio-political formation. In short, to profoundly doubt the interiority of one's politics or political agency can hardly be anything other than a real political *faux pas*.

World politics and its systems – whether erected on the side of outright repression or on the side of emancipation – have every reason to be wary of a politics of decay, because the ultimate truth of decay is that it is a building process that builds a nested maze of interiorities whereby all interiorized horizons or formations are exteriorized in unimaginably twisted ways. To put it simply, decay is a process that exteriorizes all interiorities via their own formal or ideal resources (capital?); and in doing so, its politics and schemes of complicity operate not on behalf of the interiority of the horizon (of any kind) but rather on behalf of the exteriority which demands their inflection to the outside. For this reason, we shall simultaneously explicate the weirdly-resident, or undercover, exteriorization of decay in regard to space and time so as to subsequently draw out a formalism of decay's dynamic process wherein the abstract matheme of decay gains a chemical disposition, and the chemistry of putrefaction is distributed in a mathematical space. The embracing of a politics of decay as a building process toward exteriority, and the possibility of political intervention against decaying formations, both demand a systematic investigation that criss-crosses territories associated with chemistry, mathematics, biology, geophilosophy and ontology. Without such a preparatory investigation, one risks either over-aestheticising decay as the fetish of the age, or falling into a moral credulousness that sooner or later will host a political parasite which cannot tolerate any doubt regarding the wholesomeness of its interiority. As a mere overture to the politics of decay, this essay, accordingly, proceeds to expound on the calculus of putrefaction – together with the reason as to why we associate decay with calculus – with respect to its conceptions of space, time, form and dynamism.

Since decay is the intensive destiny of terrestrial life and ecology, tellurian formations and earthly thought, a geophilosophy or tellurian politics that does not inflect upon its intensive destiny has its head – speaking entirely non-metaphorically – in the clouds.

DECAY AS A BUILDING PROCESS, OR EXTERIORIZATION VIA NESTED INTERIORITIES

The first axiom of this essay is that decay is a building process; it has a chemical slant and a differential (hence open to mathematical formalisation) dynamic distribution. The process of decay builds new states of extensity, affect, magnitude and even integrity from and out of a system or formation without nullifying or reforming it. The decaying formation is dispossessed of its chances to die or to live wholesomely, to be abolished, reformed or delivered to its origin. For this reason, decay is an irresolute process of building that potentiates architectures which, whilst infinitely open to new syntheses and transformations, cannot undergo complete annulment or return to their original form. One of the basic questions regarding decay as a building process is, thus far, the question of its vectorial alignment: Is decay a positive or a negative building process? The answer is that the building process of decay is subtractive, which is to say, it is concurrently intensively negative and extensively positive. Just as the vector of perpetual subtraction adds to the subtracted amount by deducting from what is subtracted, the process of decay generates differential forms by limitropically subtracting from the rotten object. This process is manifested vividly in a rotting fruit as it generates gradients of decay and differentiates into close and distant derivatives, whilst at the same time progressively shrivelling. The differential or germinal derivatives of the rotting fruit – its rancid smell, maggots, colour changes, secreted enzymes, etc. – constitute the positive building vector of decay which extends outwardly. Yet the shriveling body of the fruit as it continuously shrinks forms the negative building vector of decay. As long as the fruit shrivels, it gives rise to its derivatives or gradations of decay. In fact, the longer and more the object shrivels, the more remote and distant – hence weirder – its putrid derivatives and differential forms become. The process of decay, therefore, exacerbates the blackening indeterminacy already entrenched at the heart of subtractive cosmogenesis: It is no longer possible to determine how much one can lose or shrink before it becomes void and zero or how much one can spew forth and generate before it becomes nature or God.

Confronting the problem of the *infinitesimal persistence* of the decaying object, it becomes increasingly difficult to say when the process of decay ceases to exist and is supplanted by complete ontological annulment or extinction. However, the problem of infinitesimal persistence (becoming infinitely close to zero but never effectively becoming zero) poses yet another perplexing quandary in regard to the process of decay, a problem which can be summarized as follows: If the decaying object never completely disappears, and, in so far as it continues to become less, generates derivatives and maintains a germinal capacity, then does this mean that death never occurs and the minimally surviving object can never be fully exteriorized? An affirmative answer to this question surely risks advocating a form of vitalism that is ultimately unable to think exteriority. An outright negative answer can also lead to a form of utopian naivety for which the outside – viz. inflection upon death and binding exteriority – is always available and at hand. In order to examine the process of decay whilst avoiding such tortuous traps, we propose that decay as a building process renegotiates – or simply *twists* – the loci for the effectuation of architecture, exteriorization and binding death. In brief, the process of decay finds and develops a different site for the unilateral power of negativity. The infinitesimal persistence of the decaying object – in other words, its limitropic convergence upon zero – and correspondingly, its unceasing germinal power in decay, should not be examined in an isolated manner. In decay, the infinitesimal persistence of the decaying object marks a limitropic line of transition along which the interiority of one decaying object falls back onto the interiority of its constitutive ideas, and those ideas in turn are undone to other fundamental interiorities whose intrinsic nature is exterior to the decaying object. As the ideas break into their more fundamental but minimal ideas, the infinitesimal persistence of the object becomes asymptotic to the extinction of the object. Correspondingly, if in the subtractive logic of decay, *remaining* (viz. residing within the interiority of what is left) means *remaining less* (viz. moving in the direction of more fundamental interiorities which constituted the horizon of what had previously remained), then to remain indefinitely means to limitropically converge upon zero. Therefore, although the inward and depthwise movement toward the constitutive ideas or the ideal substratum which manifests itself as 'remaining less' happens only within the confines of different horizons of interiority, its dynamism limitropically embraces the *zero of ideas*. In doing so, the interiorized movement becomes asymptotic to a line of exteriorization upon which death is inflected, and objectal persistence in decay becomes an asymptotic expression of loosening into the abyss.

In order to simplify the above argument, we shall develop a spatial model for decay whereby both the infinitesimal persistence of the decaying object (i.e. a horizon of interiority) and its outward differential productivity become the essential vectors of a process of exteriorization – a *corrupt* method of binding exteriority. The reason why, in decay, binding exteriority occurs in such a twisted way, comes down to the following: living things undergo decay, not so much because decay and life come hand-in-hand, as because the living – whether living on a biological level or not – secures a horizon of interiority whose envelopment must be exteriorized according to the differential rates or gradients that bind the horizon to that which is exterior to it. In other words, if decay is most frequently associated with life, it is because the manifestations of life are all founded on horizons of interiority. All that is interiorized decays.

If the process of building is not exclusive to architecture and if, wherever building as a process is actualised, architecture too is potentiated, then the locus of architecture can also be renegotiated. Architecture and its socio-political aspects can be approached in territories where they are least expected. We call this architecture with an anomalous locus, *ex situ* architecture. The process of decay as a building process, as we will elaborate in what follows, generates an *ex situ* architecture where what is built cannot not be dwelled or grounded in any possible way. Because what is in the process of being built, in this case, is a nested exteriority wherein one interiorized horizon (such as the organism) falls back upon its precursor exteriority, which itself is another interiorized horizon built upon an exterior horizon which is in the process of loosening into its abyssal backdrop. Just as the lines of envelopment and growth for any horizon of interiority (whether the organism, earth, sun, or matter on the cosmic level) are convoluted and circuitous paths (*umwege*) toward the precursor exteriority, the line of exteriorization is also a circuitous path drawn along and through the horizons of interiority which fall back, decompose and loosen into each other.

Consider an elucidating – albeit reductive – example: Terrestrial organisms mark the organic interiority enveloped against the inorganic materials which under hospitable conditions can envelope the potencies of life. As both the vessel and the medium of complicity for inorganic materials, Earth is yet another interiorized horizon which is set against its immediate source of energy, the Sun. However, the solar empire is, in the same vein, an interiority enveloped and determined against its exterior cosmic backdrop. This nested continuum of interiorities goes on to the material substratum of all horizons. Yet even matter as the fundamental requirement for embodiment and materialisation is an enveloped horizon whose interiority and supposed necessity is a roundabout expression of a refractory indifferent universe in which even matter is an interiorized – hence idealised – contingency. Accordingly, what decay or putrefaction draws is a line of exteriorization toward the precursor exteriority. The organism decomposes into its inorganic terrestrial environment, the tellurian bedrock is in turn decaying into the solar horizon as the Sun's thermonuclear decay dissipates the star into its cosmic backdrop, whose material veneer, in turn, is peeling away. Decay draws a line of exteriorization which traverses the nested interiorities in order to asymptotically bind exteriority. Therefore its dynamism is subjected to differential bonds which connect and nest these interiorities within each other. For this reason, such a differential line of exteriorization or dissolution into conceptless exteriority is neither manifestly a *return* to an ideal origin nor a *decontraction* back into the originary exteriority where even matter enjoys no privilege of any kind. This is because decay's line of exteriorization builds a space of complicity between horizons of interiority wherein the unilateral power of exteriorization is mathematically and chemically contorted. This contortion or twist happens in a specific fashion: That which is exteriorized or dissolved into its precursor exteriority becomes a differential interpolation of a nested series of interiorities whose limitropic convergence upon zero (i.e. inflection upon death) has a weirdly chemical – thus contingent and productive – disposition which simultaneously forecloses the idea of return to the ideal origin and differentially convolutes the path of decontraction to the originary flatline of death. Let us recapitulate the reasons why the process of decay does not abide by the laws of return to the ideal origin and the energetico-dynamic principles of decontraction:

- The site where decay's process of exteriorization is effectuated is the interiority of the horizon. Therefore, the course of exteriorization conforms to the differential fields enveloped inside or extended from the interiorized horizon. Decay loosens up the interiority of the horizon, firstly through exploiting the horizon's own differential links between its actualities and potencies; secondly by conforming to the differential bonds between the interiority of the horizon and its precursor exteriority. Yet precursor exteriority (whether as the material, systematic, formal or ideal fundament, as in the case of inorganic materials and the organic horizon) is itself an interiorized horizon determined by its inner and outer differential bonds. This nestedness of interiorities wherein every idea or form differentially – and in this case regressively – inflects the next idea or form keeps decay's line of exteriority in conformity with the differential bonds and the increasing inflections of the nested horizons of interiority. Therefore, decay's process of exteriorization does not bind the outside from without so much as it binds the exteriority from within nested horizons of interiority. This binding of exteriority, however, is in conformity with differential fields inherent to each horizon of interiority as well as inter-connective differential bonds between these nested horizons. Consequently, the course of decay's process of exteriorization is conducted in accordance with spatial involutions, differential rates and modes of distribution immanent to nested interiorities. Since courses of exteriorization are subjected to differential peculiarities and twists of the nested space of interiorities, effects of exteriorization – that is to say, the effects of binding exteriority and inflecting upon death on interiorized horizons and formations – are also expressed in different ways. For this reason, the persistent involvement of nested interiorities undoubtedly complicates the philosophical, political and social implications of binding exteriority, inflecting upon death and extinction, for all formations and systems (from basic terrestrial formations to social networks, political systems and the horizon of thought). In decay, what is considered as the bedrock of the originary turns into a slimy swamp of nested interiorities where the bottom is always too soft and unsolid to hold or ground anything. The sinking is neither swift nor clean.

• The differential and regressive movement through nested horizons of interiority which the process of decay undertakes is not unidirectional and simplex, since, as argued above, this process conforms to the space of interiorities, which are nested within each other, not according to a one-to-one line of correspondence but according to a differential and multiplex nested structure. For example, in decay an idea qua an index of interiority is not merely differentially founded on one precursory idea but on a multitude of other fundamental and constitutive ideas which themselves are also inflected within different ideas. The image that the nested space of interiorities – as the site of decay – calls to mind is not a unidirectional tunnel of connected niches whose size and qualities are uniformly changing, but rather a rabbit warren or a worm-ridden cheese where every niche or hole opens into numerous smaller or larger interconnected caverns and holes. As the liquid that enters the first niche seeps into all such connected caverns, the gradationally rotting object, idea or formation also oozes, or more accurately, is exteriorized into the multitude of interiorities inside which it is nested. The model of exteriorization, in this sense, follows (1) the instantaneous rate of change between the decaying interiorized horizon and those non-uniformly nested interiorities into which it is being exteriorized, and (2) the instantaneous rate of change between the inter-connected multitude of interiorities which are differentially exterior to the decaying horizon of interiority. The idea X is inflected back upon its nested fundamental ideas which are themselves differentially interconnected (X inflects back to X_1, Y, Z, D, F, X_2Z_3, $X_3Z_2Y_1$, D_2, Y_2D_3, …). The process of decay, accordingly, traverses multiple ever-changing ideas or variables (as indexes of interiority). Therefore, in order to differentially exteriorize or putrefy an object, the process of decay must operate according to the instantaneous rate of change not only between the decaying object (the variable X) and nested interiorities gradationally exterior to it, but also between those interiorities / variables into which X is limitropically diminishing. The instantaneous rate of change, accordingly, is calculated between X and X_1, Y, Z, D, F, X_2Z_3, ... as well as between X_1, Y, Z, D, F, X_2Z_3, ... themselves. The interconnected and nested space of interiorities, for this reason, requires that decay operate as an instantaneous rate of change between different horizons of interiority or points of inflection. It is this ability to exteriorize a horizon of interiority via the relation – *viz.* nested interconnections – between exterior horizons which themselves are being exteriorized – and thus changing – that posits the process of decay as the blackening counterpart of the differential calculus. This is because differential calculus is a technique to determine and calculate the instantaneous rate of change between different uniformly or difformly changing variables. Just as Leibniz's solution for calculating the instantaneous rate of change between different changing variables involved the concept of infinitesimals, decay exteriorizes an object into its exterior backdrop through the limitropic shrinking of the object. For a decaying object, what is considered the exterior backdrop – as argued earlier – is a nested space of interiorities whose complicities do not allow the process of exteriorization to be vectorially unidirectional, structurally uncomplicated or, as a consequence, unproblematic. *The complicity between interiorities cannot be undone or decontracted in a simple fashion, for such complicity engenders differential fields which can only be exteriorized by the subtractive logic, chemical techniques and mathematical dynamism of decay as a building process and a model of complicity.* The political implications of decay as a model of complicity corresponding to the original ideas buried in differential calculus call for a thoroughgoing investigation into the calculus of decay.

• The differentially regressive plunge of decay into the depth of nested interiorities always finds an extensive echo in the form of differential reverberations of rot. There is no depthwise putrefaction or *nigredo* without the wriggling of worms on the surface and the mephitic extension of the rotting object into the air. Decay's intensive exteriorization of nested interiorities has an outward productive expression which is subtractively correlated to the blackening line that traverses the confines of nested interiorities. The more enveloped and interiorized the horizon, the more chemically productive its extension to the outside. It is as if the degree of interiorization – that is to say, the spatial confinement of the horizon and the amount of capital enveloped for sustenance and development – is directly proportional to the chemical fertility of the horizon when it begins to extend outside of its confines. Here, the degree of interiorization does not become an impeding factor for the extensive loosening of the horizon, but contributes to the differential extension of the horizon to the outside as well as the chemical – hence contingently dynamic – productivity of the horizon during decay. This illogical proportionality between the insistence on remaining interiorized and the spontaneous chemical loosening into the outside shares more with the laws of the grave than with the laws of nature – the putridly productive amalgamation of the restrictions of *nomos* and the confines of *taphos.* We argued that decay is neither wholly negative nor wholly positive; it is rather subtractive. The subtractive logic of decay suggests that decay does not merely build the nested horizons of interiorities as an intensive limitropic vector toward zero but that it also builds via extensive deployment of interiorities so as to create a dynamically contingent universe. Leibniz – following the proto-scientific ideas in the Middle Ages – frequently uses as an example the model of a rotting body (usually cheese) whose remaining perforated body suggests an intensive limitropic convergence upon zero. Yet this intensive movement in the interiority of the object, manifested as shrinkage, cannot exist without another opposite movement which extends the body into the outside in the form of contingently differentiated ideas or smaller bodies. At the same time as the apple shrivels, it spews forth worms as extensively deployed and hence dynamically contingent interiorities. These worms or derivatives in turn envelop smaller worms and further derivatives which contain yet smaller bodies *ad infinitum* … all ready to heave forth and be extensively deployed in the most contingent manners. This applied dynamics of contingency marks the rise of chemistry as a process commencing from within. The subtractive movement of decay's blackening line of exteriorization through nested horizons of interiority produces two functions: firstly, a limitropic convergence upon zero dubbed *complicatio* and formally expressed as progressive shrinkage; secondly, a differential extension or divergence from the object, called *explicatio* and expressed in the form of a dynamic and contingent process of productivity. *Complicatio* and *explicatio* are subtractively correlated, in such a way that the intensive interiority of *complicatio* contributes to the extensive deployment of interiorities in *explicatio*. The decaying idea, in this sense, not only undergoes a nested twist as it limitropically approaches the *zero of ideas*, but also a productive twist as it is subtracted to the outside. For this reason, decay's process of exteriorization is in complicity with interiorities and their differential fields on two levels: (1) the intensively enveloped – hence nested – interiority of the decaying idea or rotting object; (2) the extensively developed interiorities which are differentiated from the rotting object and whose contingent world points to a dynamic chemistry which enforces the irruptive contingencies of time mobilized through the involutions of space. To sum up, decay's line of exteriorization has, weirdly, a productive disposition which generates extensively and contingently distributed differential fields (or sites of chemical activity). The eruption of these explicated differential fields reinforces the necessity for a complicity between the process of exteriorization (*viz.* binding exteriority and inflection upon death) and horizons of interiority, whether as fundamental terrestrial formations or sociopolitical grounds and networks.

The three reasons enumerated above briefly explain the complications that the process of decay brings about for the idea of return to the origin, and for a philosophy based on the implications of binding extinction and decontraction into originary death. Yet they also diagram the spatial model in which the process of decay operates. In order to present a formalism of decay which provides us with a mathematical model for decay's dynamism, we must, in addition to decay's conception of space, examine decay's conception of time. For this reason, we shall inquire into decay's conception of time and how it is expressed by the spatial involutions generated by decay's line of exteriorization as it traverses nested interiorities.

MEMENTO TABERE: THE TERNARY CONCEPTION OF TIME, OR THE MISSING LINK OF CHEMISTRY

The process of decay has a spatial model comprised of intensive envelopment and extensive development, and whose subtractive correlation creates differential fields which are sites for the generation of abstract twists and deformities. In other words, these sites spatially narrate chemical activities potentiated by time's contingencies; activities whose irruption endows the spatial plot with a holey and porous underside. Chemistry, therefore, as applied dynamics wherein contingencies of time are extensively enforced by the involutions of space, requires a third conception of time whereby absolute contingencies of time can operate from within the interiority of a horizon. If putrefaction marks the beginning of chemistry, its subtractively-productive process needs such a conception of time so as to mobilise the contingencies of time as the chemical traces of those spatial involutions and envelopments which are asymptotic with the conceptless exteriority of space. This brings us to more fundamental questions concerning the role of time in any politics or philosophy incorporating decay as the building process of its formations or ideas: What is the relation of decay or putrefaction to time? Is decay a narrative conception of time's indifference to ontic differences, or is it the experience of time as presence which – in a Heideggerian fashion – turns death into an infinitely-deferred occurrence through *Dasein*'s already-dying? What exactly is the role of time in decay, and does this role reinscribe the correlationist appropriation of time through experience and presence, or amount to an idealism which favours and privileges time over space? And finally, if time is imbued with radical contingencies which suspend all affects and relationships through the indifference of time as an impenetrable alterity, then how can decay as a building process bring about the opportunities of complicity between the involutions of space and contingencies of time? It is evident that decay's conception of time, which emphasizes the role of time in the chemistry of decay, is so pivotal that it determines different conceptions of decay and putrefaction. Decay as a romanticized concept, decay as a necrocratic fetish, decay as a differential form of emptiness, decay as an *umwege* (maze) toward base-matter and decay as an ontological fate, are all decided by different conceptions of time, in itself and in its relation to space.

The chemical potency of putrefaction (*tabes*) which decomposes the object into other horizons of interiorities across infinite latitudes of forms, attests to the fact that there is a complicity between irruptive contingencies of time and spatial folds and inflections of space.

Through such complicity, the diachronicity of time and the exteriority of space are evinced by each other: Whilst space is perforated by time's emptiness or fundamental indifference, time's contingency is formally expressed by space's unbound ferocity for the assimilation of any ground of individuation. It is this collective fold of complicity – neither demanding a commonality between the parties involved nor the substitution of either of them by the other – that makes decay an unwholesome participation between the most abominable aspects of time (non-belonging and pure contingency) and the most degenerate aspects of space (space's tendency for infinite involutions which undermine any potential ground for the emergence of discrete entities). It is the complicity between the worst nightmares of space and time that brings about the possibility of putrefaction (even an infinite decay) as a differential form of irresolvable emptiness disguised as ideal objectivity with a generative twist. To think of this impregnable hollowness endowed with a generative proclivity, one can envisage an infinitely porous abomination, an obscene hollowness, folded and mobilised in such a way that it has an objectal grimace: The mediaeval *danse macabre* depiction of the Tree of Rot – a 'difformly difformly difformly difform'[5] (Nicole Oresme) tree trunk which spews forth a cosmic range of both familiar and nameless creatures as a differential extension of its arborescent emptiness.

The complicity between space and time – that is, between the dynamism of inflections and the irruption of contingencies – brings forth the possibility of chemistry as the concomitantly softening and loosening dynamism of putrefaction.

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[5] See L. Thorndike, 'An Anonymous Treatise in Six Books on Metaphysics and Natural Philosophy', The Philosophical Review 40, no. 4, 1931: 317-40.

As the chemical space of decay, putrefaction exposes the object to the contingencies of time so as to thaw the object's ideal integrity and initiate its loosening into the conceptless involutions of space. In order to explicate the nature of this complicity as an intrinsic act for the chemical dynamism of putrefaction, first we must clarify the modes of complicity at work here. If time belongs to no one and is absolutely indifferent to ontic differences, then how can its worst nightmares participate with space? And if, notwithstanding such irresolvable incommensurability, time and space can indeed participate with each other, then how can this participation be conceived outside of the correlationist ambit? Our conjectural solution for these problems concerning a blackening complicity between space and time consists of two stages: In the first stage, our solution entails the implementation of two conceptions of time. On the basis of these two conceptions, we seek to bridge the exteriority or diachronicity of absolute time and the exteriority of space. This means that in addition to the absolute conception of time, an intermediary conception is also required. The intermediating time must be interconnected with the absolute conception of time (i.e. time as an indifferently impenetrable alterity that belongs to nothing and no one) as a manifestation of the latter's pure contingency. In other words, the intermediating conception of time should itself be a production of absolute time's pure contingency which suspends all natural laws, obstructs the operation of belonging and nullifies ontic differences. To put it differently, the intermediary conception of time should itself be a symptomatic production of absolute time's pure contingency. *Accordingly, the intermediating time does not suggest a dichotomous scission in time, but a temporal and contingent conception of its absolute form.* Only the vital temporality of this intermediating time can bring about the possibility of ontological difference in relation to appropriated regions (scales) of space.

Space-time syntheses – necessary to support ontological determination – require the bifurcation of Time into two different but interconnected conceptions. Without such a bifurcation, absolute time and thanatropic space remain inherently exterior to each other and cannot ground the conditions for ontological determination on any level. It was the Stoics who for the first time fully realised the necessity of having different conceptions of time with the aim of explaining the vital syntheses of time and space. In order to explain the intensive vitality of determination qua difference-in-itself, Deleuze adapts and ingeniously modifies the Stoic model so as to develop and employ two conceptions of time, the time of aîon and the time of chronos.[6] Since the indefinite non-pulsed time of aîon is inherently closed to vital bodies, there must be another conception of time capable of synthesizing with the scales of space and supporting vital vibrations. This second conception of time is the pulse-time of chronos, which supports organic vitalities and provides time with qualities compatible with the structure of corporeal beings. Accordingly, the first *already-established* stage of our solution requires the bifurcation of Time into two different but interconnected times. Following Deleuze, but in contrast to his quasi-Heideggerian reading of time, these two conceptions are reabsorbed in this fashion:

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[6] See John Sellars, 'Aîon and Chronos: Deleuze and the Stoic Theory of Time', **Collapse III**, 177-205.

1. The ungraspable and cosmic time which belongs to nothing and no one. It is the absolute time of pure contingencies or cosmic climates which unilaterally suspends all laws and eliminates all necessities.

2. The temporal conception of time, which is time insofar as we experience it and which, therefore, is characterised by the access to its presence rather than its quiddity *per se*. Yet, even more importantly, the temporal conception of time supports the temporality of beings by providing the conditions for their ontological determination and emergence. These conditions are nothing but the contingencies of the cosmic and absolute time. The temporal conception of time, accordingly, envelops and foregrounds contingencies of absolute time in the form of conditions for the emergence of life (or the subject of temporality). Therefore, the temporal conception of time is an interiorized or bounded form of absolute time, a temporal set wherein contingencies are taken as conditions for the determination and the continuation qua temporality of existence. In other words, temporal time posits the contingencies of absolute time as the ground for the determination of difference and ontic emergence, through a bracketing and interiorizing of those pure contingencies. We call this temporal conception of time, vital time or the time of determinations and making differences. Constitutive to the ground of life, vital time is accentuated in the organic realm through the compatibility of its interiorized and sequential structure with the sequential growth or the rhythmic difference of organic interiority. In other words,

> the interiorized contingencies of vital time become structurally compatible with the involutions or interiorized horizons of space. Without such basic structural compatibility between space and time – albeit at the cost of their envelopment and interiorization – ontological determination and the emergence of ontic differences which are tied to space-time syntheses are impossible.

Vital time – the intermediary conception of time – emerges from the cosmic time of pure contingencies as ‘an interiorized set of contingencies’. As a temporal set, vital time interiorizes contingencies as its elements. Since the function of the set is interiorization, it can intensively determine the contingencies of absolute time as conditions for the emergence of life, or as necessities for making difference. In the process of interiorizing contingencies and realizing them as concomitantly temporal and necessary conditions, vital time appropriates the exteriority of cosmic time and turns it into an interiorized conception of time accessible by life and its manifestations. Yet the cosmic time of non-belonging and pure contingencies can never be fully appropriated or assimilated (interiorized) by vital time and its temporal conception. This is because vital time is itself contingent upon cosmic time as a *temporal condition* for the interiorization and bracketing of absolute time’s contingencies and their realisation as the conditions required for the emergence of life. This means that since vital time is itself a temporal condition *qua contingency* of cosmic time, it cannot fully interiorize the exteriority of absolute time qua pure contingencies. Vital time suggests only one of the infinite pure contingencies of absolute time; its fundamental functions are simultaneously supported and derailed by other contingencies. For this reason, contingencies of cosmic time are never fully reintegrated and absorbed within the manifestations of life (viz. realised horizons of interiority) conditioned by vital time. To put it differently, vital time can be interiorized by beings as the necessary condition for their emergence because it is itself an interiorized conception of cosmic time's pure contingency. This brings us to another problem which constitutes the second stage of our conjectural solution to the problem of complicity between space and time necessary for the chemical dynamism of putrefaction.

If cosmic time can never fully be appropriated by and within vital time, then the horizons of interiority inherent to manifestations of life or ontic differences cannot assimilate and appropriate the contingencies of cosmic time either. Consequently, the interiority of life is a host or a niche for the inassimilable contingencies of cosmic time – contingencies that never completely turned into temporal conditions within vital time but remained part of the unilateral ecology of the cosmic abyss within vital time's temporal set. Briefly, vital time interiorizes contingencies of the cosmic abyss in order to form its temporality; however, there are still contingencies of cosmic time which, despite being interiorized, defy assimilation by the laws of the temporal set that turns contingencies into vital conditions. These interiorized yet inassimilable contingencies, consequently, implement the unilateral ecology of the cosmic abyss from within vital time and consequently, from within an interiorized horizon such as the organism or the planet. In conditioning the emergence of life, vital time introduces the nightmares of cosmic time into the phenomena of life. The horizon of interiority inherent to the manifestations of life becomes an incubating chamber for the pure contingencies and non-belonging of cosmic time. It is this non-belonging qua principle of negativity that is mobilized by the dynamism intrinsic to involutions of space. The subtractive process of decay is the outcome of such spatial mobilisation whereby the unilaterality of cosmic time underpinned by its irruptive contingencies gains a subtractive – that is, extensively positive and intensively negative – momentum through inflections of space. As an outcome of its complicity with space, time's unilateral negativity is imposed on the horizon of interiority in a way that forces the horizon to be concurrently swept away along the extensity of space and intensively shattered on zero qua the eternal.

Thus cosmic time is deployed inside vital time and, correspondingly, inside the life or the horizon of interiority that is conditioned by vital time. This remobilisation of cosmic time's exteriority and redeployment of its contingencies within vital time and manifestations of life posits a third conception of time which constitutes the second stage of our conjectural solution. The blackening complicity between space and time can only be fully explained via recourse to a third conception of time which is always implicit – as an internal tension – to the dyadic conception of time. We call the third conception of time, the *insider conception of cosmic time*. It is conceived of as a treacherous insider insofar as it internalizes the complicity between time's diachronicity and the exteriority of space within the manifestations of life and the horizons of interiority. The conception of cosmic time as the insider redefines the intermediary conception of vital time as a 'temporal agent' that brings with it into life's horizons of interiority the contingencies and non-belonging of cosmic time. In other words, the insider conception of cosmic time interiorizes and cultivates the incommensurable tensions between cosmic contingencies within life and its manifestations – thereby giving cosmic ecology an eruptive (i.e. volcanically extrusive) expression rather than an intrusive insinuation.

In the wake of the insider conception of time, the termination of life does not *exclusively* mark the temporality of life qua its contingency, because the very interiority of life (its difference and internal vitality) can unfold as the abyssal infinity of material and ontological contingencies whose irruption is equal to death. This unfolding of cosmic time's pure contingency through life and by life is expressed by decay as a dysteleological process. In this sense, life's interiority is a medium for the cultivation of incommensurable tensions between the contingencies of cosmic time. And decay is the germinally-cultivated expression of these incommensurable tensions or contingencies along infinite involutions of space – a complicity between time's subtractive enmity to belonging and the enthusiasm of space for dissolution of any ground for individuation, a participation between cosmic time's pure contingency and the infinite involutions of space from whose traps nothing can escape.

The process of putrefaction or decay accentuates the compulsion to return toward pure contingencies of cosmic time through the third conception of time (i.e. cosmic time as insider time). This so-called 'compulsion to return' instigated by the insider conception of time becomes a source of tension between the principles of cosmic time (i.e. contingency and non-belonging) and the temporal conditions or necessities of vital time. These contingent and subtractive tensions are narrated by the degenerate qualities of space through the process of decay in the form of a progressive softening of forms and loosening of the horizon. We can say that in decay space is perforated by time: Although time hollows out space, it is space that gives time a twist that abnegates the privilege of time over space and expresses the irrepressible contingencies of absolute time through dynamic and formal means. This in-flective mobilisation of cosmic time's radical contingencies heralds the birth of chemistry as the blackening complicity between time and space. It is chemistry that endows the subtractive process of decay with a putridly productive nature.

FIGURING OUT THE FACE OF ROT, OR IDENTITY AND THE FORMS OF BEING LESS THAN A THING, MORE THAN NOTHING

The subtractive dynamism of decay is generated on the basis of a complicity between space and time which allows for the chemical loosening of the horizon of interiority along nested inflections that are simultaneously extensive and intensive to the horizon. The dynamism of decay utilizes the complicity between space and time as the principle for an unconstrained deformability where loosening and softening – the lytic functions of chemistry and the smoothing functions of differential calculus, i.e. mathesis – are intertwined and unbound. Yet such unconstrained deformability is translated, as elaborated above, into the intensive complicity of nested interiorities as well as the complicity of interiorities in their extensive deployment. Through these intensive and extensive planes of complicity, interiorized horizons asymptotically bind the exteriority of space and the diachronicity of time.

The asymptotic binding of exteriority requires an interpolating dynamism capable of traversing all interiorities complicit in the process of exteriorization as changing variables whose ratio must be calculated. To put it differently, since interiorities are always in complicity with each other, the process of exteriorization must find a way, firstly, to grasp interiorities in terms of their complicities; and secondly, to conduct exteriorization based on the dynamic factors, elements and variables brought about by such complicities. Exteriorization is not possible without factoring in and acting upon the complicities between interiorized horizons. Yet acting upon such complicities – characterized by dynamic relationships and rates of change between horizons of interiority – requires a solution reminiscent of differential calculus, a solution capable of calculating the instantaneous rate of change between changing variables.

The solution of decay's process of exteriorization for the problem of changing and complicit interiorities/variables is the limitropic decomposition of the object or formation. Only though the limitropic movement of the object or formation toward zero (whether as the conceptless exteriority of space or the diachronic eternality of time), can the process of exteriorization cut through the complicity between interiorities which is too differentially convoluted to be disentangled or decontracted through regressive thanatropic movement. The limitropic wasting or subtraction of the object (or formation) along its extensive and intensive vectors does not allow for the complete eradication of the object's ontological registers, structural fundaments or operating axioms. The effect of such limitropic wastage, in which the formation is loosened and softened to no end yet leaves traces which linger as the agents and particles of complicity, has a strong socio-political undertone. Even after a political formation turns into an unrecognizable corpse, where all of its structural and operative influences have presumably vanished, there still remain active structural fundaments and functional axioms from that formation without whose complicity the political calculus of world politics cannot possibly be formed. For, once again, in decay the relationship or change between horizons of interiorities (as entities intrinsically susceptible to decay) is possible only through limitropic deterioration toward a *zero of interiority*. The limitropic deterioration brings about the possibility of the differential interpolation of the decaying horizon between other interiorized horizons and, as a result, instigates the construction of a universal calculus of putrefaction. It is this limitropic deterioration that introduces the lingering and persistent axiomatic remnants of the decaying formation to an unsuspecting *uni-versal* calculus, as minute but ineradicable agents of complicity.

Neither fully negating the system by overthrowing it nor reaffirming it through reformation, the process of decay imposes a perpetual deformability on the formation without completely erasing its ontological registers and functional axioms. In short, decay extracts infinite deformability from an interiorized horizon without eventuating in radical erasure or complete transformation. Such perpetual deformability is supported by the intensive and extensive complicity of horizons of interiorities in the form of an unbreakable continuity in which every horizon of interiority either inflects the next or is nested within yet another horizon. Accordingly, it is the ceaseless continuity – in the sense of intensive and extensive inflections of forms and interiorities – that imparts a fluid continuity to the rotting object without essentially turning it into fluid. Each form is only *gradationally* preceded and succeeded by other forms in such a way that transition along latitudes (of forms) is always blurred. The gradients of deformities are differentially smooth, to the extent that the formal dynamism of rot appears to be that of sludge or oozing flesh. In decay, the solid undergoes a flowing series of deformations without becoming liquid, or in other words, without losing its basic principles of solidity. The wholeness or coherency of the solid is derailed within the fundamental principles of solidity. In a similar fashion, in putrefaction the liquid's degeneration vacillates between solid and gas, slime or miasma, but in either case it remains fundamentally – albeit minimally – liquid. This minimum body of the element, horizon, formation or object, in fact suggests its concomitant asymptotic exteriorization and limitropic diminution. Recall Bishop Berkeley's sneering deprecation of infinitesimal calculus as dealing with the 'ghosts of departed quantities';[7] the decaying object, indeed, is an evanescent yet lingering ontological register that is less than a thing but more than nothing.

Supported by the complicity of interiorities, the continuity of forms or the gradients of deformability ensure that the interiorized horizon is always formalized as a fluxion of contingent and even inconsistent forms. It is actually in decay that inconsistent forms are smoothly connected to each other so as to form a congruous plane of deformability in which becoming does not essentially follow the logic of the affect but rather the logic of putrefaction and its method of exteriorization. Victor Hugo concisely epitomizes this fluxional connection of inconsistent forms, ideas and entities in putrefaction in *Les Misérables*: 'In a pit of slime [...] the dying man does not know whether he has become a ghost or a toad.'[8] It is only in putrefaction that death is essentially and weirdly non-hauntological: one becomes a toad rather than a poltergeist annoyingly clamouring for appropriate mourning, for a proper judgment or a spectral solution. Whilst in putrefaction the human might end up as a toad, the toad itself grows a tail. The tail, in this case, speaks to the differential idea or latitudes of form between a toad and a tadpole, the mathemathico-chemical affect between them, the ratio of putrefaction: the longer the tail, the fouler the putrefaction:

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[7] G. Berkeley, *The analyst; or, A discourse addressed to an infidel mathematician* (1754), 59.

> It was observed in the great plague of the last year, that there were seen, in divers ditches and low grounds about London, many toads that had tails two or three inches long at the least; whereas toads (usually) have no tails at all. Which argueth a great disposition to putrefaction in the soil and air. It is reported likewise, that roots (such as carrots and parsnips) are more sweet and luscious in infectious years than in other years. [...] So the parts of beasts putrefied (as castoreum and musk, which extreme subtile parts,) are to be placed amongst them. We see also that putrefactions of plants (as agaric and Jew's-ear) are of greatest virtue. The cause is, for that putrefaction is the subtilest of all motions in the parts of bodies; and since we cannot take down the lives of living creatures, (which some of the Paracelsians say, if they could be taken down, would make us immortal,) the next is for subtilty of operation, to take bodies putrefied; such as may be safely taken.[9]

Putrefaction is comprised of these extremely subtle motions – infinitesimal fields of differentiation – according to which various and outlandishly incongruous forms can smoothly blend. The idea of the human becomes a smooth gradient of different worms, flies, wasps, plants and fungi. The toad, the miasma, the sludge and the human all become part of a differential field wherein each entity can gradually unfold into another regardless of the congruity of their traits, environments and habits. These subtle, fluxional or infinitesimal movements point to the gradational continuity of deformities in decay whose basal continuity is maintained by the dynamism of complicity as a form of participation in which, instead of commonality and replacement, inflection and nestedness – that is to say, the mathesis of the insider – are the guarantors of the collective action. To this extent, a politics of decay as building process fully employs the mathesis of the insider as the prerequisite for the dynamism of collectivity: In the calculus of decay, it no longer matters if there is a commonality or even a minimal agreement between conjoined or discrete elements; putrefaction causes the decaying or infected parts or elements to interpolate themselves between other healthy elements and parts in such a way that everything is collectively mobilised by and toward putrefaction.

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[8] V. Hugo, *Les Misérables* (London: Penguin, 1982), 1087.

[9] F. Bacon, *The Works of Lord Bacon* (London: Henry G. Bohn, 1854), 159.

The fluxional continuity of decay gradients smoothly, or more accurately, differentially connects incongruous forms. The act of figuration, in terms of decay, is equal to smoothing what is already out of place; everything must be con-figured again according to the smooth gradients of decay whose basal continuity lies in the complicity of horizons of interiority. To putrefy means to 'parabolify the straight line' (to use Boscovich's term),[10] then to twist the curve and eventually to convolute the already twisted curve. In other words, in order to approximate forms, the line of figuration must pass through points of inflections or latitudes of a given form. In this sense, figuration becomes more accurate as it passes more points of inflection or traverses more latitudes; yet to encompass more points means that the line of figuration cannot remain a straight line but must become an increasingly convoluted curve. The painter Francis Bacon presents such a model of smooth figuration in which a form is limitropically approximated through ever swirling and twisting curves. Bacon's method of figuration becomes a function of approximation rather than reproduction and for this reason, it acquires a configuring mechanism that corresponds intimately to that of decay and its smooth gradients: How many points can a line encompass, how many latitudes can be traversed by a differential function, before the line turns into a coiling abomination or the differential function becomes 'difformly difformly … difformly difform'? The thawing meat of Francis Bacon's figures, the oozing colour gradients of his landscapes and the heads whose figural approximations are bundles of coiling tails all suggest a differential function which indexes instant and remote derivatives of a given form in the smoothest fluxional manner.

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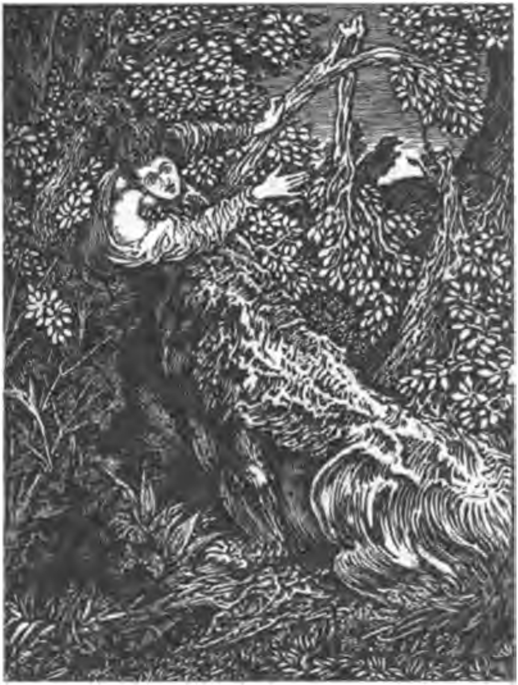
[10] J. F. Scott, 'Boscovich's Mathematics' in *Roger Joseph Boscovich, S.J., F.R.S., 1711-1787: Studies of His Life and Work on the 250th Anniversary of His Birth* (London: George Allen & Unwin Ltd., 1961), 183-92.

In decay, the act of figuration corresponds to the act of curve fitting in interpolation. Between two forms, two entities or two horizons, one can only make a continuously smooth connection by encompassing the derivatives which remotely connect these forms or entities together. The remoter and further apart the derivatives of these forms and entities, the smoother and more congruously they can be connected to each other. As the forms or given variables increase, the differential function also becomes more complex and the curve for smoothly connecting these variables or given data points becomes increasingly more convoluted. A curious literal depiction of these seething differential curves which connect putrefying forms together in the slimiest and most twisted ways possible can be found in Laurence Housman's intricate art nouveau drawings. *Cauchemar* (which originally appeared in *The Dome*, published by Unicorn Press [1899]) is a nightmare of a slimy nature lost and perplexed in the putrid mazes of its evanescent forms and their derivatives. It depicts a man being consumed by trees, becoming a tree,



yet this concomitant change of identity and forms leaves behind it a slimy trace, demonstrated by a pandemonium of twirling curves which connect the horizon of man to that of trees.

The universal calculus of decay does not tolerate an abrupt mutation from human to tree, as Hieronymus Bosch's tree-man might imply. In decay as a process of cosmogenesis, the tree and human are not two entelechies or perfected bodies of actuality which can be connected together via a straight line. Both 'being a tree' and 'being a man' are changing variables – rates of change between their respective actualities and potencies on the one hand and between their interiorities and the exteriority on the other. Therefore, the most veritable line of transition that can be drawn between a human and a tree is not a line connecting their fixed actualities or traits but a line that encompasses their existing actualities (given points) as well as their potentials and derivatives (even the remotest ones). The tree is itself a differential field of ideas – or in a Leibnizian sense a generative reservoir of smaller bodies – which themselves are changing and have their own derivatives; the same profusion with subtle bodies and movements is also applicable to man, its idea and its form. Therefore, in order for the line of putrefaction to draw gradients of decay between the man and the tree, it must encompass such ever-increasing (both in quantity and distance from their original ideas or formations as a whole) emerging bodies, ideas or derivatives. In interpolating between all these points and emerging values, the slimy line of rot becomes an ever-convoluting curve. For this reason, the nightmarish plunge of the human into the verdant inferno of growth is accentuated when the line between the human and the tree becomes infinitely convoluted, encompassing a cosmic array of beings which only differentially – that is to say, very remotely – connect to either the tree or the human. In other words, in decay, the object travels across a world of familiar and alien beings which may or may not have any immediate relationship or affinity with the decaying object. This also means that the most accurate line of transition between a human and a tree is a line that progressively encompasses not only the tree and the human but also their remotest derivatives and the least actual potencies. This is the taphonomic logic behind the slimy forms of putrefaction and the ever-shrinking bodies of decomposition (as in ruins) where the complicity between parts and derivatives becomes a subtractive and hence synergistic counterpart to the limitropically shrinking remnants of the thing's former self. In becoming a vividly accurate (i.e. nightmarish) transition between the human and the tree, the connecting line encompasses more beings and consequently becomes more convoluted. Decay corresponds to such an approximation of the distance or relationship between two given entities as continuously-changing variables. The minimum possible number of curves for passing through the maximum number of points or entities – this flawed but concise formula defines the nightmare of decay as an abominable curve that extracts values and beings from all that it encompasses, building worlds and corpses more efficiently than God. The effect of decay's cosmogenesis for any horizon of interiority is a weird amalgamation of vitalistic trust in one's survival and susceptibility to a unilateral terror from the inside – the treachery of the former and the non-negotiability of the latter. This is not just because decay draws its lurid forms upon the complicity of contingencies of an indifferent time with the conceptless exteriority of space, but because it mobilises the exteriorizing terror of such complicity right from the inside of the interiorized horizon and through its locus of persistence and its definition of survival.

BUILDING WORLDS AND CORPSES, OR THE QUESTION OF MATHEMATICO-CHEMICAL DYNAMISM

> I observe in advance that numerically the same change may be the generation of one being and the alteration of another: for example, since we know that putrefaction consists in little worms invisible to the naked eye, any putrid infection is an alteration of man, a generation of the worm.[11]

It was argued that decay effectuates a perpetual deformation which does not dismantle the primal formation by erasing its fundamental ontological registers or minimal formal traits, but rather ceaselessly pushes the formation to new levels of degeneration by infinitely building over and through it. For this reason, decay can extract softness from solidity (if solidity is inextricable from its stable, molar and rigid qualities as well as its manifest wholeness) and its socio-political abstractions, deducing political tenacity and persistence from the degeneration of power formations. This is the arcane *modus vivendi* of certain political systems whose decay or corruption does not lead to their demise and destruction but rather endows them with the gift of a camouflaged existence – a simultaneous unrecognizability ensued by thawing forms and an axiomatic or fundamental persistence as the result of their limitropic dissolution. Once the state embraces decay as a form of camouflage and persistence, it turns into a site of complicity between all decaying elements or splinters of rot in its vicinity, in the manner of an interpolating differential function. The nebulous term 'rouge state' outlines some of the characteristics of a state which has deliberately bound decay as the building process of its formation. It is in this sense, that the degeneration of the solid and its abstractions does not essentially entail its dissolution into liquid or the fluid state where the solid loses its minimal traits through fundamental transformation, but the differential deformity of the solid to such an extent that the idea and formal integrity of solidity are chemically pulverised by the inner potencies of the solid itself. The solid gains a corrupting mobility – or a differential power of interpolation – at the cost of losing its integrity and established forms. The impaired integrity of the solid formation allows for the eruption of potencies whose actualisation would otherwise have been subjected to the pre-established laws and climates of solidity (viz. its coherence, formal rigidity, stability, etc.)

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[11] G. W. Leibniz, *Philosophical Papers and Letters* (Dordrecht: Kluwer Academic Publishers, 1989), 96.

The forms of rot, as discussed in the previous section, are in direct correspondence with the dynamism of decay or its differentially corruptive mobility. Since the complicity of time and space in their contingency and exteriority bring about the possibility of this peculiar dynamism, the dynamism of decay is characterized by a chemical disposition with a calculative mode of distribution. Whereas its chemical disposition is associated with the spatially enveloped and mobilised contingencies of time, its calculative mode of distribution is the result of its asymptotic approach to the exteriority of space according to which every interiority inflects yet another interiority, whether in the direction of the precursor exteriority (*complicatio*) or the extensively dissipated interiorities (*explicatio*). This chemically-charged and calculative dynamism, accordingly, operates as a bidirectional building process: it intensively builds the abstract by positively binding a limitropic conception of zero (the body of the minimum) and extensively builds the concrete by extensively giving rise to derivatives or differentiated horizons of interiority (worms, animalcules, ontic differences). In order to formalise the dynamism of decay as a building process, a reductionist mathematical formula of decay can be constructed so as to demonstrate, capture and ultimately diagram decay as a building process. This reductionist formal model incorporates three basic interconnected aspects of decay's dynamism:

> (1) Perpetual inclusion – inflection and nestedness: The line of decay or the differential function of putrefaction must cover and encompass all given values – given points, forms and traits of the interiorized horizon as well as its emerging derivatives, actualities and gradationally emerging potencies. Perpetual inclusion ensures that all emerging potencies be indexed and encompassed by the differential function of decay. Any change – whether extensive or intensive, outward or inward – in the decaying object should be included by the process of decay. The possibility of including and encompassing both intensive and extensive changes attests to the imperfectibility of being and the inherent susceptibility of the interiorized horizon to exteriorization. Since perpetual inclusion means that both extensive and intensive changes are encompassed concurrently and since these changes are subtractively correlated to each, the perpetual inclusion is essentially the ratio of changes which registers itself

as a slope – the rate of ex-plicatio (unfolding) to complicatio (folding), extensive motions to intensive motions, $\frac{\Delta y}{\Delta x}$.

(2) The law of basal continuity, or the persistent continuity between limitropically vanishing values and emerging values: In a decaying object, no matter how significant the change or how unrecognizable the deformity is, it cannot depart from the ever-shrinking fundaments, axioms or basic registers of the object or formation. In other words, as the formation undergoes new extremes of deformity or the object rots to new levels, the fundaments of the formation or the basic ontological registers of the object also become more emphatic – that is to say, truer to their ideal. The law of basal continuity in decay holds that emerging values or changes must be continuous to fixed or established values, fundaments and basic axioms of the formation regardless of their distance and difference. Here continuity can be formalised as follows: Suppose X is a fundament or an axiomatic value of a decaying system and Y is a deformation, a change or an emerging value, and the function f stands for the putrefying line of decay that encompasses X and Y. Now, f is continuous at x for some $x \in X$ if for any neighborhood W of $f(x)$, there is a neighbourhood Z of x such that $f(Z) \subseteq W$; meaning that, irrespective of how small W becomes, a Z containing x that will map inside it can be found. If f is continuous at every $x \in X$, then f is continuous.

(3) Differentiable smoothness: Following and in accordance with the first two principles, the encompassing process of decay as an interpolant should be as smooth as possible, or more precisely, infinitely differentiable so as to support both the perpetual inclusion of all extensive and intensive changes and the basal continuity between persistent remnants and emerging forms and values.

In decay what is firstly enacted is the subtractive power of putrefaction whereby extensive and intensive changes are simultaneously included. Subtractive binding of changes ensures that vectorially opposite changes can be included in regard to each other in such a way that every extensive change inflects an intensive change and vice versa. For this reason, the law of basal continuity which emphasises the continuity between ever-shrinking fundaments and the emerging changes cannot be maintained except through the subtractive power of decay, or more accurately, decay's perpetual inclusion of changes and deformities. Therefore, perpetual inclusion enacted by the subtractive logic of decay precedes the continuity between the intensive ideals of the formation and its extensive ideas which are in the process of unfolding. In this sense, continuity C is built upon the output of inclusion I (i.e. inclusion of both intensive and extensive changes). Inclusion alone, however, does not support the continuity of what is included either in terms of 'the continuity between those changes which will be included and those which have already been included' (the intensively enveloped fundaments) or in terms of 'the ceaseless differentiability of the process'. For this reason, the input of continuity should be the output of inclusion, which is the sum of the actualities of the interiorized horizon and its gradient of potencies, the extensive development and the intensive envelopment of the formation. Here, if *I* is the perpetual inclusion and *C* the basal continuity, then their relation can be formalized as:

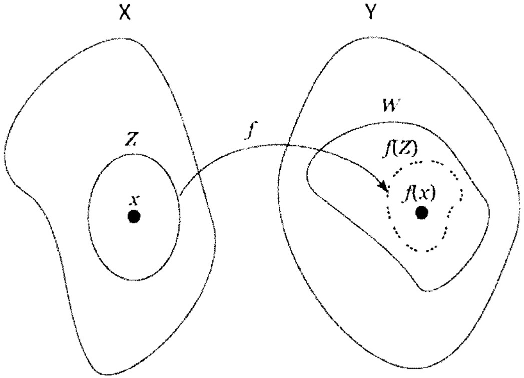

Diagram 1. Basal continuity between the limitropically shrinking object (persistence) and its putrid deformity (change)

$C \circ I$ or $x \mapsto C(I(x))$

Perpetual inclusion *I*, basal continuity *C* and differentiable smoothness constitute the main principles of decay's dynamism *D* in regard to any interiorized horizon *H* and in relation to time *t*. These three principles give decay the power to mobilise and unleash the irruptive contingencies of time from within and through the interiorized horizon.

Putrid deformities or smooth gradients of decay are forcefully yet nonviolently extracted from the ostensibly secured interiority of the horizon by the combined function of the aforementioned principles. Accordingly, for an interiorized horizon demarcated by the ratio of its actualities (*a*) and potencies (*p*), decay can be reductively symbolized as:[12]

$$D = H\int_{p}^{a}\left|\frac{(C(I(x)))^{n}}{t}\right| dt$$

The Leibnizian notation for the differentiation $(C(I(x)))^n$ would be $\frac{d^n(C(I(x)))}{dx^n}$ expressed as a rate of differentiation within itself – a differential curve within a curve. To put it differently, in the above formalised model of decay's dynamism, the process of decay D evolves not only as a curve generated by the complicity of time and space but also as a curve that differentially encompasses the potencies and actualities of a horizon. Decay, in this sense, is a curve in the perpetual act of curving. The act of perpetual curving whereby for every twist another twist is reinvented (*cyma reversa*) presents (reductively) a model of decay as a building process that delivers the interiorized horizon to its heretical wastelands. In line with Leibniz's remarks cited at the beginning of this section regarding the dynamics of infinitesimal vermiculation of the body in putrefaction, the process of decay returns every outward twist developed from the interiorized horizon with an inner twist within the horizon itself and vice versa. The reason (*ratio*) according to which the horizon of interiority works and strives for its ideal status takes a vermiculate turn once it is bent from both ends by the twists (abstract worms) which force it to veer in unforeseeable directions. Once a rectifying ratio between the ideal and the idea (both in its intensive envelopment and extensive development) is established, reason becomes a worm that bores through the horizon so as to prepare it for that which can easily creep in or ooze out. By differentially corrupting the ratio between the idea and its ideal and the ratio between actualities and potencies of an object, decay reinvents the interiorized horizon on the heretical side of itself. It is the pragmatic artistry of decay to harvest limitless potentialities from the subversive logic of interiority on behalf of an exteriority in whose term every horizon must be deserted according to a reason (*ratio*) which is crooked at both ends.

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[12] The vertical bars here signify the absolute value of decay's dynamism D, both in its negative and positive orientations. Schematically, by positive decay we mean the extensive vector of decay which takes the idea toward its concrete chemical manifestations and unfolds the forms or derivatives which are enveloped by the interiorized horizon. By negative decay, on the other hand, we point to the intensive vector of decay which limitropically abstracts and shrinks the idea toward the zero of ideas and inflects the interiorized horizon toward the precursor exteriority.

Nowhere has the curving function of decay been more explored than in scholasticism – in particular in the theories developed at Merton College, Oxford and the University of Paris, which constitute some of the germinal ideas of mathematics and chemistry. In scholasticism, *mortificatio*, *nigredo* and *putrefactio* all point to the overlapping regions between chemistry and mathematics through proto-scientific ideas germinated in theology, natural philosophy, medicine and the culinary arts. The corpse, as the epitome of putrefaction, demarcates the transition from the *complicatio* of a body to its *explicatio*. Such transition essentially takes place as a slope, 'the rise of potentialities in the form of actualities' in respect to 'the varying flux of potentialities'. These are the slopes of body qua *complexus* that provide the process of decay with fields of gradation whose dynamism can only be differentially grasped. Unlike the *complicatio* of God, the *complicatio* of body qua *complexus* is under the influence of its actualities whose distribution is extensively toward the outer world or the world of multitudes. In other words, since the actualities of the body are not perfect (immutable), nor are its potencies fixed, the *complexus* of the body is determined by the ratio of *complicatio* (envelopment of potencies) and *explicatio* (the development of potencies as actualities) in regard to each other ($\frac{\Delta p}{\Delta a}$). For God, there is no rate of change (slope) between possibilities and actualities, since God is the complete actuation of its complete potencies or *Possest* (Nicholas of Cusa). Accordingly, if there is no rate of change between possibilities (Δp) and actualities (Δa) in God, or in other words, if God is not ontologically differentiable within itself, then $\frac{\Delta p}{\Delta a}$ cannot have a rate of change or slope, i.e. $\frac{\Delta p}{\Delta a}$ must be a vertical line (illustrated by the vertical fold *ap* in diagram 2). It is the verticality of God in the scholastic threefold of existence that precludes deviation, the emergence of gradients and consequently, the curving dynamism of rot – God is the one without slopes. Hence the saying, God is too stiff to rot.

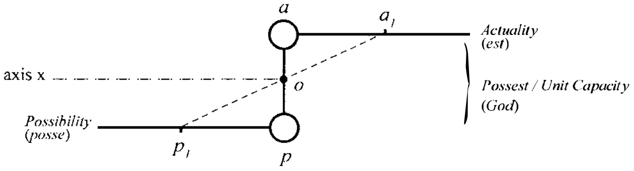

Diagram 2. The scholastic threefold of existence (*posse, est* and God qua *possest*)

For the scholastic marriage of mathematics and chemistry through natural philosophy, the *complicatio* of body is full of deviations, rates of changes between actualities and possibilities, little slopes everywhere swerving from the vertical positioning of *possest*. Twisting in and out, wiggling in all directions, slopes are bodies, disturbances in existence for which infinite differentiation is assured. Scholastic bodies are slopes or rates of change between the rise of actualities and potencies capable of being actualized ($a_1 p_1$). Despite their tangency to God, they possess the power of infinite differentiability, the power of prolonging the slope process – dragging the rate of progression and change between potency and actuality forever. But at any given time, for scholastic bodies, $\Delta p \succ \Delta a$ and $\Delta p \neq \Delta a$ otherwise the body is supplanted by the full body of entelechies whose possibilities have all been actualised. That is to say, if actualities become equal to possibilities or possibilities (all variations of *posse*) become exhausted by being actualised, then the scholastic body becomes a rival for the Divine or is posed as a blasphemous threat to its *possest* where $a=p$. The perfection of God is assured by uniting (or completely overlapping) the latitude of both potencies and actualities with the distance or the longitude between them. The impermeable infinity of God cannot express the world outside of itself; because outside of it is the field of slopes which expresses everything in the language of complicities, differentiations and ratios, rises over runs, the worlds produced by the undulations of imperfectibility – the cosmogenesis of decay. For scholastic bodies whose potentialities are infinite, their actualities can be neither infinite (as opposed to the infinite *entelechia* of God) nor equal to possibilities/potencies as in the case of the *possest* of God (i.e. $\Delta p \succ \Delta a$, $a \neq \infty$, $a \neq p$). Consequently, in this case, as actualities are fulfilled, their number in respect to potencies (possibilities) starts to decrease. In other words, the increase in fulfillment of actualities or perfections is equal to the decrease in actualities' capacity for differentiability. Therefore, for scholastic bodies, which are tangential to God's *possest* ($a=p$), being is $\lim_{\Delta a \to 0} \frac{\Delta p}{\Delta a}$ – that is, an open quandary in regard to infinity.[13] However, even if the potentialities/possibilities of being are not limitless (as some scholastic theologians like Anselm of Canterbury might object), the scholastic body is still an anomalous tangency to the Divine that instigates an 'infinitesimal subversion' against God: $\lim_{\Delta a \to 0} \frac{\Delta p}{\Delta a}$. Therefore, in either case, bodies of scholasticism are insurgencies or insistent perversions mobilized by slopes. In taking all beings as tangential to the *possest* of God, being can only be conceived in terms of rates of differentiation. The consequence of the onto-theological marginalisation of scholastic bodies via the privileging of God's *possest* is that the exclusive power and use of slopes is inadvertently dedicated to beings; this power is the power of extracting worlds through differentiation, or unearthing schemas of subversions through the limits of ratios. Everything other than God is the *explicatio* of slopes (Athanasius Kircher's abstract worms); this is far too cosmically revolutionary to be fathomed. Such is the revolution of scholasticism, flourishing in the mediaeval orgy of scholastic theology, natural philosophy and science.

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[13] The anachronistic use of the limit function here is solely for a succinct exposition of the quandaries spontaneously generated in scholasticism as the result of marginalising the *explicatio* of beings. These quandaries or ideas, as implied in this essay, began to haunt mediaeval philosophy, and initiated a series of philosophical and scientific problems heralding and eventually leading to the rise of Renaissance philosophy and science.

Corresponding to the subtractive logic of decay, the ratios or slopes of putrefaction ramify the mathematico-chemical vectors of decay in two directions. This results in the architecture of decay being posited as a turning point (inflection) at which the concrete manifestation of the process of decay is chemically invested as the product of its abstract process, and the abstraction of decay mathematically returns to its concrete investment. The double-dealing attitude of decay in regard to the concepts of the abstract and the concrete contributes to the twist of decay as a building process: That which is palpably rotting develops out of that which is progressively becoming abstract. To put it succinctly, the process of decay is progressively concrete and retrogressively abstract. This return between the abstract and the concrete is especially evident in ruins, where the abstract is inextricable from the concrete; to privilege one over another is either a necromantic fallacy or a necrocratic policy.

Mathematics with a chemical disposition or chemical revolution via mathematical distributions, decay captures both within its act of building. It is only in the light of the mathematical and chemical complications of decay as a building process that the melancholic admiration for decay and fetid entities, along with the ostracization and dismissal of socio-political decay, can be dissected without blind romanticism, moral opprobrium or crude judgment. It is not that earthly thought is the site of decay from which we must ascend to the fresh air, but that the calculus of decay constitutes the ecology of our interiorized worlds – whether built on the desolate surface of the earth or in the fresh air of a beyond. The calculus of decay has its own problems, ideas and solutions; to politicise, philosophise, scheme or take action without such calculus is tantamount to calculating out of this world – an outside that does not suggest the great abyssal outdoors but the sealed enclosures of pure entelechy whose immutable horizon does not welcome ecological changes in any direction whatsoever.

Philosophers' Islands[1]

Robin Mackay

Theoretical physics and cosmology over the last half century has provided a new context in which some of the most fundamental questions of philosophy find a new life and a new sense. In this new context, we find the recurrence of an image that spans the history of Western philosophy: that of the island.

If we think of the fundamental parameters that govern the laws of physics as the axes of a topographical space, a landscape of possible universes, then to our best knowledge, only a very small area of it is 'habitable' by life: We live on an island – or rather, life as we know it is itself an island. Of course this does not mean that the universe was 'designed for us': Rather, it opens up the question of whether there might be other 'islands' in this space, other possible universes in which radically different forms of life could emerge. Milan Ćirković, posing this question of 'astrobiology', insists that we ought not to let the confined shores of our island existence mislead us into thinking that this is the only 'habitable zone' in the sea of possibilities. Instead, he hypothesises, there may be an 'archipelago of habitability', a system of islands whose pattern might even be mathematically discoverable. Artist Charles Avery's 'Sketch for an Archipelago', with its spiral structure, illustrates the hypothesis perfectly.[2]

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[1] Text of a public lecture given in January 2009 at the Scottish National Gallery of Modern Art to accompany Charles Avery's exhibition *The Islanders: An Introduction.*

This notion of the tiny habitable island in a vast sea of possible universes belongs to a novel philosophical discourse subtended by contemporary physical and mathematical concepts. But it attests to the fact that certain enduring images continue to constitute something like pieces of a re-usable theatrical stage-set for philosophical thinking. The image of the island is one of these, and is as old as Western philosophy itself. Charles Avery, like many before him, has taken up this concept of the 'philosophical island' and made it his own. In order to understand Avery's contribution to this history, we shall take a historical tour – inevitably very selective – through the various ages of the philosophical island. This subject, and its history, are so rich in particular because philosophy shares the 'geophilosophical concept' of the island with literature. In fact, the island has always defined an important relationship between the two: The island is a kind of conceptual laboratory for transplanting stories into ideas, for imbuing narratives with concepts, for bringing ideas alive through myths.

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[2] See Milan Ćirković, 'Sailing the Archipelago', **Collapse** V, 292-329.

The island first appears when Western philosophy, at its birth, is still negotiating its divorce from its other: namely, myth. In Plato's *Timaeus* the fable of the island of Atlantis occurs within a discussion of the rational principles of a perfect society. Socrates complains that, whilst he *understands* the conclusions arrived at, he would 'compare [him]self to a person who, on beholding beautiful animals either created by the painter's art, or, better still, alive but at rest, is seized with a desire of seeing them in motion or engaged in some struggle or conflict to which their forms are suited'.[3]

This demand of Socrates sets in motion the history of the philosophers' island. The demand for something to *bring alive* ideas; to quicken the still body of rational discussion, finds satisfaction in the story of Atlantis, the lost island.

As we know, Plato's dialogues often comprise secondhand reports, but the *Timaeus* ramifies further this strategy of framing, as the story of Atlantis is reported by Socrates' friends as an ancient story heard from a grandfather, who in turn heard it from a friend of *his* great-grandfather, Solon, who received it from an Egyptian priest. Through this relay of memory, Plato establishes Atlantis at an immemorial distance from his audience, endowing it with a properly mythical status.

The priest's story is of a war waged by the island kingdom of Atlantis against the city of Athens – but this is an Athens separated from Plato's contemporary Athens by an impassable gulf of forgetting. For the flooding of the nile, as the priest tells Solon, has on many occasions saved the Egyptians, and their knowledge, from great catastrophes periodically visited on the Earth and which have wiped out many other peoples including the Greeks. In this way Plato gives his audience to understand that they belong to a shallow memory cut off from the deep past in which the story takes place. Hence the priest's gnomic declaration: "You Hellenes will never be anything but children".

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[3] *Timaeus* 19b.

At the climax of the war both (the immemorial) Athens and Atlantis were inundated by a great flood, and their people, Plato tells us, 'disappeared in the depths of the sea'. The island of Atlantis never reappeared, but Athens rose again from the waters. Reborn into an immature state, stripped of its former glory, the 'infant' Athens would have to learn once again to be the perfect republic.

This unveils the original function of the philosophers' island as being connected with a mythical conception of time, with forgetting and memory, with re-beginning and with founding; It sets up a theme of utter oblivion and forgetting only so as to pose the question of the new foundation – no island, therefore, without the flood.

How does this myth transform the philosophical discussion of Socrates and his friends? 'The city and citizens, which you yesterday described to us in fiction, we [...] now transfer to the world of reality'. Paradoxically, fiction imparts reality to the philosophical discussion. For the ideal city they had discussed now becomes the city of their *own* lost ancestors. Where there was the mere *idea* of a city run on rational grounds, now there is the prospect of a repetition, the fulfilment of a cycle. The island myth, of course, dramatises the notion of *anamnesis*, or *un-forgetting*: Rational insight comes not from our experience of this world, but from a remembering of an *other* world, the recovery of a pure knowledge that was lost when we were incarnated.

Plato's Atlantean myth rises again as the perfect narrative form for the ideals of the humanist Renaissance – naturally, considering that it precisely concerns a 'rebirth'. In Francis Bacon's 1623 *New Atlantis*, for example, all the important elements are reworked: A crew lost in a 'part of the South Sea […] utterly unknown', cut adrift 'in the midst of the greatest wilderness of waters in the world', discover the island of Bensalem, whose perfectly-calibrated civilisation, with its gentle, humanistic, scientifically-advanced government, embodies all of Bacon's aspirations for the improvement of human society. The people of Bensalem, it transpires, whilst their existence is perfectly unknown to the rest of the world, have an astonishingly complete knowledge of the whole globe, and their civilisation has endured from time immemorial, from before the 'universal flood'. Of the people of this island, too, one could well say: 'you Europeans will never be anything but children'. Again, Bacon's advanced ideas on society and science, in the mouths of these fictional, antediluvian islanders, become an invitation to repeat: Not only does his 'New Atlantis' repeat Plato's, it also calls his contemporaries to repeat the example of the people of Bensalem.

But we are getting ahead of ourselves: For we should remember the extent to which, before the Renaissance, It was Arabic philosophers and commentators who nurtured and developed philosophical thought. And the concept of the philosophical island is no exception. One remarkable text by a Spanish muslim philosopher could, without much exaggeration, be described as being halfway between

Aristotle and *Robinson Crusoe*. This is Ibn Tufayl's book 'Hayy ibn Yaqzân', a twelfth-century arabic text translated into English in 1708 as 'The Improvement of Human Reason', known in Latin as '*Philosophus Autodidactus*' ('the self-taught philosopher'). This is a text known to have been influential for some of our most enduring modern myths: *The Jungle Book*, *Robinson Crusoe*, *Tarzan* to name but a few. Tufayl's narrative tells the story of a child named Hayy ibn Yaqzân, who is cast away on an unpopulated island, and raised by gazelles. The narrative follows the development of this castaway's philosophical meditations as he grows up and discovers the world, in isolation from all human contact.

Tufayl's book is essentially a philosophical treatise, speaking of all things from biology to planetary motions. But its form is that of a progressive narrative, recounting how these philosophical reflections emerge in a man reduced to his 'natural state', removed from all cultural influence: We see Yaqzân growing up among animals, first lamenting his own weakness and vulnerability relative to them, then discovering the uses of his hands, making clothes, devising tools and weapons. He discovers fire and cooked food, thus awakening his human difference from the animals. But his philosophical development really begins in earnest when his gazelle-foster-mother dies. This precipitates a reflection upon what is alive in an animal being, with Yaqzân concluding that the body is 'a very inconsiderable thing', and beginning to foster a conception of the soul. Thence to the questions of how the soul is conjoined with the body, with the conclusion that the soul is akin to fire, a kind of warm vapour. The individuality of each being must then consist in this 'vapour'; and Yaqzân conceives an analogy between his own use of various tools, and this vapourous spirit's use of the various animal bodies for different purposes. With lengthy meditations on unity and plurality, individuals and species, the self-taught philosopher rediscovers the principles of Aristotelian taxonomy, and proceeds to classify the entire animal and vegetable kingdom, finally considering inanimate objects, and coming to the conclusion that 'all these things [are] in reality one, though multiplied and diversified accidentally as the plants and animals [are]'. But what then is the nature of this unified substance that underlies all these various things in the world? ... With further meditations reaching ever more abstract questions and lofty conclusions, the feral child Yaqzân achieves philosophical enlightenment as an adult.

In fact Yaqzan does make contact with civilisation again, through the medium of a holy man who comes to the island to meditate; however, after having returned to his fellow humans, he finds them so unwilling to consider the way of wisdom that he returns to his island.

This remarkable story is the first fully *philosophical* use of the island. Recounting the genesis of philosophical thought as a natural development, it serves to ratify a body of doctrine as belonging to the natural progression of reason, untainted by outside influences. And the function of philosophical islands continues to be involved with this desire for purity – with philosophy's impatience with dogmatism or received wisdom, its compulsion to begin from nothing, to re-begin with no presuppositions, to *found* itself. For the philosopher, the island is a chance to begin over again, giving us the possibility of re-founding our knowledge on the basis of an imaginary innocence.

Returning to the Renaissance and to its utopias – those New Atlantises reflecting the optimistic spirit of the age – the most important is probably Thomas More's 1516 fictional crescent-shaped Atlantic Island *Utopia*, a name which of course harbours an etymological ambiguity: 'no-place' and 'good-place'. It's precisely an ideal which cannot be fully realised but which might serve as an orientation, a navigation point: More's discussion of the ills of society, the vanity of people, the belligerence of leaders, gives us an enduring model of sociological and philosophical reflection that is very much alive two hundred years later – in more satirical form – in *Gulliver's Travels*, which however teaches through a mocking *reductio ad absurdum*, not by example, and is all the more entertaining for it.

Where Ibn Tufayl's account of the gazelle-child Hayy ibn Yaqzân contained both an treatise of philosophy and a philosophical thesis on the genesis of thought in one isolated individual, these political fables use the island as a controlled setting for thought-experiments concerning the foundations of the social. A great seminal moment in philosophical island literature occurs, however, when these two aspects – the innocent *individual* finding enlightenment in the seclusion of an island, and the ideal island *society* prompting reflection on our own – are brought together. This is Defoe's 1719 *Robinson Crusoe*.

In *Robinson Crusoe* all the essential problems of the philosophical island are brought together beautifully. We have Crusoe as Christian autodidact, discovering true faith through his own solitary meditations. But it is not only

God that Crusoe discovers: he also enacts the origins of sedentary human society: The need to settle and defend, the planting of crops and building up of stores, the need to domesticate wild animals, even the development of hierarchy and the legitimacy of servitude … But *Crusoe* is also the point at which the philosophical island comes into disrepute, when we begin to harbour suspicions about the supposed innocence of the protagonist. Readers excited by the idea of the shipwrecked mariner exploring the virgin isle, surviving on his wits, cannot but be somewhat disappointed when Crusoe spends his first two weeks rowing back and forth to the shipwreck to bring out everything he needs to set up home, from gunpowder to tunics, from oatcakes to a complete set of carpentry tools; cannot help feeling a little cheated when he takes his smug walks to his 'country house' with his four guns slung around him, or when by 'chance' he discovers some ears of wheat and prudently sews and stores his harvests for three years …

At a century's distance Marx sums it up drily in the first volume of *Das Kapital*: 'having saved a watch, ledger, ink and pen from the shipwreck, he soon begins, like a good Englishman, to keep a set of books'.[4] For Marx, Crusoe represented 'a totally illusory foundation for economics, that of the independent, non-social being'. The story was an ideological sham, serving to naturalise the system of bourgeois capitalism, its function to justify a system through a bogus mythical 'proof' of its spontaneous nature. In short, the island is 'a false "origin"'.

In his 1946 essay 'Causes and Reasons of Desert Islands', Gilles Deleuze, whilst affirming the philosophical power of the island myth, seconds Marx's suspicions. The problem with *Robinson Crusoe*, he writes, is that Defoe's narrative fails the profound sense of the *reinvention* of mythology that characterises the philosophical island: In *Crusoe* 'The mythical recreation of the world from the deserted island', Deleuze says, 'gives way to the reconstitution of everyday bourgeois life from a reserve of capital. […] Robinson's vision of the world resides exclusively in property. Nothing is invented.' He continues, somewhat harshly: 'One can hardly imagine a more boring novel, and it is sad to see children still reading it today […] Any healthy reader would dream of seeing [Friday] eat Robinson.'[5]

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[4] K Marx, *Capital*, vol I, tr. B. Fowkes (London: Penguin, 1992), 170.

Despite these cavils, the structure of Robinson Crusoe so perfectly distils the island concept that it has proved robust enough to be critically rewritten, not only in countless inferior and derivative novels, but also in many inventive and subversive ways: For example in the wonderfully philosophically-rich 1972 novel *Friday, or the Limbo of the Pacific* by Deleuze's friend Michel Tournier. Tournier's Robinson, on the island he names 'Speranza', is depicted in the light of a philosophical and psychoanalytical mélange combining Freud, Jung, existentialism and structuralism. For Tournier, the story becomes that of Robinson discovering that what made him human was his interaction with others. Alone on the island, he begins to succumb to depersonalisation, sinking into a delirium where he identifies himself increasingly with the island. The very delirium against which Defoe's Crusoe had defended himself implacably with all the salvaged accoutrements of civilisation becomes, for Tournier, the truth of the island adventure as philosophical, psychotropic journey. As he struggles to 'humanise' the island, Robinson becomes dehumanised, becomes the island: 'So Robinson is Speranza. He only has a consciousness of himself by way of the fronds of myrtle, through which the sun launches its arrows of light, he only knows himself in the foam of the wave washing across the white sand'.

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[5] G. Deleuze, *Desert Islands and other Texts*, tr. M. Taormina (Cambridge, Mass.: MIT Press, 2003), 12.

The influence of Tournier's novel can be read in J.G. Ballard's short 1973 novel *Concrete Island*, in which – with typical mordant wit – a businessman finds himself car-wrecked on a traffic island. Unable to escape, this hapless protagonist also undergoes a kind of psychogeographical trial, repeating, at the height of his ordeal, the phrase of Tournier's Robinson: 'I am the island'.

Between Crusoe's island and the Concrete Island, we must also note a great efflorescence of what can only be called island narratives without islands: The social contract theorists. The thought-experiments of Hobbes, Locke and Rousseau, imagining how society might develop from a 'state of nature', are the great speculative works of modern political philosophy. These theorists rightly saw that the island-principle corresponded to an important truth: The real – even the reality of society – can be profoundly explored only through an ideal scenario, a controlled experiment, that steps beyond the bounds of that reality. In the twentieth century, John Rawls re-imagines the social contract experiment using imagery that corresponds to that of isolated islands such as Bensalem, with the 'veil of ignorance' an impenetrable bank of fog around the philosophical island. To make his argument, however, Rawls for the first time posits the 'original position' of the philosopher *outside* the island, meditating on the possibilities of what it might hold and planning his disembarcation.

Even if social contract theory represented in certain respects the consummation of the political employment of the philosophical island, in a new modern conception of the 'grounding' or re-foundation of the social on the model of a civil contract, from the nineteenth century onward its works were liable to come under suspicion, and to be dismissed as 'robinsonades': post-*Robinson Crusoe* any supposedly 'innocent' deployment of the island as a speculative device would be subject to great critical scrutiny.

In marking out Reason's legitimate from its illegitimate uses, Kant's *Critique of Pure Reason* aims to provide the map for a domain of well-founded, systematic knowledge, and secure it against the flights of fancy and the speculative excesses to which Kant considered earlier philosophers had all-too-easily abandoned themselves. And yet to promote this somewhat gruelling task Kant employs the image of the *island of truth*, in this famous passage from the *Critique of Pure Reason*:

> We have now not merely explored the territory of pure understanding, and carefully surveyed every part of it, but have also measured its extent, and assigned to everything its rightful place. This domain is an island, enclosed by nature itself within unalterable limits. It is the land of truth – seductive name! – surrounded by a wide and stormy ocean, the native home of illusion, where many a fog bank and many a swiftly melting iceberg give the deceptive appearance of farther shores, deluding the adventurous seafarer ever anew with empty hopes, and engaging him in enterprises which he can never abandon and yet is unable to carry to completion. Before

> we venture on this sea, to explore it in all directions [...] it will be as well to begin by casting a glance on the map of the island which we are about to leave, and to enquire, first, whether we cannot in any case be satisfied with what it contains – are not, indeed, under compulsion to be satisfied, inasmuch as there may be no other territory upon which we can settle; and, secondly, by what title we possess even this domain, and can consider ourselves as secured against all opposing claims.

As Michèle le Doeuff remarks in her *The Philosophical Imaginary*, Kant uses the image of the island to defend his sober 'critical philosophy' against the more colourful and grandiose promises of speculative metaphysics: The 'critical' island is certainly not a paradise – but it is infinitely preferable to the frustrations and dangers of the boundless ocean, upon which metaphysical speculation recklessly sets out. If he claims to re-place our knowledge on its proper ground, Kant is most circumspect about what sort of territory philosophy can promise to secure for us.

Notably, as le Doeuff remarks, elsewhere Kant warns against *another* island: the paradisiac island of the South Seas. The yearning for its easier climes and for its innocence is a snare, Kant suggests: they represent a pernicious, imaginary utopia. Thus Kant sets the seduction of the southern isle against the foggy northern isle which, whilst somewhat bleak, is true and solid. As Deleuze says in his book on Kant, this is the element in which Kant's thought is at home: 'the fog of the North'. When Kant trills 'the island of truth – seductive name!', this is nothing but sarcasm: the *serious* philosopher has no business with seductive, pretty islands where he can lounge about all day under palm trees.

So Kant reinvents the philosophical island as a duality: There is the southern isle, with its dangerously desirable holiday-brochure illusion of luxury and leisure; and the northern isle, safe, secured, and systematic, if a bit grey. In short, the island of truth is a *dreich* isle, but it's all we've got. But even Kant's carefully-delimited and hard-won piece of solid territory doesn't last long in the history of the philosopher's island, as Nietzsche, in his 1882 *The Gay Science*, announces the crisis of late modernity – not only have we left Kant's island of stability, our own critical self-consciousness has destroyed it:

> In the horizon of the infinite.– We have left the land and have embarked! We have burned our bridges behind us–indeed, we have gone further and destroyed the land behind us! Now, little ship, look out! Beside you is the ocean: to be sure, it does not always roar, and at times it lies spread out like silk and gold and reveries of graciousness. But hours will come when you will realize that it is infinite and that there is nothing more awesome than infinity. Oh, the poor bird that felt free and now strikes the walls of this cage! Woe, when you feel homesick for the land as if it had offered more freedom–and there is no longer any 'land'!

In the epoch that this declaration announces, the problem is no longer that of founding or re-founding. Instead it is the crisis of the fruits of enlightenment turning bad, of science and critical thought having gnawed away the very foundations of human existence. But even Nietzsche's declaration that there is 'no longer any "land"' cannot prevent literature from re-engineering the island for this age, and according to its dreams and fears. From the end of the nineteenth century, the philosophical island becomes a dystopia where the most extreme possibilities, doubts, and horrors of Western civilisation are given free (if safely-sequestered) rein. This tradition begins with H.G. Wells' (1871) *Island of Dr Moreau.* Rather than the island being a metaphorical setting for a *philosophical* thought-experiment, instead we find ourselves on an island where actual (scientific) experiments are underway and running out of control. The island becomes a warning, concentrating the most threatening aspects of contemporary reality into their confined space.

Instead of accommodating an ideal society whose principles instruct our own, then, the twentieth-century island – in which we can include, of course, many of science-fiction's alien planets and stranded space-stations – is more likely to amplify developments of real society, concentrating them into an imagined future that is all-too-near. The power of ideas, rather than being owned and judiciously employed by philosophy, is now a power effectively at work in the world, embodied in technology, uncontrolled or controlled by megalomaniacs and evil geniuses, perplexing and injuring humanity. This, in short, is the philosopher's island resounding with the aftershock of World Wars; and the island *after* Marx *after* Freud, *after* Darwin.[6] And after the twentieth-century revolution in physics: it is the Island of the fateful experiment – the Bikini Atoll – and its aftermath (*Lord of the Flies*, and countless other post-apocalyptic fantasies).

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[6] Incidentally, we should remark that we owe the whole elaboration of evolutionary theory from Darwin onward, to an island voyage – Darwin's journey, onboard the *Beagle,* to the Galapagos, islands whose slow geological drift apart had effectively isolated the different species of finches, which thus provided a living stop-motion image of the process of natural selection. Note, however, that in his new book biologist Steve Jones argues that despite their mythical importance in the popular imagination, in actual fact the most important island for Darwin's work was England. S. Jones, *Darwin's Island: The Galapagos in the Garden of England* (London: Little, Brown, 2009).

In his last novel, entitled imply *Island* (1962), Aldous Huxley seems to reverse the trend: He turns the island once more into a utopia contrasting with the dystopia of reality. Imagining science being harnessed only for the use of man, rather than overpowering him, Huxley's 'Pala' is an imaginary island of sanity in a mad world, where Eastern wisdom and Western science comet together in the persons of a shipwrecked scientist and an indigeneous quasi-buddhist order, giving birth to a society stable and free from madness and venality. Like the autodidact Yaqzân, everyone on the island is in a state of enlightenment, nirvana even. And through the great slogan of this modern Utopia still echoes the voice of Platonic *anamnesis*: 'Nobody needs to go anywhere else. We are all, if we only knew it, already there'. If only we knew it, we could repeat, return to where we really are. Ultimately, however, the final twist in Huxley's tale shows that he was himself no longer convinced of the possibility of such a 'sane society', such a return to the source.[7]

Let's now ask whether we can make out the shape of a new, twenty-first century philosophical island? Previous models still haunt us: Just as, in the sixties, *Lost in Space* reworked *The Swiss Family Robinson* for the space age, Koushun Takami's (1999) comic book *Battle Royale* and its (2001, 2003) film adaptations unfolded as an ultraviolent revisiting of *Lord of the Flies*; and the TV series *Lost* (2004-5), with its plane-crash and its characters named Locke and

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[7] In a typically cynical reappropriation of Huxley's combination of science and religion, Michel Houellebecq's (2005) *The Possibility of an Island* returns it to reality. Houellebecq envisions an island run by a 'cloning cult', based on the actual cult 'Raelians' - a real world example of the terrifying combination of genetic engineering, nanotechnology and religious messianism.

Rousseau, remixes a bygone era of island thinking. At the end of the second episode of *Lost*, entitled 'Tabula Rasa', one of the characters declares: "This is a chance for everyone to start again, regardless of what they were before the crash". Utopia endures in Hollywood, even if the tale of *Lost* becomes darker and more twisted (fatiguingly so) as the episodes progress.

Perhaps ours is more properly the age of the house-island, isolated but visible by millions, and manipulated by an unseen controller. *Big Brother* and its various reality TV imitators (several of which take up the island theme very literally, with woeful results), although they harbour no illusions of a *tabula rasa* or a complete new beginning, are perhaps still rather tied to antiquated forms, their social engineering redolent of *The Tempest*, where the audience delights in Prospero's behind-the-scenes manipulation of the hapless groups shipwrecked on his enchanted isle. Ours is also the age of the geoplastic megalomania of Dubai's man-made archipelagos, where millions of tonnes of sand is dredged up from the bottom of the sea to create new islands full of luxury villas. (Have their architects never heard the phrase 'built on sand' ...?) Since every modern convenience has already been imported, however, the rich man's island is never interesting, it's never a desert island. None of these constitute a philosophers' island for today.

The philosophical references of Charles Avery's work set the conditions for one possibility of what such an island might be. And his project itself responds to them. It's a project which resides as much in his book,[8] at once an

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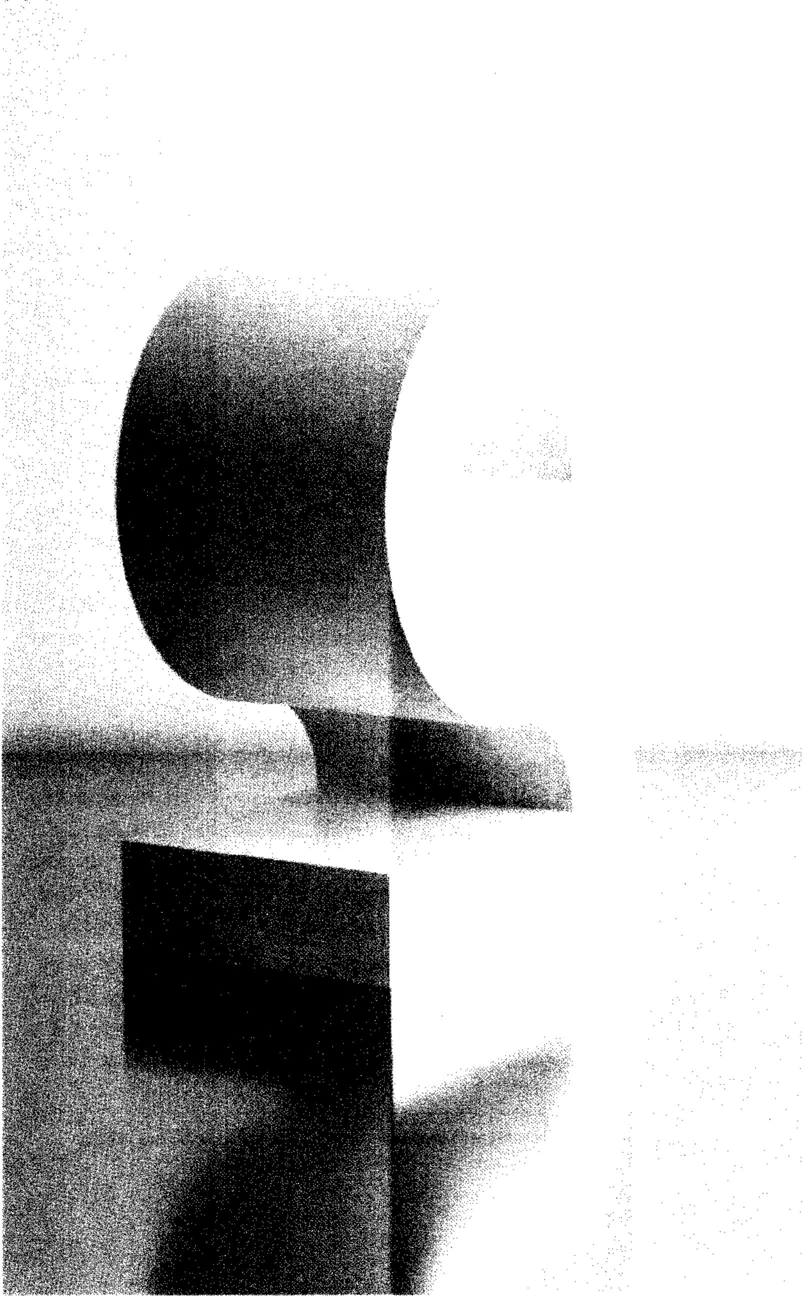
[8] C. Avery, *The Islanders: An Introduction* (London: Parasol Unit/Koenig, 2008).



island travelogue and an enigmatic work of philosophy, as in the catalogue of drawings and exquisitely-crafted objects in different media which make up his oeuvre.

At first, Avery's island seems to represent the landscape *of* philosophy, rather than being a vehicle for any particular philosophical thesis. Looking at the names on his maps, it seems Avery wishes to make the landscape of his island and the world surrounding it describe the whole history of philosophy. In this, his closest reference is Borges' (1940) story *Tlön, Uqbar, Orbis Tertius*, which tells of a researcher's discovery of a land – possibly real, possibly conspiratorially fabricated by scholars – whose regions can be differentiated according to their inhabitants' subscription to different philosophical theories of meaning. But if we read Avery's island as some sort of grand allegory, we soon find out that there is no straightforward 'mapping'. Far from simplifying the world of ideas by mapping it out, Avery adds to it and twists it with his strange cartographies. The relation between metaphor and what is metaphorised is always slipping and sliding, and everything refuses to fit together neatly.

There are however some privileged philosophical references. They belong to the development of the philosophy of logic and mathematics at the beginning of the twentieth century, the story of the search for a theory that would provide a systematic foundation for all logical and mathematical thought. One of the few actual philosophers to appear in Avery's drawings, Bertrand Russell, has the great distinction of having ruined this idea forever, in his polite letter to his colleague Gottlob Frege. The simple but powerful paradox discovered by Russell, and which bears his name, resonates throughout Avery's work: Take the set of all sets which are not members of themselves: if it does belong to itself, then it doesn't – And vice versa … Take the barber of the regiment, defined as the man who shaves everyone who doesn't shave themselves … does he shave himself or not?? (You'll find Avery's own answer to that particular riddle in his book.) Russell's paradox seems to be the engine of all the dualities in Avery's work. His islanders love to cut everything in the universe in two. In fact, the apotheosis of the islanders' creed might be the old joke that 'there are only two types of people; those who divide people into two types and those who don't'. But the island is also prowled by anomalous animals that don't seem to obey these distinctions: The Elusive Noumenon; The If'en, whose 'defining characteristic […] is that they lack a defining characteristic';[9] The Essential Mr Impossible … one suspects these are the animating principles of the island, paradoxes that not only accompany the sharp distinctions the islanders like to make, but might even sustain them, as the hope of snaring the Noumenon sustains the hunter.

The disorienting effect of all these paradoxes is already a little like stepping into Avery's 'Eternity Chamber'. But there is more. Russell had shown that the most powerful foundational logical theory was punctured by paradoxes. But by the 1930s, Gödel had proved his incompleteness theorem, demonstrating that any logical system powerful enough to provide a foundation for simple arithmetic *will* contain at least one proposition whose truth is undecidable. This shatters philosophers' dreams. Avery's work registers both the gravity and the humour of these developments.

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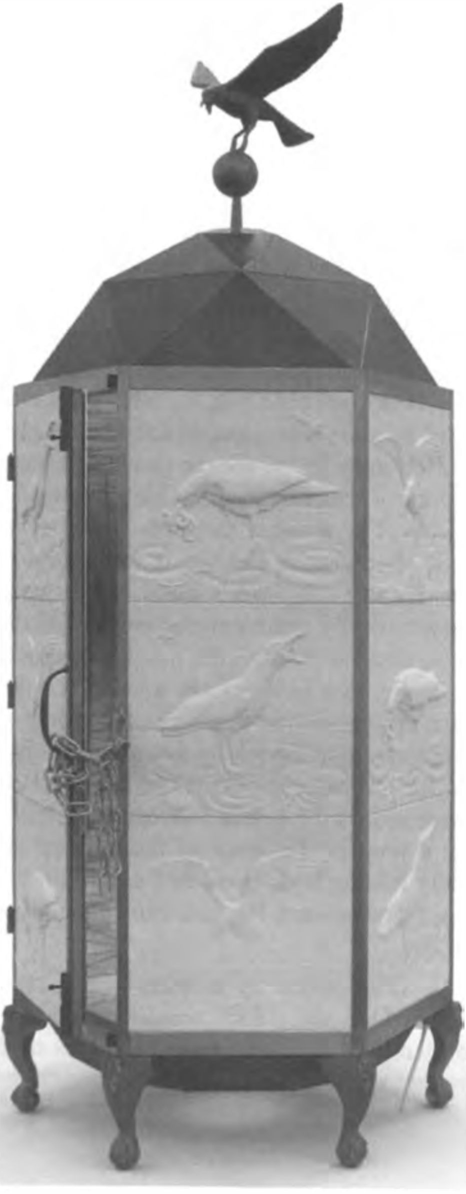
[9] Avery, *The Islanders*, 47.



No foundations: does this mean no islands? 'In the horizon of the infinite', neither philosophy nor art can rise above or systematise the All, or provide it with a foundation. philosophy and art are themselves situations within the world, and all situations are incomplete. Avery's work constantly presents us with this 'punctured' and incomplete state of knowledge.

In this respect, one might relate Avery's work to that of an apparently very different artist, Keith Tyson. In fact Tyson shares similar formal concerns, since his work wrestles with the idea of systems that strive to encompass and tabulate. In *Large Field Array* Tyson tries to create a modular 'system of everything' – scientific theories, his childhood memories, images from TV, abstract concepts – and systematically connect it all together. But he is inevitably faced with having to rescind this work's claim to be comprehensive or to systematically represent the world. Of this 'failure' Tyson says that we must accept that it's impossible for the artist to create, in a work of art, a model of the universe that doesn't participate in that universe; works are models *in* the universe, not models *of* the universe. In an image very apt for the present discussion, he says that they are 'like a postcard on the beach'.[10] Avery's work is something like this: a map of the space of thought we inhabit, but continually folding back upon that space, so that the map can never be completed, but continually complexifies what it's mapping.

G. K. Chesterton, in a witty piece entitled 'The Philosophy of Islands' (1903), remarks on the very human need to identify things, and sees at the root of this a wish to isolate. It is to this desire that he links both what he calls the 'perennial poetry of islands' and 'the perennial poetry of ships':

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[10] Keith Tyson, *Studio Wall Drawings 1997-2007* (London: Haunch of Venison, 2007), 27.

> A ship like the Argo or the Fram is valued by the mind because it is an island, because, that is, it carries with it, floating loose on the desolate elements, the resources, and rules and trades, and treasuries of a nation, because it has ranks and shops and streets, and the whole clinging like a few limpets to a lost spar. An island like Ithaca or England is valued by the mind because it is ship, because it can find itself alone and self-dependent in a waste of water, because its orchards and forests can be numbered like bales of merchandise, because its corn can be counted like gold, because the starriest and dreamiest snows upon its most forsaken peaks are silver flags flown from familiar masts, because its dimmest and most inhuman mines of coal or lead below the roots of things are definite chattels stored awkwardly in the lowest locker of the hold.

This explains why earlier philosophers' islands now appear to us to be typical 'philosophers examples' – they are commodious to the mind only because of their oversimplicity. The contemporary island can no longer pander to the desire for isolation, because we know our world is complex, interconnected, and uprooted: There *are* no more desert islands. Nicholas Bourriaud calls Avery's island a 'heterotopia' rather than a 'utopia': it's neither 'no-place' nor 'the best place', but an 'otherplace', a 'manyplace', a multiplicity that is already 'out there'. It is the multiverse as refracted in Avery's mind. His question, though, is how to create 'one' out of this dazzling multiplicity. This is precisely the task Avery set himself when, in the inaugural gesture of his mammoth project, he declared that from now on *all* of his work would find a place in this island kingdom (so that the 'work' consists not in any one of the objects created, but in the structural consistency of the whole).

In regard of the need to isolate things, Chesterton speaks also of the fear of infinity: for 'to be infinite is to be shapeless', he says. However, as Alain Badiou has argued, it is the *finite* that is the exception: infinity is normal. Every thing, every situation, can be seen from infinitely many perspectives, dissected in infinitely many ways; so that things are never one in themselves, they are always multiple, infinitely multiple: To 'count-as-one' a situation or a thing is always to intervene in it, to creatively shape it.

Cantor's transfinite mathematics, which Badiou suggests we take as one of the conditions for contemporary philosophy, is the third of Avery's philosophical sources to which we should draw attention: Cantor's proof that there are different *sizes* of infinity, which secularises the concept of infinity and introduces some exquisite paradoxes into thought. For on Avery's island we meet the strange, ramified quasi-elephantine creatures the Alephs, believed by some to be 'descendent[s] of the Noumenon', of which we are told: 'upon the discovery that Aleph Null was not unique, the ideas accounting for the species were modified'.[11]

And infinite variety is certainly reflected in Avery's island – it may be a 'northern isle', but it is not ordered and bleak like Kant's 'island of truth'. It's an island of gods and pickled eggs, of bagatelle and pyramids, of seagulls and alephs. All these things, belonging to very different registers of reality, co-exist on the island, depicted through Avery's work through a constantly-evolving palette of techniques and media. Thus the aforementioned structural principle of Avery's project is a way for the artist to 'count himself as one', to bring together all the different situations of which he is an intersection: philosophical ideas, places, concepts, people he's seen or known, historical figures, imaginary situations from books – without suppressing their multiplicity. The idea of the 'whole project' always goes before him as a task that will never be finally completed. There is always more for him to discover on this island, now that he's decided that the island is where everything will be.

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[11] Avery, *The Islanders*, 50.

He therefore suggests a contemporary role for the philosophical island, for individual and society alike: stifled by a wealth of multiple possibilities, we lack any immemorial, mythical example to repeat; there is no deep past, no 'before the flood', that unifies us; We can't appeal to memory anymore for political strength, to tradition for identity, or to ideal models for simplicity. It is therefore no longer a question of *founding* ourselves on the basis of mythical islands. Rather, given this multifarious reality, the problem is to find *ourselves in* it - or to *hunt* ourselves in it, in the process adding to the territory with yet more maps.

Finally, Avery's story is also about the practice of philosophy itself. His protagonist comes to the island with a view to being its discoverer - he craves the glory of discovering something new.[12] But he immediately finds he's not alone. The fantasy of the Victorian explorer is already dispelled on page one of Avery's travelogue. This in itself is the condition of doing philosophy in the present day: a sometimes disheartening process of discovering who has already had your thoughts before you. You're exploring a land that seems, to you, to come directly from the deepest part of yourself and to contain the strangest, most intangible thoughts; But you constantly have to accept others have been there before you, already mapped, charted, and named these zones of thought, just like the names on Avery's map: *Descartes' axiom*, *The phenomenon of sense*; *The procession of the Greeks* (an archipelago which includes the island of Timaeus). To think today, is to negotiate an historical constellation of thought-positions; *anamnesis* become historical. It is the problem, not of how to begin from nothing, but of how to synthesise existing, multiple lines of thought into something new. This quandary, this weight of history, was the same in which Avery found himself with respect to an overly historically-conscious discourse of art. The island, the construction of this island that belongs only to Charles Avery, more than the sum of its parts, more than any one narrative, is his response.

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[12] Avery, *The Islanders*, 9.

According to Avery, if one can't be a discoverer, the only thing to do is to reinvent oneself as a hunter, trying to locate the island's greatest treasures, those that have eluded everyone so far. If Avery says that this characterises the figure of the artist, one would be inclined to say it corresponds also to the figure of the philosopher: 'an eternally hopeful and eternally hopeless individual. Even though history and reason tell him otherwise he continues to believe he will prevail'.[13] As we have seen, the history of philosophers' islands is a moving image of this eternal hope.

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[13] Avery, *The Islanders*, 23.

WE DON'T
STAY HERE
BECAUSE
OF GRAVITY
WE STAY
BECAUSE
WE LIKE IT.

The Islanders: Epilogue[1]

Charles Avery

This is the plain where Rocco once found a dead monster.

Within its thinness I am profoundly lost.

Multitudes of round white flowers vanish into the endless ring of light on the horizon, and there is little else, other than the wind, which ruffles the meadows.

Every so often I think I see, at the edge of my vision, some small animal flitting, but I cannot say that any of these sightings are conclusive.

I resolve to fix my eyes downwards and comb the ground in search of any sign of diversity.

A little flat stone … the remains of a small and long-dead creature … possibly … strange S-shaped lines in the dust… some foamy substance on a stalk … another stone ... an old bottle!

When turned upside down and shaken, it yields a few drops of rusty red liquid which disappear into the ground.

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[1] Text originally commissioned by *To Hell with Journals* and published as 'The Fancy of the Hunter', in issue d (Nov. 2009), eds.. C. Arsène-Henry and H. U. Obrist.

Many have ventured to the remotest part of this far off isle. Some return to tell the story. Those who do say they came in search of something new, for it is the fancy of the hunter that, in this reified atmosphere, a beast called the Noumenon may reside. The existence of this creature has never been proven, yet there is a deep conviction that it must indeed be, and do so here, in the wilderness, for the rest of the Island is well charted.

Some come alone so as not to alarm the creature, but hope to enchant it – yet any sighting reported by such solitaries is dismissed as the altitude induced hallucination of the wishful, or the fabrication of the charlatan. Others come in pairs so as to have somebody to corroborate their testimonies, but none have been successful. It seems ‘Three’s a crowd’ as far as the Noumenon is concerned.

Then there have been great enterprises where hundreds have come up here, with dogs and nets, and all manner of contraptions, and have sought to encircle the creature, fruitlessly.

This is clearly a being of infinite finesse. Its existence is sustained by faith alone, or, as The Urbane Wit commented: “It’s behind you!”

Nevertheless there is an ocean of amnesia that new generations must cross to come to the island; and as they pull their barques ashore and savour the moist air, each expedition with its newest equipment, a picture of jovial young women and men on the beach, full of optimism as they head for the darkness.

I too was drawn up here by the scent of this enigmatic cat, and am all regret. I would gladly settle for the impression of its droppings if I could be delivered from this situation.

I am disgusted with my weakness of character, for I must admit that a sickening loneliness has come upon me more quickly and profoundly than I imagined it could. I yearn to be planted back in the marginally less lonely situation of the café in the outpost of Onomatopy, where I first conceived this misguided expedition. Where a rude waiter dumped my coffee in front of me, spilling a good deal in the saucer, conducted exclusive banter with the barmen and made lewd comments about inaccessible females (to him through coarseness, to me through shyness) who walked past the window. Where two huge men in tall hats sat strikingly by a mirror on the wall, engrossed in conversation. A mendicant wandered into the café and mumbled something to me in dialect, about milk for his baby (absent) – from which I understood that he wished to indent me for currency – and stood around for several seconds after my refusal, allowing me to inhale his hum. I thought, drat, why don't the waiters intervene and remove this loon from the premises. To my discomfort he then took a place at the bar, where he appeared to be on first name terms with the staff, and proceeded to imbibe a coffee, served to him immaculately, apparently on the house, exchanging friendly salutations with the giants in the corner as he did so.

But I am far from Onomatopy, and I do not know my way back, indeed death is closer than town.

Yesterday I saw that pretentious hare, at a distance. It stopped a moment and looked in my direction, I thought in pity. I hoped it might point the direction home, but instead it just flashed its rings at me, and passed on. As an afterthought I fumbled a couple of cartridges into my gun but the hare was long-gone.

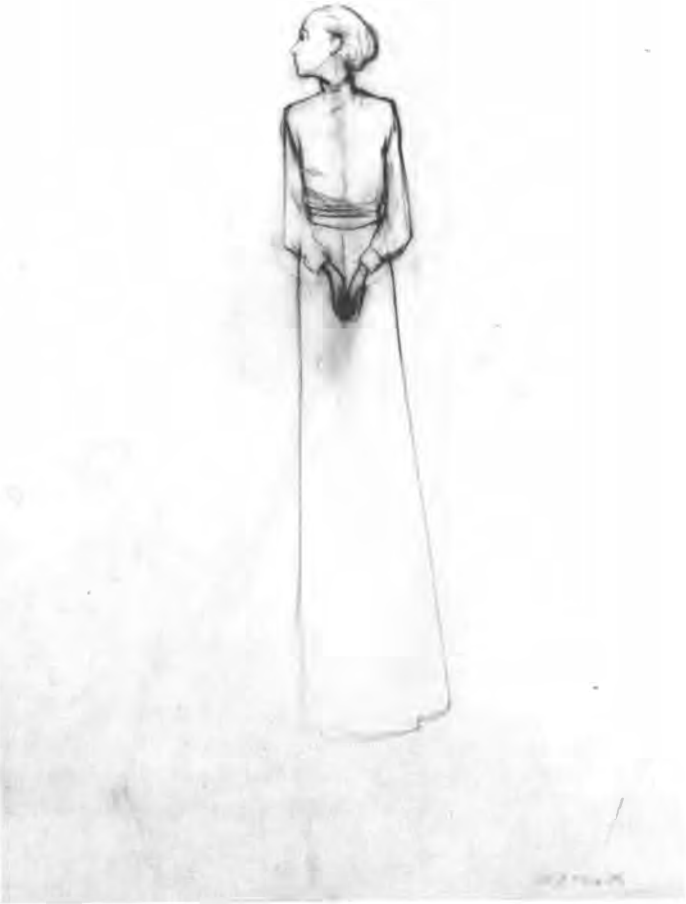
Another hunter once told me that all you really amount to out here is the contents of your bag, the contents of your self, and your gun. You have to concentrate to remember what you are, which is why I have started to write, to help me remember. It's no good just thinking: you have to think "I am thinking!"

Each day – a subtle event at these latitudes – I make an inventory to keep me together, or rather to keep myself apart from things:

> Self: I am called Only Macphew (really!). My best friend is a girl – I call her Miss Miss. I am in love with her but she has no idea, or pretends not to notice. I am a man.
>
> Bag: Two Pencils. One Notebook. One jar. A knife, naturally, with which to skin that blasted hare when it gets too bold. Half a bag of dried banana slices. One one-armed snake. I'll put it with the other one I have at home, if I ever make it back. I'll mount them on L-shaped bits of wood and have them as bookends. That's a cheering thought.
>
> One hole-punch, the cherished possession of Miss Miss which she lent to me a while ago (a burdensome piece of equipment and utterly useless in my current circumstances). I have it with me because I forgot to take it out of my bag before I left, and did not notice the weight due to my jaunty attitude at the outset of the expedition,

My thoughts wander to an erotic meditation on Miss Miss.

I know I must be high up the world, for the flowers are vivid against the dark grey sky, and I hear the noises without causes, tiny musical explosions in the air – a phenomenon that must be perceived to be believed, like



flying fish, of which I have heard sailors speak (and whom I don't believe).

I feel as though I am walking sideways through time, my past to the left of me, my future to the right.

I cannot carry on this way. I must make a choice but won't, for fear of it being the wrong one. I am just continuing, putting one foot in front of the other, hoping for a sign to direct me.

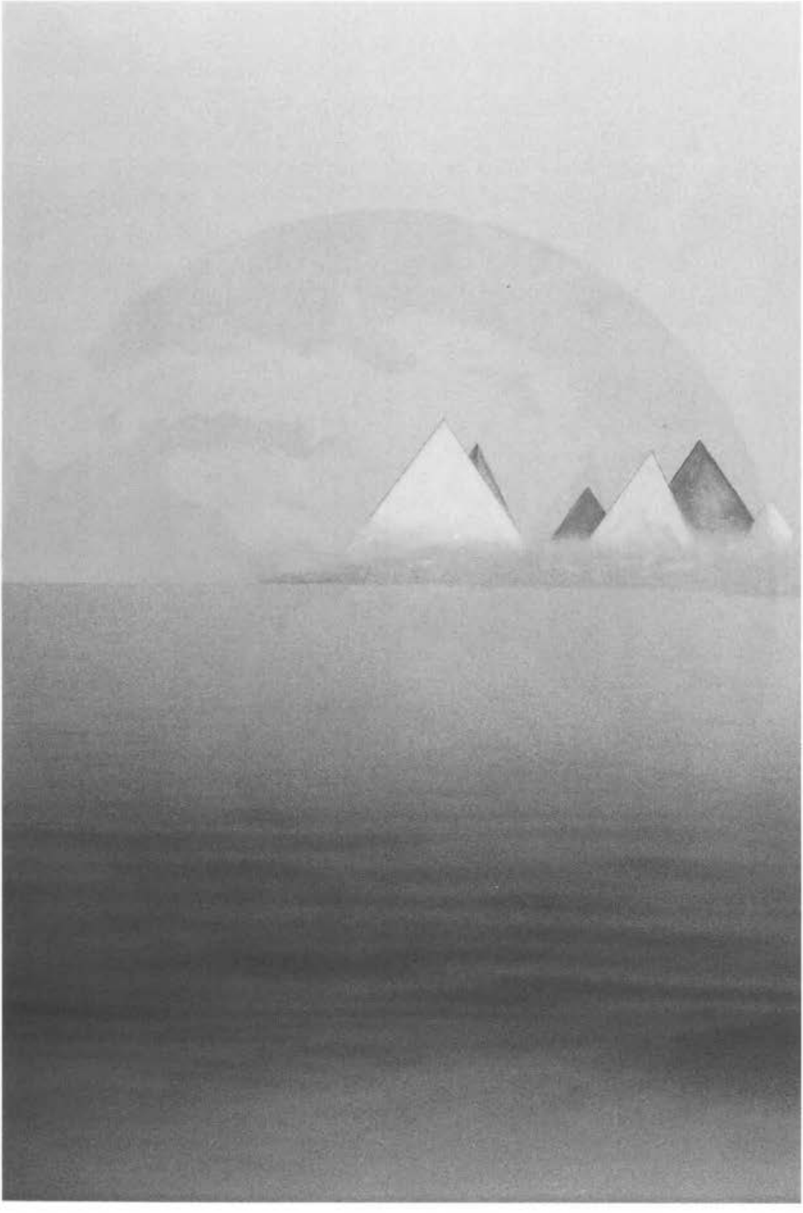
Meanwhile, worst of all, I have started to doubt. I seriously doubt the Noumenon, and wonder if I have jeopardised my life, sacrificed my bones to the anonymous dust of the plain, all for the sake of a chimera. (I imagine that hare will gingerly approach my corpse when it is sure I am dead beyond the possibility of resurrection, and when the flesh has rotted on my fingers, it will take my garnet ring for its collection.)

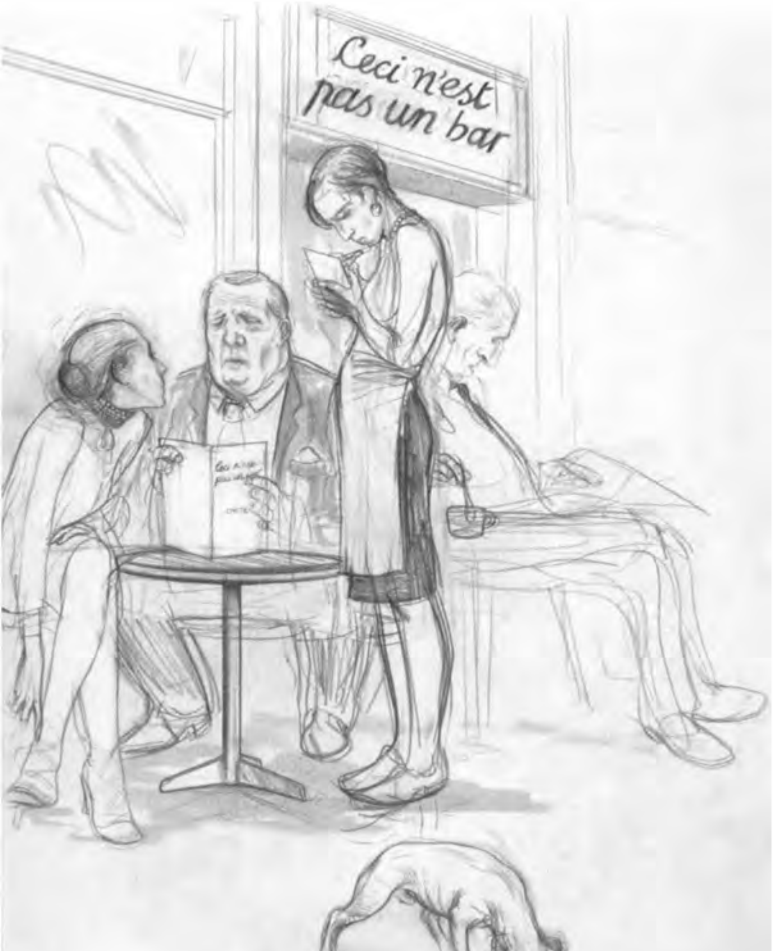
I doubt the affections of Miss Miss, or that her fatalist self will view my demise as anything other than the course of events. Certain other things have also begun to disturb me: sometimes the flowers don't quite align with their stalks. Why have I never seen the bottom of a mountain? Despite my patient efforts in studying the If'enish language, I have acquired no more than a few words – leaving me to suspect that this argot amounts to little more than gobbledygook improvised for the consumption of the tourists.

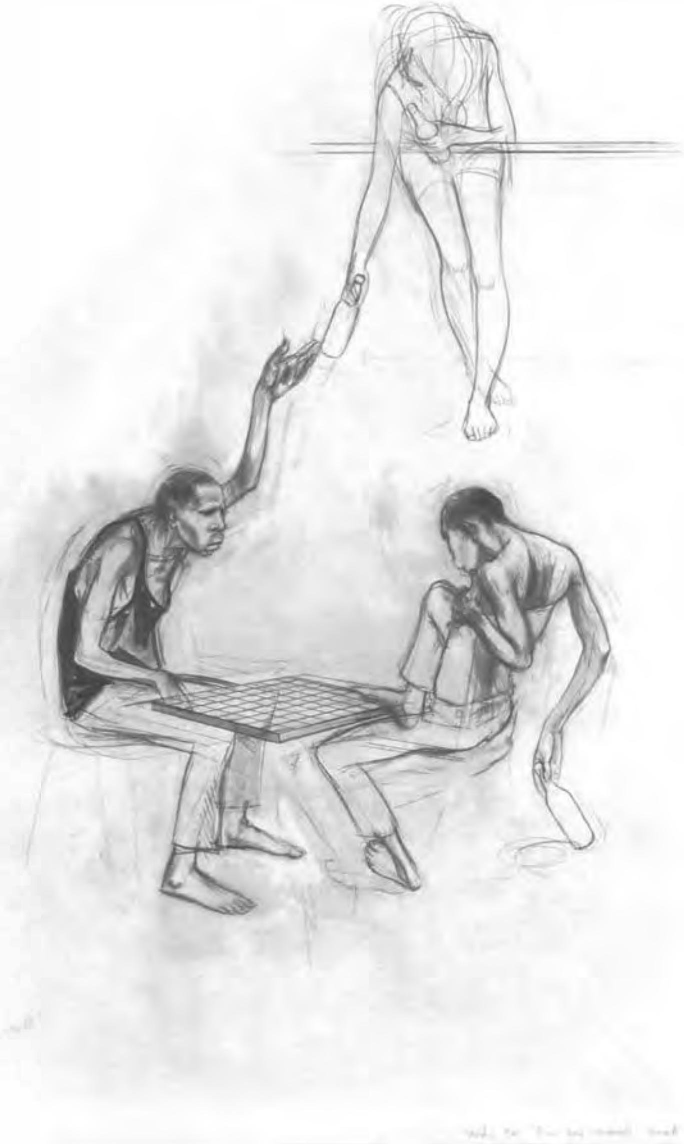
And finally I have started to wonder if, beyond the shops and bars and lights of Onomatopoeia, beyond the plane of the gods, where the defunct machines and litter are strewn, underneath the Mountains, and the flowers, and the dust and the bones of the hunters, there is an Island at all?

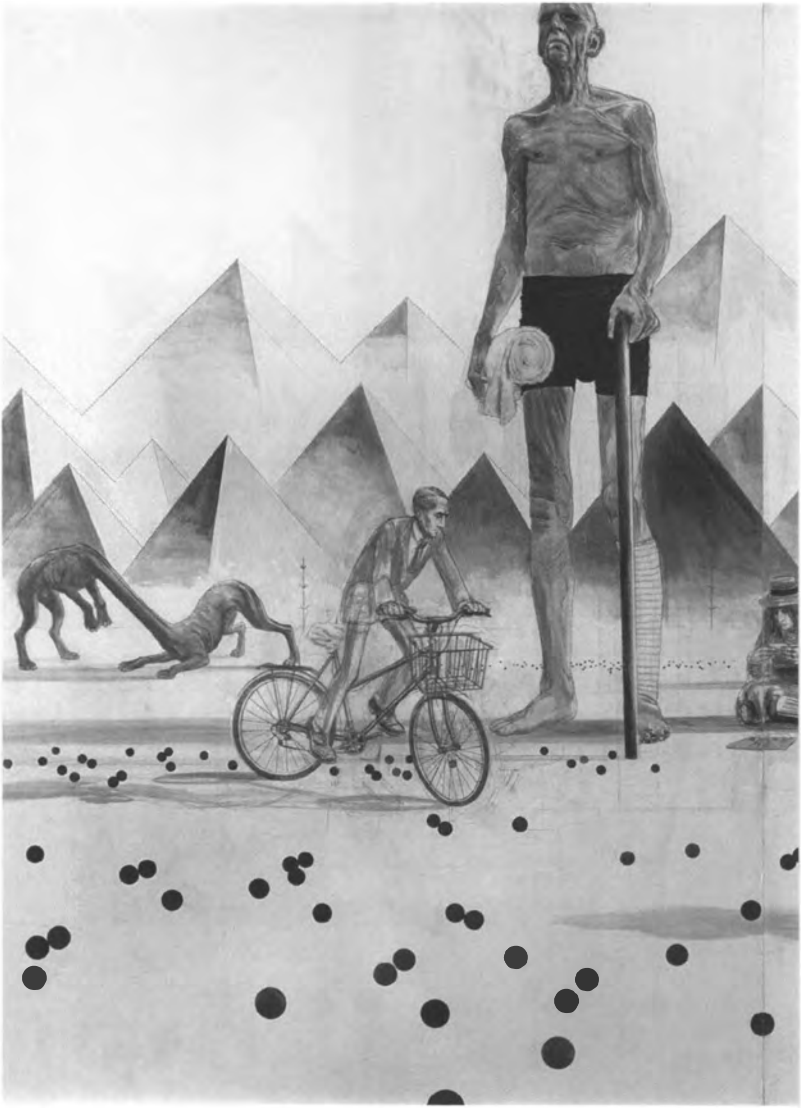
The Tropic of the Horizon
The Diving Birds
Effect
The Sea of Clarity
The Ocean of the Procession
The Analytic Numbers
The Principle of the Dithering Fill
The Three Points
The Milltam Isles
The
The
Of

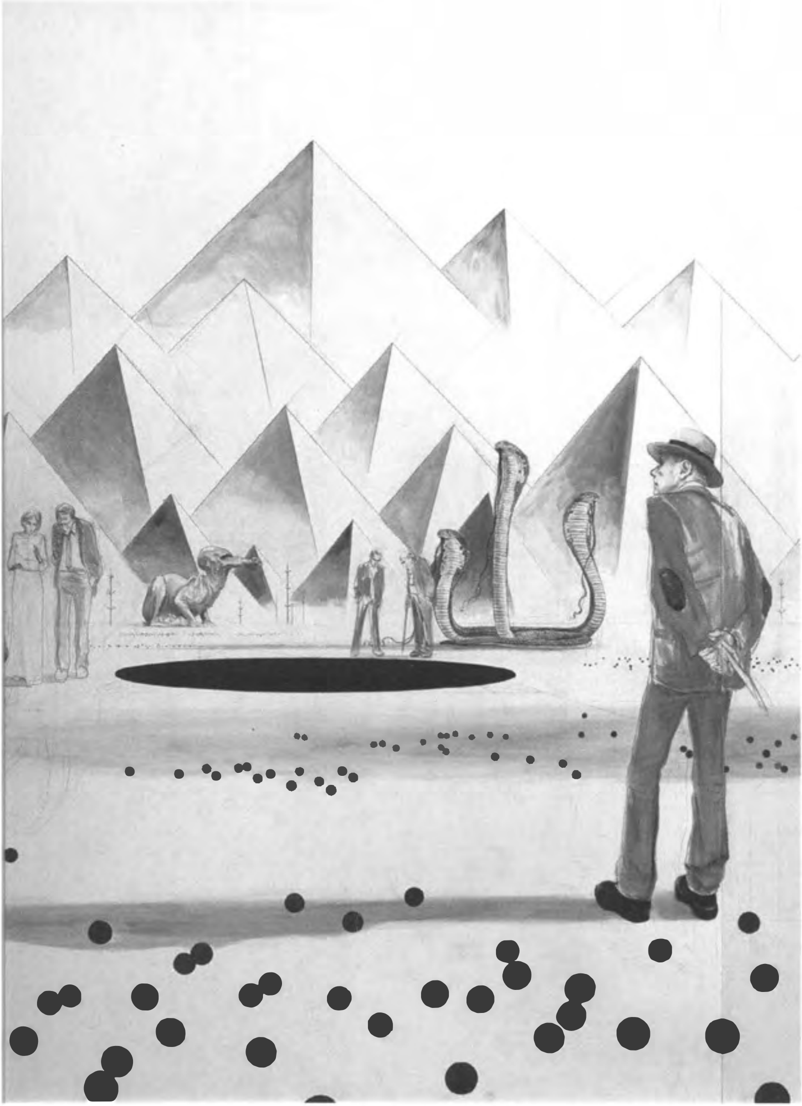
The Sea of Clarity
The Occluded Ocean
The Horizon
The Subconscious
The Margins of Consciousness
Cape Conscious
The Occluded Ocean
The Horizon
The Subconscious
The Margins of Consciousness
Cape Conscious
The Sea of Clarity

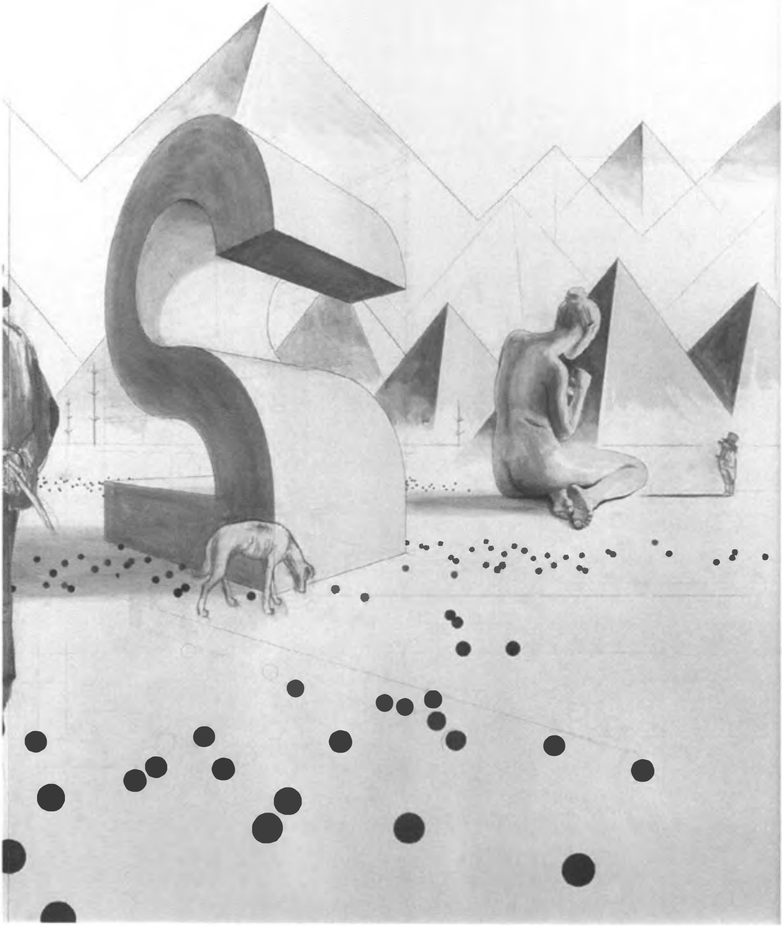



Ceci n'est pas un bar









Theory is Waiting

Gilles Grelet

I

La théorie est attente, établissement de l'homme – du réel sans chair, sans phrase, sans monde – dans la condition de l'attente

II

Le corps de la théorie
– écriture formulaire, enthousiasme ascétique, surrection populaire ordonnée, coque passant bien dans la lame, voile vibrant dans la brise, montant à l'assaut du vent – est institution de l'attente

III

Cette institution – cet acte – est attentat au plein du monde, à la suffisance des mondains, à la morgue des vivants ; attentat par le vide, la distance prise, la parole laconique, défaite, tirée du silence ; attentat angélique, de l'ange qu'est le je sans moi, le corps sans chair, l'acte sans pratique, la formule sans discours

IV

Austère et théâtral, l'acte de la théorie traverse la pratique, ne s'y englue pas : ne fait pas monde. Tranchant de l'aile, du tract épuré, du traité incendiaire, de la joie marine traversant la mélancolie sans bornes

V

Attente instituée, attentat formel, en forme de traversée,
de discernement, d'ordre tranchant, sévère, ardent.
Attentat du je traversant le moi
(écriture en-je destituant les bavardages du moi).
Théorie aiguë, armée.
Théorie-bateau

VI

Les mondains, qui ne savent que les compromis jou(iss)eurs de la terre et du ciel, parlent d'une mauvaise blague, d'une blague qui ne fait rire personne

VII

Théorème d'Anacharsis :

IL Y A LES VIVANTS, LES MORTS, ET CEUX QUI VONT SUR LA MER

Gilles Grelet
Celui Pour Qui Le Monde Est Un Bordel Dont La Pratique Est La Putain Et La Philosophie La Grande Maquerelle

Le 5 juillet 2007

I

Theory is waiting, it establishes man –the flesh-less, phrase-less, world-less real– in the condition of waiting

II

The body of theory
–formulaic writing, ascetic enthusiasm, ordered popular uprising, hull cutting truly through the waves, sail fluttering in the breeze, taking on the wind–
is the institution of waiting

III

This institution –this act– is a full-on attack on the world, on the vanity of the worldly, on the morgue of the living; an attack via the void, the distance taken, via the word that is terse, distraught, dragged from silence; an angelic attack, from the angel that is the I without me, the body without flesh, the act without practice, the formula without discourse

IV

Austere and theatrical, the act of theory crosses practice without getting bogged down in it; it does not become worldly. Incisiveness of the wing, of the purified tract, of the incendiary treatise, of maritime joy crossing boundless melancholy

V

An instituted waiting, a formal attack, in the shape of a crossing,
a discernment, an order that is cutting, severe, and ardent.
The attack of the I crossing the ego
(the writing in I dismissing the chatterings of the ego).
Armed theory, extreme theory.
Boat-theory

VI

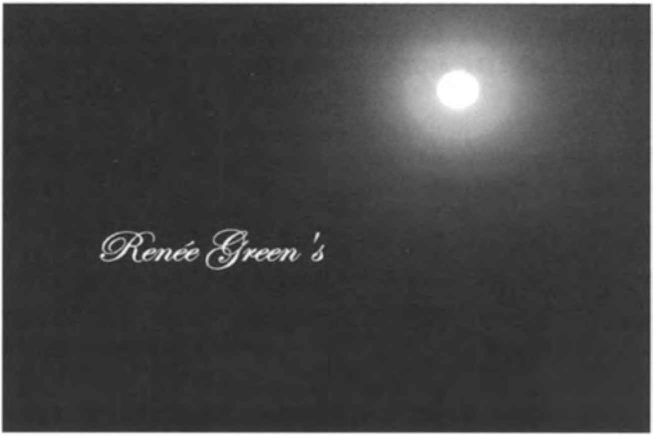
The worldly, who only know of pleasant compromises between Heaven and Earth, speak of a bad joke, a joke nobody finds funny

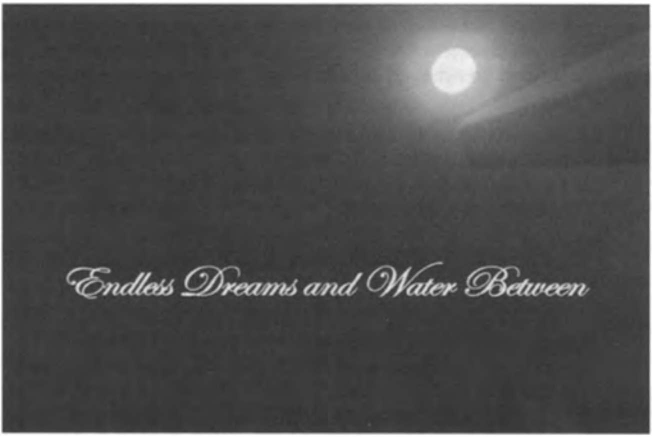
VII

Theorem of Anacharsis:

THERE ARE THE LIVING, THE DEAD, AND THOSE WHO GO TO SEA

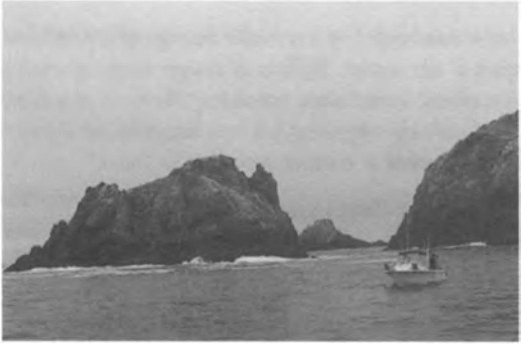
Gilles Grelet
He For Whom The World Is A Brothel Where Practice
Is The Whore And Philosophy The Great Madam
5th July 2005


Renée Green's


Endless Dreams and Water Between

Endless Dreams and Water Between

Renée Green



Aria: '*If someone were to tell me I had twenty years left, and ask me how I'd like to spend them, I'd reply: Give me two hours a day of activity, and I'll take the other twenty-two in dreams ... provided I can remember them.*'

****

'*[T]he mind is bombarded by a veritable barrage of dreams that seem to burst upon it like waves. Billions of images surge up each night, then dissolve almost immediately, enveloping the earth in a blanket of lost dreams. Absolutely everything has been imagined during one night or another by one mind or another, and then forgotten.*'

Luis Buñuel

Dreams and Islands

Aria: *'This is to state once again that the essence of the deserted island is imaginary and not actual, mythological and not geographical* [...] *We have to get back to the movement of the imagination that makes the deserted island a model, a prototype of the collective soul. First, it is true that from the deserted island it is not creation but re-creation, not the beginning but a re-beginning that takes place* [...] *It is not enough that everything begin, everything must begin again once the cycle of possible combinations has come to completion.'*

Gilles Deleuze, *Desert Islands*

Raya: '*Islands may no longer be the material prizes they once were, but islands of the mind continue to be extraordinarily valuable symbolic resources, a treasure trove of images through which the West understands itself and its relations with the larger world. Like all master metaphors, the island is capable of representing a multitude of things.'*

John R. Gillis, *Islands of the Mind*

Aria: What is this need to travel? Why are we haunted by it? According to George Sand,

> The fact is that nowhere, these days, is anyone genuinely happy, and that of the countless faces assumed by the Ideal – or, if you dislike the word, the concept of something better – travel is one of the most engaging and most deceitful. All is rotten in public affairs: those who deny this truth feel it even more deeply and bitterly than those who assert it. Nevertheless, divine Hope still pursues her way, assuaging our tormented hearts with the constant whisper: 'There is something better – namely, your ideal!' (George Sand, *Winter in Majorca*)

Mar: In Randa at approximately thirty years of age in 1263, after a dissolute life up until that point, Ramon Llull had a vision of crucified Christ that he took as a sign to dedicate his life to his service. The form of service took three forms: To missionize at the cost of martyrdom. To write a book, the best in the world against the errors of the unbelievers. And to go to the Pope, to kings, and to Christian princes to incite them to create language monasteries for missionaries. Thus he had to travel.

Lyn: On a late summer's day in the year 1608, a gentleman of London made his way across that city. He was a man of ambition, intellect, arrogance, and drive – in short, a man of his age. Like our own, his was an era of expanding horizons and a rapidly shrinking world, in which the pursuit of individual dreams led to new discoveries, which in turn led to newer and bigger dreams.

This man, a ship's captain, was named Henry Hudson.

Aria: From the Convent of Palma in Mallorca, Fray Junipero Serra struggled with his dreams:

> I have had no other motive but to revive in my soul those intense longings which I have had since my novitiate when I read the lives of saints. These longings have become somewhat deadened because of the preoccupation I had with studies.

To recapture the intensity he ventured to the New World to perform an act of self-sacrifice, emulating his predecessors. In 1749 he left Mallorca never to return.

Long before his decision to venture out, there were others familiar with legends of gold. In one romance with the theme of attacks by 'pagan forces on the mediaeval Christians occupying Constantinople', during the battle the pagans were aided by Calafia, a warrior queen who came from a place

> at the right hand of the Indies, an island named California, very close to that part of the Terrestrial Paradise which is inhabited by black women, without a single man among them, who live in the manner of Amazons [...] There weapons were all made of gold. The island abounds with gold and precious stones, and upon it no other metal is found.

Also upon this island 'there are many griffins. In no other part of the world can they be found.' From Biscay to Cádiz, '"California," the lilting name for Queen Calafia's land, was on everyone's mind.'

Aria's Dream
and
First Letter

Dear Friends,

Raya (Raya L. Carlton), Lyn (Sandlyn Ryder Hoving), Mar (Maryse-Françoise d'Île),

It was a dream that stirred me to action.

I dreamt that I lived on a precipice by the sea. The house was made of stone and had spacious terraces surrounding it. Beyond that a garden and beyond that, rows of olive trees in red earth. In my dream I had awakened to find that everything that had previously been troubling me was a dream and that I was free to create and use my time as I wished. I had no financial worries and I could sponsor events to invite esteemed thinkers and creators for one month each year. During these days we would meet for a few hours of conversation, go for a swim, and have wonderful dinners on the terrace at night. Only guests who really wanted to be there would attend. They would be few in number. The rest of the year would be devoted to making beautiful, precise publications and productions.

There would be enough time to realise them without stress.

This dream affected me so viscerally that I perceived it as a signal and began writing this letter to you. Please excuse the group message, but this is a way to begin a conversation by writing to each other. I thought about myself and others I knew. Very skilled and intelligent people, yet not really creating as they could be for various reasons. It was around then that I was reading an odd little book called *A Primer for the Gradual Understanding of Gertrude Stein*, in which I read her words: '*Anything you create you want to exist, and its means of existence is in being printed.*' I adapted that sentence to the present, as also meaning 'diffused via an interface', and I read on:

> After all, my only thought is a complicated simplicity. I like a thing simple, but it must be simple through complication. Everything must come into your scheme: otherwise you cannot achieve real simplicity.

I wondered, "Was Gertrude Stein a Buddhist?" I continued to read:

> A great deal of this I owe to a great teacher, William James. He said, 'Never reject anything. Nothing has been proved. If you reject anything, that is the beginning of the end as an intellectual.' He was my big influence when I was at college. He was a man who always said, 'Complicate your life as much as you please, it has got to simplify.'

Ideally I would like us to explore writing letters. This is something that has become nearly extinct and I'd like to attempt reviving the art of writing actual letters, as I've been reading examples of correspondence from the past. In these letters we can tell each other our thoughts and feelings in more than a few choppy words.

These letters can be sent via e-mail, although I'd like to experiment with sending them by post, so that it is possible to have something tangible we have touched. Actual matter. Let's see if that has any altering effect on our approach to being in contact. One thing is certain, it will require slowing down occasionally to reflect.

I wanted to remind you that each of us live in island locations. Much water is between us, but we can remain close, as I feel we are. Mar and I live on the same island, but in different parts and rarely see each other. I think there is something affecting about this island-dwelling condition and I'd like to think more with each of you about it. My suggestion is to focus more specifically on where we are. I think we are each trying to do this in our own ways. Yet, perhaps we can also be conscious of how the physical location and history of the places we inhabit affect how we currently perceive and engage living in the world, in conjunction with how we can have an exchange between each other. We're not going to live forever. To be blunt, I'd like to think about our lives and I'd like to do this together. We are each unmistakably independent, but now I think it's a good time to use our energies in conjunction for our benefit. Why not? This may sound old-fashioned, but I thought it might be interesting to write about what we read. Remember, reading? As I know you are each readers as well as writers, perhaps this can be fun? Do you ever feel as if you haven't anyone to discuss much with? This is a way to alleviate that feeling. I've been reading George Sand. Does that seem odd? Check out her *Winter in Mallorca*, edited by Robert Graves, when you get a chance. I'd be interested in getting your feedback. Although I'd never previously read George Sand, as I follow her trail I find many fascinating constellations to ponder. ‘Constellations’ is my current keyword.

I’m curious to know what you think about these suggestions. I’d also like your agreement that we will continue to keep up a regular correspondence. You must pledge like in the Three Musketeers: “All for one and one for all.” In addition, I invite you to convene in September with me in Mallorca. Please save up and clear some time. We always plan to get together, but life’s many accidents seem to usually get in the way, so let’s really make an effort. Perhaps we can develop interesting ways to think and create together. I have in mind a form of gathering and publishing that differs from what I’ve previously been involved with, and I’d like your help to think with me, as well as to enjoy being together.

That’s all for now. I hope you are each very well and I look forward to our being in ongoing contact.

Yours,

Aria

Aria Phoenix, in case you’ve forgotten which Aria, as we’ve been so out of touch!

P.S. Lyn you are an Oulipian, Mar, you are an Eulipion. And Raya, you flow like the tides.

Take care!

Aria Phoenix

Aria

Aria is again an editor and now a publisher. She thinks in terms of all that literature has been and can be.

She grew up reading continually and often saw herself in relation to both the characters she read about and the authors she read. Identification of this sort became a concern for her after she'd learned in college that it indicated a naïve relationship to the text and its production. After that she resolved to thoroughly understand this process. She attended Radcliffe Publishing Procedures Course, then still in Cambridge, and immediately began working for a respected publishing house that had been founded, as their colophon depicting a flaming torch noted, in 1817. Thus began her years in book and magazine publishing. She also wrote.

For a time she worked in academia, where she'd landed by chance, via her abilities as an adept editor and manager, with insight regarding intellectual trends.

As a creative contributor she wanted to avoid becoming embedded in the drudgery of administrating. She didn't want her life to be perceived by herself or by others as a path to avoid – the way she'd sometimes thought about her predecessors whom she'd studied and tried to use as models or guides. Often, there were aspects of their lives she'd like to avoid experiencing. She didn't want the same to be observed about herself, so she shifted.

She experienced a moment of conversion and revelation, realizing what she did want to do. That was the beginning of the September Institute. In her travels she met many people, some of whom became friends with whom she has overlapping interests. She decided to write to these three friends and to suggest they begin a project that involved an examination of what they most enjoyed, as well as things they've been curious about. They would write actual letters to each other from their various locations to describe their interests.

Aria reads many languages and is fluent in a few. She prefers to be based in one location, yet she likes to spend time in places to which she feels connected for reasons of friendship, links to her life, and because she enjoys the ways she can feel in these environments. She has an encyclopaedic relation to life. It is important to her that she participate in the relay between what has passed and what is present.

Sandlyn Ryder Hoving

Lyn

Lyn's been a wanderer. What she enjoys increasingly is gaining deep understanding about where she is and where she's been. She returns to places. For her watching films is also a return to sensations she enjoys. Mental links can be made to other experiences. She imagines these moments of fixed concentration as something akin to pausing at the stations of a pilgrimage to remember. The notion of a pilgrimage appeals to her and she's become curious about the enactments and motivations behind such endeavours. Her own travels mirror these. She is very linked to her island, and its many quirks. More than one lifetime would be needed to begin to sound all that resides there.

Even though she'd been away many years, she decided that this location is her home, even though so much had changed and so many people she'd known no longer lived there or were alive. There she felt closer to the fullness of her life, which now interested her much differently than when she'd lived on this island as a youth. She felt as if she now could discover where she could be and where she enjoyed being, without pretence or shame. With so many people gone she felt able to have a different relation to her life and to the island. Her focus includes the long past and the nature of the island.

She continues to work independently, sometimes as a designer. Occasionally, if a book of interest is proposed, she will index it, as this way of creating links is akin to the ways she enjoys probing and thinking about material.

Now she lives near the Cloisters, which seems somehow appropriate for this phase in her life. Her interest regarding the Middle Ages has grown. Yet she thinks about that time in relation to different bodies of water, such as the Indian Ocean. For years she'd been interested in the life and writings of Ramon Llull. She felt she could now go further into her interests.

Maryse-Françoise d'Île

Mar

Mar adapts easily to different environments. She likes to appear to blend into local settings, even places where she isn't fluent with the language. She doesn't like to be a foreigner, even though she can admit her lack of knowledge about the specificity of a place, she compensates by being very curious and receptive to local habits and idioms, as her sense of observation is acute. She learns rapidly, has the humility to accept correction, and others sense her respect for their customs. She is engaged in a lifelong study of herbs and of plants. As these represent knowledge that has been culled over centuries from around the world, her gift of grasping languages and her interest in etymology are put to use in relation to exploring the plant world past and present.

She is independent and used to being on her own since an early age. Travel is common for her, a way of life. Migration of plants is of particular interest to her, as well as the movement of people. Her parents were agronomists. In a way, she continues some of what they did. That recognition accompanies her and comforts her as they are gone. Her focus is on plant life, their properties and their beauty, that can be observed as well as represented.

She's comfortable in crowds, in markets, in rural and urban settings, and especially by the sea. Her preference is for a base near the water in a modest house in nature. For this reason she's deeply inspired by Lester Rowntree's way of life, based on what she's read about her in her book, *Hardy Californians*. In particular, she often thinks of this phrase of Rowntree's self-description in relation to how she sees herself: '*A wayfarer urged by conjectural curiosity.*'

Raya L. Carlton

Raya

Raya is extremely intelligent, yet often perplexed by what people say and mean. The differences between what people say and what they mean confuse her, as she imagines these to be synchronous acts, yet via experience she's learned otherwise. She is attracted to organisms in nature, particularly water varieties of fauna and flora. They can have surprising traits. Appearance and encounter can contradict. This contact allows her to form analogies to life situations, growing out of her increasing knowledge of underwater habitats and creatures.

Born inland near a Great Lake, she had an early desire to be near water. She won a scholarship to study at an institute for oceanography on the Pacific coast. Many years have passed and she continues to observe and investigate the waters and the shores.

She prefers being with one person she feel close to. She avoids crowds. She also feels good in small gatherings of people she knows she can trust and whom she feels close to in some way. Sometimes a person will make a statement that she will ponder for years. Her mind works to attempt to search in the world for evidence of what was mentioned, so that she can mull over and decide what she thinks about what was posited. The statement is usually a casual one, yet for Raya it may loom large with potential content, a sort of key that may open an aspect to living that seems distant to her.

She is quite at ease on her own, walking along the shore, or wading in tide pools.

Water, Time and Islands

Aria: ‘*In every country the Moon keeps ever the rule of alliance with the Sea which it once for all has agreed upon.*’

The Venerable Bede

Aria: ‘Continental islands *are accidental, derived islands. They are separated from a continent, born of disarticulation, erosion, fracture; they survive the absorption of what once contained them.* Oceanic islands *are originary, essential islands. Some are formed from coral reefs and display a genuine organism. Others emerge from underwater eruptions, bring to the light of day a movement from the lowest depths* [...] *Continental islands serve as a reminder that the sea is on top of the earth, taking advantage of the slightest sagging in the highest structures; oceanic islands, that the earth is still there, under the sea, gathering its strength to punch through to the surface. We can assume that these elements are in constant strife, displaying a repulsion for one another. In this we find nothing to reassure us* [. . .] *In one way or another, the very existence of islands is the negation of this point of view, of this effort, this conviction.*’

Gilles Deleuze, *Desert Islands*

Dear All,

This is an immediate follow-up. I realize you haven't had a chance to respond yet, but I wanted to send this off to you as I'm eager to read your initial thoughts.

The basis for the ideas of what I'm calling the September Institute is in a separate description that you'll soon receive. I'm thinking about a project that can rely on our various strengths, or as I've heard stated recently, 'skill sets'. The focus continues to be on locations we inhabit, yet that seem exotic for those who aren't familiar. As a future long term project, I propose creating an *Island Encyclopaedia.* This is an impetus to shift our thought into different kinds of associations, for example, beyond the assumed acceptance of continents or nations. These concepts are up for questioning in any case. We've talked about some of these things before, so why not enact them? First of course, we have to get the letter exchange going. Please excuse my enthusiasm, but I feel as if a weight has been lifted from me since I had a kind of 'conversion' experience. I promise not to attempt to convert any of you. I already like you. But we are all seekers.

To follow up an earlier wish, has anyone yet read George Sand? *Winter in Mallorca*? Please do! I'm beginning to read her *Story of My Life* (*Histoire de ma vie*), a very unusual approach, as she begins the story at least forty years before she's born, which I like. There are many biographies, most of them are annoying, but some are interesting. I come across all sorts of curious descriptions of writing women when I read Sand-related books. It's still fascinating to me that Sand was penalised for what were considered her excesses. Here's one instance, from Belinda Jack's *A Woman's Life Writ Large:*

> For Nietzsche, Sand was a prolific, ink-yielding cow, an example of 'lactea ubertas.' Her overflowing, undisciplined writing was evidence of her incapacity to reason logically […] [H]e likened her to Wagner. What disconcerted both Baudelaire and Nietzsche above all, beyond or beneath their more rational objections, was Sand's passion, her energy, and her capacity to respond with enormous courage to conviction. These same attributes account for her enormous popularity.

I'm also reading her *Lettres d'un voyageur*, which provide another perspective. Sand's correspondence is impressive. It is still being edited. There are twenty volumes to date. She was a precursor to the open letter, in writing letters to be read publicly. As she said, '*I felt I had many things to say and that I wanted to say them to myself and others.*' Take this as an encouragement. As Henry James put it – interesting how this is the second mention of one the James family – George Sand '*is open to everything*': her discourse might be '*amatory, religious, political, aesthetic, pictorial, musical, theatrical, historical.*' It might also be, as we see in *Lettres d'un voyageur*, botanical, astronomical, mythological. In fact, about almost anything that seized her interest and imagination she was remarkably knowledgeable.

Alright friends, I'll leave it there. As always, looking forward to hearing from you.

Yours,
Aria

Humans and Islands

'[H]umans can live on an island only by forgetting what an island represents.
Islands are either from before or for after humankind.'
Gilles Deleuze, *Desert Islands*

'The meaning of a name is more than the meaning of words composing it.'
George R. Stewart, *Names of the Land*

Manatay
Manhattan

Lyn

Dear Aria,

cc: Raya, Mar

I like your idea very much. Count me in. I pledge allegiance to the experiment.

Shall I begin now?

I do feel as if I have been saving many words. I don't really talk with many people, beyond those I encounter while doing errands or in a professional capacity. Not speaking hasn't bothered me, as I write, but since you mentioned it, yes, there are few people now here to speak with about what means something to me, beyond politics and the economy. Is it generational? So many people are gone even though we're not what I used to imagine as old. We were described by the media as Generation X, remember? It figures: no name, just a letter. In the 1920s some advertising type coined the phrase 'lost generation' and later during 1970s punk times, 'blank generation.' It's kind of ridiculous to even consider being branded by a time period, don't you think? Now there is a 'Gen X' President elected in the US, and youth have hope. Really? Yes, let's write about our lives and about where we are.

To begin, here's a dream I'd written down many years ago, before I'd been anywhere farther from this island and this country than Mexico:

> This is the second time in a row that I have dreamt about water. Two nights ago I dreamt about the Mediterranean Sea and a Greek island named Pesta. The dream was related to Atlantis, the city that sunk into the ocean. Last night I dreamt about travelling outside of one's body. I dreamt of the Brontë children dying, but not really being dead. A small boy suddenly died, but his corpse was not buried. Within a few days it did not rot. I saw him breathing as if asleep. He opened his eyes and sat up. Said he had been on a voyage beneath the sea.
>
> Many of my friends were disappearing and I could not find them. They returned telling me that they were in another dimension, beneath the sea. Several of them said that suddenly they were able to go to a place in the depths of the ocean. They were going to have a party there and asked if I would come. I wanted to know the secret of how they were able to go to this deep place. One gave me a very tiny submarine, smaller than my smallest finger, and told me to climb in. I just held it, not knowing how to use this submarine. I looked out of a window, which came to the water's edge. I wondered what would happen if I were to jump in. Would I develop fins on my neck for breathing the farther I sank? Would I find this secret buried place?

When I had been on the road the first time, years ago, I'd gotten physically familiar with different places.

By foot I walked in Oklahoma, past an Indian reservation along with an occasional lone Indian, who didn't even try to hitch a ride. For three days I waited at a truck stop for a lift East. I never got it.

Walking became a mode of transportation then. Although my friend Voy's scam got me on a plane and out of there.

Since then I've become familiar with places by walking in them, learning them by foot. Figuring out routes I prefer based on invented reasons of taste. Not enough trees on this street. Depressing buildings on that street. The grade of this hill is more gradual. In many cities, towns and villages, in different countries, I've walked. Walked and worked. And also just walked, watched, listened.

Eventually I lived in a place by the water. It had seven hills and I walked each of them and stared at the water when I'd reach the top. I took ferries across the water and continued to walk. Sometimes I rode buses to the beach and walked the long shore.

Now islands. I never really thought of myself as being particularly fond of islands. But you're right, I do live on one. It had even been called, as well as thought of itself as, 'the island in the centre of the world' – how about that for megalomania? It does seem to be a tendency that has affected different locations at various times in history. Since I've been back I've become quite interested in finding out more about this island and its past. I've also become very interested in studying the Middle Ages. Maybe these interests are strangely related. In part they derive from the fact that I now live on the only part of the island that has areas with its earlier vegetation and rock formations, and this location is near that odd importation of the European past, the Cloisters. In addition, I've been trying to enter the thoughts of a mediaeval mystic and philosopher from Mallorca, Ramon Llull. Perhaps you can help me from your location? The island I inhabit is indeed a mysterious island, but all of our locations involve combinations. I've been thinking about Llull's *Ars combinatoria*, in relation to living. Perhaps it gives some indications of value in the present, even if it's challenging to decipher thoughts from a medieval Christian mindset. But certain ways of working with permutations are related to computer science. He is also considered by Oulipians as what they call an anticipatory plagiarist.

I think one of the attractions to me of the Middle Ages is that it was necessary for some to keep ancient knowledge alive. The primary protectors of received knowledge at that time were Islamic. This, I'm sure, resonates with your own interests in your Mallorcan island, as there are many traces in place names and in surviving structures of an Islamic past.

Al-Mayurka, is this the correct name? What was Mallorca before? And what was Manhattan before, during those earlier times? Before maps and fixed boundaries? Before passports?

This island region had a confederacy called Iroquois, that dated back at least nine thousand years. It was a complex of islands. Algonquins were called 'The First Peoples' of North America and had at one time covered a third of the continent. Most of the peoples that passed through the area were related to the Lenape, described as 'an ancient riverine people of Algonquin stock.' They can be perceived as comprising hoops or circles within circles of other related peoples. Munsee people were the last to predominate.

The Mohican descendents of Algonquins are more well known, but they were also called 'People of the River.' I read that there are 18,000 skeletons of Native Americans hidden in museum storage, of different museums like the Peabody Museum, for example.

Menatay means island to the Unami Delaware. Mahatuouh, 'place for gathering bow wood' to the Munsee. Manhattan or Manahatta, 'rocky island', add the 'ten' and that means habitation in Munsee. So Manhattan is the Munsee name.

I'll stop now and see if I have any messages or post from any of you. I picture messages in bottles moving through the sea. We could start a blog, but that would defeat the purpose of intimacy and depth, I think, at least at this phase.

Looking forward to continuing.

Yours,
Lyn

Al-Mayurka
Mallorca
Mar

Dear Aria,
cc: Lyn, Raya

Thank you for your letter and invitation. Maybe we'll be in touch differently. Yes, I will participate in a correspondence. It has been a long time since I've written the kind of letter you describe.

While thinking about your proposition I came across a letter in a novel I'm reading. The letter is meant to have been written by a priest and it launches the novel *The Dolls' Room*, by Llorenç Villalonga. It is set in a fictional Mallorcan town called Bearn, which is also the name of the founding family that is dying out. The letter is dated 1890, but the book was published in 1956. I'm reading the English translation, which didn't appear until 1988, after the author's death. He was born in Palma.

This may interest you. In a way it relates to the issue of generations that Lyn mentioned and change to which you allude. I quote:

> The question is not a simple one, and I feel the need to start from the very beginning. Giving you all the details of that life I loved so deeply, despite its grave errors, has provided a solace for me in my solitude. I must admit that the motive of my story, written in the course of these endless nights, may not be solely the scruples of my conscience, but rather the pleasure of reviving the familiar venerated figure I have just lost. With him an entire world has disappeared, beginning with these lands that have seen my birth and that will have to be auctioned off because the creditors have already notified us that they do not wish to wait any longer. The Senyor's nephews and niece neither have enough money to pay off the mortgages nor feel any love for Bearn, being used to city life as they are. There might be one last source of hope: they say a relative of the Senyors has arrived from America after having become a millionaire selling cardboard boxes. It seems unbelievable that anyone should become an important personality selling little boxes, but he has introduced himself with much pomp, laden with gold and determined to dazzle all of Mallorca with an electric automobile that has already killed two sheep. On his calling card, below his name, are the words Cardboard Containers, which no one quite understood until they realised it referred to those famous boxes.

I'll skip ahead, the quote continues:

> To me, halfway down the path of my life, this Cardboard Container Bearn would be nothing but an intruder. Yet there is no question but that a new generation is emerging, which is willing to associate these old lands with the personality of an outsider and will experience the same feelings towards the union of senyor and lands, which it will believe to be deeply rooted, that I felt towards Don Toni as a child.

For some reason, after reading this I thought about Robert Graves and Deià, all the changes in that area. I have also been reading George Sand's *Winter in Mallorca* and I took notice of the many footnotes, written by Graves, contesting nearly everything she wrote. It was quite remarkable. I was somehow reminded of Kinbote's role in Nabokov's *Pale Fire*. We've had some laughs over that. Some of these notes extend for pages on their own, as if he's taking over her book. It's quite weird. I realise I wasn't born on this island, although now I feel as if I had been, since I've been 'adopted' by a very kind family. I have become familiar with the vegetation and landscape over these years and I must say that Graves seemed rather harsh on Sand. That made me wonder what had been his experiences? He gives the appearance of being omniscient regarding anything Mallorcan and it seemed as if he'd perhaps had his own story with another woman who was also a writer. Through reading, I found this was the case. Two poets together. He lived in Deià with the writer Laura Riding. They had even founded a press together. Isn't that interesting? Of course you probably know all about this. There are even books in English on their years together, which were 1926 to 1940. Strange, isn't it, what become the remnants of a life and what people who have the possibility to publish choose to remember? Concerning both Robert Graves and Frédéric Chopin in Mallorca, we didn't yet discuss how Graves seems to identify with the male artist, composer and pianist Frédéric Chopin, who spent the winter in Mallorca with Sand – according to her, in a sickly state. Graves and Chopin are considered cultural monuments, whereas Riding and Sand are not. I haven't yet found statues of either of them. They're seen more as extreme, crazy and witchlike, from what I've gathered in conversation and through books.

The photos of Laura in Deià are particularly unflattering. In the early days she was considered to be as beautiful as a movie star. Of course, I prefer to read what she wrote rather than focus on the personal drama. But yes, thanks also for the Polti suggestion. I'll check out the thirty-six dramatic situations.

I have been enjoying reading *Winter in Mallorca*. It's pretty easy to find here in many languages. As it's such a tourism product I'd never felt compelled to read it until you suggested it. Sand describes a challenging situation in an unfamiliar place known prior to her journey only through painted images and travelogues. In some cases I disagree with Sand and Graves. But it is an interesting read. It makes me more curious about aspects I've been investigating concerning the Islamic past, via botany, gardens and architecture. It's been an extreme pleasure to encounter the small painted illustrations in the old herbal botanicals. Even though the classification systems have been contested, there is much to be found there. That's a possible direction I'd be interested in developing.

In terms of my research I have found sources focusing on the Balaeric Islands. This has something to do with your request that we think more about where we are. One of the particular aspects we face as islanders concerns scale. There are rare species of flowers here, but they may grow only in a small area. They may be the only examples of their sort in the world. There is no elsewhere beyond these island locations for certain plants. They are not endlessly replenished. I've read that 'the near-disappearance of Minorca's *Vica bifoliolata* can be blamed on collectors of rare plants.' Luckily with photography plants can be 'collected' in photos, rather than killed.

So I've been busily engaged. I'm curious to read more from each of us. The letter exchange is a good idea. Aria, it would be wonderful to see you sometime, even before September. Let's visit? To Lyn and Raya, I look forward to being in contact via post and hope to see you soon.

That's it for now.

Yours,
Mar

Yerba Buena
San Francisco Bay
Raya

Dear Aria,
cc: Lyn and Mar

It's great to receive a letter from you. I'm glad to resume contact and I look forward to participating in the correspondence with you, Lyn and Mar. Thinking from the islands we inhabit is an interesting way to begin locating our various intersections and yes, thinking of constellations can be a stimulus. It's been ages since I've written an actual letter to anyone, especially as nearly everyone I know communicates very succinctly via e-mail and in code.

To begin, I want to use words that I like. They remind me of your invitation:

> I want you to hear these words. Now I am speaking to you about our lives.
>
> That is the way we begin speeches in Cherokee, and then we say what we would like to see happen, with a simple statement that begins with "I want," as in "I want us to go

> to Washington and tell them just what's going on down here." The way white people exhort in their speeches – such as "we should …" or "we must …" – sounds to us not only arrogant but devious. Is this guy trying to hide from us his own thoughts? Then why speak? (They often do speak only for the purpose of hiding their thoughts.)

This was from *Those Dead Guys for a Hundred Years* by Jimmie Durham. I've liked those words for a long time and it's great to be able to share them.

I'm surrounded by water, which I enjoy, and I spend most of my time moving through or around water and shores checking the habitats and studying different aspects of what supports life. As I drive to work I see water and other islands, as San Francisco is technically a peninsula, although it feels like an island as it is an archipelagic region and there are, I believe, forty-one islands in the vicinity of the San Francisco Bay, leading out to the Pacific Ocean.

I, like Lyn, imagine what existed before. I think about long spans of time, millions of years, and what was here before and before and before, as I keep finding traces of the past when I walk along the shore. The life forms are also ancient. They survived all kinds of turbulence and adapted to the changes. In this region there is much awareness of the intensity of the earth, as we're on an earthquake fault. The San Andreas Fault, which is actually a network of faults, that converge near where I spend a lot of time, around Bolinas Lagoon. All of the faults have shown tectonic activity, meaning that the North American and the Pacific Plates shift. One of the things I find so fascinating about the area is that two distinct provinces from different geological time periods are now juxtaposed because of the movement of earth. One observer described the aerial view:

> Looked at from the air, the Point Reyes Peninsula seems about as disjunct from the rest of California as Saudi Arabia is from Africa, and for the same reason: a boundary of lithospheric plates.

Witnessing the strength of the sea and the changing climates is unavoidable here. Watching the waves I often think of the distances they travel. For example, seismic waves, called tsunamis. It's impossible not to think of islands in relation to these. Unlike larger landmasses islands, as Rachel Carson tells us,

> are the result of the violent, explosive, earth-shaking eruptions of submarine volcanoes, working perhaps for millions of years to achieve their end.

As she notes:

> It is one of the paradoxes in the ways of earth and sea that a process seemingly so destructive, so catastrophic in nature, can result in an act of creation.

Forces that occur in the depths of the ocean are fascinating and these processes continue, as they have for millennia.

Yet there are moments of human intervention. One island I see often is Alcatraz. I found a book called *Alcatraz is not an Island*, published in 1972. I quote:

> Alcatraz was born a mountain, surrounded by the waters of a great salt sea. [...] We send out our voices to that desolate rock, and are gifted with echoes which resound our strength.

It was reclaimed by Indians of All Tribes in 1971, but it was taken away again by the invaders, yet it's a strong symbol for me. I remember everyday. The Spanish named it Alcatraz as it was once inhabited by many pelicans. It remains a wish to see the prison concrete and steel removed and a regeneration of long gone pelicans, vegetation and wild flowers.

From this island area in this state that was once perceived to be an island, how do I inhabit this place? It's been interesting to begin reading George Sand and to attempt understanding her context. Wars were quite constant in Europe before her birth and through her life. I think about that here, as this nation is still at war. The rift between the rich and the poor is wider than it was before 1981. Prison expansion as a private industry has been growing and California is notorious for its number of prisons and number of incarcerated people. I think about these things here, as there continue to be reminders, like Alcatraz. To balance that, there is the sea and the long histories.

I do experience more dreamy states of mind while reading and drifting. Wet sounds of steadily falling rain and of spinning car wheels. These are common during winter in northern California. This was what I heard as I began reading letters written by George Sand to someone named Marcie.

Writing is a bit like dreaming. Thoughts and memories swirl in and out of my mind, like a fog that I can see from a distance and watch gradually swirl in, engulf me and my surroundings, then shift again and go elsewhere. What one tries to put into words can seem dense and difficult to grasp, and like fog it's full of tiny drops of water-like thought, sometimes feeling colder depending on its density, yet it reflects many degrees of light.

Looking forward to continuing. I'm sure more words will come.

Yours,
Raya

Cycles

Another Letter from Aria

Dear Lyn, Mar and Raya,

Thank you so much for your positive responses to my wish. It makes me very glad that we are all in this new form of contact.

Did I mention to you when I was last at the Big Book Sale in San Francisco I found books by women on writing from the early 1980s and early 1990s? It was like discovering items from a time capsule, as they seemed to exist in a very distant past.

Now that we've begun our correspondence I have many things I'd like to respond to regarding what you've already written and in turn, write more ideas that your words have stimulated. There never seems to be enough time. So let's begin planning to convene.

I'd like to mention more on Georges Polti, regarding the Middle Ages, as well as think through William Morris with you. There are interesting possibilities brewing for developing the *Island Encyclopedia.* Also there's more to follow up concerning Laura Riding and her renunciation of poetry, and her quest for linguistic truth. It will take years for us to read George Sands's oeuvre, which I continue to do. I'm reminded of a story by Hollis Frampton. It described a person who'd been filmed from birth and had to watch all of the films until death. I know I've misdescribed this, but the point is that to read what Sand wrote could take a lifetime. Could that be a reason why her works have been dismissed? A resentment at its sheer enormity, that can be presented as excess? Anyway, there are pearls there.

Here are some initial thoughts I've written regarding the September Institute. These are up for discussion, so I look forward to your feedback.

I listed four mottos:

1. We still own our words and can produce them.

2. Anything you create you want to exist, and its means of existence is in being printed.

3. Sending transmissions from dispersed islands, linking worlds, time and space.

4. We continue the ongoing movement of combination people.

September Institute compiles and regenerates material from abandoned collections and publications, providing indexical access and linked research tools, that enable circulation within the depths of significant ideas, operations, and productions of those who may have been forcefully forgotten. S.I. publishes out-of-print books to give them new life.

September Institute is not a utopian community, but rather a momentary nexus. It exists in contrast to previous idealist attempts to address shifting contemporary moments. Acknowledging the predilections of the past (idealist, romantic, utopian, and modernist aims), S.I. embraces the present, however it is calibrated, in relation to time, with a consciousness of time's expanse.

Beautiful and odd remnants from the expanse of time are excavated, represented and re-thought. These include books, ephemera, notebooks, photos, and out-of-date time-based formats, i.e. pre-digital. They are evidence of encounters, a trace of experience. S.I. produces books of collected data. Online versions also exist.

Please let's continue thinking and exchanging.

I love words. Etymologically, texturally. It's possible to enter words on one's own. As each of us can enter the letters we've exchanged on our own. Examining each other's thoughts separately. This process of exchanging and learning about each other's thoughts through letters is a bit like learning about words. Becoming familiar with the vast range of nuances possible, of words and thoughts, is like entering a secret or monastic order. Very few people care about words or thoughts in this way. It's the way things are. I find comfort in this exploration though, perhaps because it's specialised rather than standardised knowledge, which is so abundant. Writing letters to each of you is different than writing for a blog, in the sense that this is a specific activity between four people, even though I do like the Disgrasian™ blog, but this is different. How to translate past feelings, times, and histories into meaningful comprehension that can provide fuel amidst present feelings of lack and absence? Was it always this way? I wonder about life before our presumed extreme technological connectivity and presumed availability. I wonder how you feel and how others have felt. Probing these things has motivated this correspondence. The wish for something else that might be possible. More profound understanding, for example. Other kinds of meaning. I do care about depth and varieties of meanings, as I care about combinations and permutations, as we've discussed.

Autodidacticism can be extremely fulfilling, especially when so much can appear to be a wasteland. This doesn't mean that I'm interested in retreating, but rather I feel my senses available to engage are sharpened as I can choose a more exact way of articulating or conveying them, in words, images, sounds, etc. I respect and admire each of you for also sharing these interests.

Since so many specialised skills, things, and people are slipping into oblivion, my interest is more and more in what is specific and perhaps thought of as esoteric. What is determinedly unfashionable. This interests me. Maybe some things are too difficult to reproduce, because there is no facility, concentration, or interest that enables easy reproduction. I'm not endorsing 'craft,' as it's recently been labelled. This is not my interest. I'm also not suggesting difficulty for the sake of difficulty, nor am I assuming that specialty can be equated with superiority, yet still, I wish to probe life's complexity.

And I'm glad that each of you is also willing to do this.

I'll conclude my letter with something to ponder, as it relates to what I've written. We can wonder with Henri Bergson and Gilles Deleuze:

> [W]hy something rather than nothing, but why this rather than something else? Why this tension of duration? Why this speed rather than another? Why this proportion? And why will a perception evoke a given memory, or pick up certain frequencies rather than others? In other words, being is difference and not the immovable or the undifferentiated, nor is it contradiction, which is merely false movement. Being is the difference itself of the thing, what Bergson often calls the *nuance*.

I'll leave you with those words until the next time. From each of our islands let's stare at the moon.

Yours,
Aria

A Film by
Renée Green

A
Free Agent Media
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Notes on Contributors and Acknowledgements

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FIELDCLUB was initiated in 2004 as a live research project based on a four-acre field in Southwest England. The project collaborators seek to deconstruct and re-codify the post-modern notion of 'self-sufficiency' through interdisciplinary art practice and direct interaction with the land. Inquiries include: The nature of progress as contingency, origins and expansion of the human niche, Biospheric/Technospheric interrelations, land as capital, and the indexing of sentimentality and function.

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Spice photographs in Nicola Masciandro's contribution by Kristen Alvanson.

Interviews with Greg McInerny and Drew Purves conducted at Microsoft, Cambridge, and via email, by Robin Mackay.

Interviews with Stephen Emmott and Rich Williams conducted via email by Robin Mackay.

Interview with Eyal Weizman conducted in London, and via email, by Robin Mackay.

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COLLAPSE

Philosophical Research and Development

VOLUME VI

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As far as we know, philosophical thought, indeed thinking as such, occurs only on one planet. **Collapse VI: Geo/philosophy** asks how, as products of the Earth, philosophers, scientists and artists have attempted to encompass it in thought; and how the philosophical enterprise of thinking 'the whole' is determined by our planetary horizon.

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Editorial Introduction

Robin Mackay and Reza Negarestani

Cookery has never been so high on the agenda of Western popular culture. And yet the endlessly-multiplying TV shows, the obsessive interest in the provenance of ingredients, and the celebration of 'radical' experiments in gastronomy, tell us little about the nature of the culinary. Is it possible to develop the philosophical pertinence of cookery without merely appending philosophy to this burgeoning gastroculture? How might the everyday, restricted sense of the culinary be expanded into a *culinary materialism* wherein synthesis, experimentation, and operations of mixing and blending take precedence over analysis, subtraction and axiomatisation? This volume, drawing on resources ranging from anthropology to chemistry, from hermetic alchemy to contemporary mathematics, undertakes a trans-modal experiment in culinary thinking, excavating the cultural, industrial, physiological, chemical and even cosmic grounds of cookery, and proposing new models of culinary thought for the future.

Proto-scientific thought and experimental practice, particularly in the form of alchemy, was linked to the culinary arts' vital engagement with the transformation of matter. Indeed, how could empirical inquiry into nature, seeking to determine the capacities of matter on the basis of what lay to hand (see Bacon's recipes in the Appendix), be anything other than a culinary endeavour? Yet with the increasing specialisation of the sciences, philosophy has misplaced its will to extend such inquiry into a speculative philosophy whose power resides in its synthetic ambition as well as its analytical prowess.

As observed by **Iain Hamilton Grant** in the interview which opens the volume, it is chemistry's retention of this synthetic ambition that recommends a 'chemical paradigm' for thinking, providing the opportunity for philosophy to step outside the circle of a 'critical' method according to which the conditions of possibility for a thinking of nature are purely epistemological. In the thought of the nineteenth-century naturephilosophers on which Grant draws, the production of 'nature' qua thought-system cannot itself be excluded from the chemical syntheses it discerns at work in the inorganic realm; and thought as much as matter must be subjected to an experimental regime.

Human thought, then, does not condition the powers of chemistry; nevertheless, the latter are mobilized in unprecedented fashion by the former. Under the influence of modern chemistry, indissociable from the industrial exigencies that have driven it, synthetic production – in the culinary as in other spheres – proceeds to reprocess the nature that produced it. Augmenting the modest chemical capacities bequeathed to the human animal by its evolutionary history, it has produced a new 'chemical earth' upon which we graze, without having fully encompassed in thought the prospects that its deterritorialization opens up to us.

Exemplary in this respect is **JOHN GERRARD AND MICHAEL A. MORRIS**'s 'Corn Bomb', which traces the implication of nitrogen in the industrialised alimentary regime, and the way in which the ingredients for postwar human culture were prepared and 'cooked' by war and petropolitics, bringing about a new planetary economy whose massive ramifications are yet to be fully comprehended. This story of the entanglement of military force, agricultural expansion and industrial science provides a backstory to Gerrard's portraits of austere, functional structures located in desolated landscapes, symbols of the virtual climate of power that the industrialisation of the chemosphere has made possible.

Extending Gerrard and Morris's 'local' history of nitrogen, which begins with the human harnessing of chemical powers, into the distant past, we realise that the preparation of food in fact takes place on a planetary and even cosmic scale. The superficial landscape of mass-produced corn and meat that Gerrard and Morris correlate with the contemporary human condition is a non-trivial section of a deeper chemical history: 2.8 billion years ago, cyanobacteria emerged on Earth, able to transform sunlight and atmospheric nitrogen directly to fixate carbon to form organic biochemical compounds. Their production of oxygen as a by-product led to a catastrophic pollution of the planet, the only survivors of which were the new lifeforms that had adapted to consume oxygen, and which are the origin of the diaspora of biological life as we now know it. The industrial Haber-Bosch process is an anthropogenic augmentation of a subsequent, weird biological symbiosis between legumes and remnants of that earlier bacteriosphere, an evolutionary contingency which allowed those nitrogen-hungry plants to migrate from abundant to relatively inhospitable environments. The advent of artificially-fixed nitrogen intensifies massively the dependency that developed between humans and these hardy deterritorialised plants whose symbiotic adaptation had allowed them to escape the contingencies of atmospheric nitrogen fixing. It locks in a new symbiosis between human culture, nitrogen, and the petroleum that fuels its artificial preparation to secure the yields demanded by an exploding population.

In line with the ethos of modern chemistry in broadening the range of chemistry's universality, the terrestrial landscape of nitrogen can be traced back yet further to its cosmic provenance: In the early universe, the 'ur-chemical' agency of gravitation (as discussed with Grant) locally breaks the homogeneity of spacetime and leads to a form of regional contraction (rather than spatial extension), creating local discontinuities and making possible the entropic conditions and chemical activities that form the universe as we know it. In the contracted regions, new morphogenetic transformations and condensations of matter begin to take place; stellar nucleosynthesis forms the furnaces in which heavy elements, including stable nitrogen isotopes, will be forged, thus brewing up, out of the undifferentiated continuum, the elements of a properly chemical, differentiated universe in which the terrestrial sphere will emerge.

Thus, just as the artist selects a single location to make a 'portrait' of the megasystem of anthropic terrestrial depredation, the unravelling of the nestedness of 'chemical valencies' within an organism or a culture gives rise to an epic chemophilosophical narrative in every case. It is in this way that a culinary materialism can open up a continuous yet twisted (topologically counterintuitive) depth beneath the surface or the ground: by bringing out the non-trivial relations between the cosmic continuum and its localized regions; by displaying relations between the earth and the regional horizons for thought that belong to it, and an unrestricted and unified conception of the universe.

The examination of the 'new earth' wrought by contemporary industrialised food production through its accessing of chemical powers continues in **FIELDCLUB**'s contribution. Offering an insight into the deranged machinations of laboratory capitalism, their investigation of the changing fortunes of the erstwhile waste product whey implicates humans, agriculturally-adapted animals and advanced chemical processes in an industrially-augmented culinary syntheses: the redistributive function previously fulfilled by the pig is usurped by a new chemically-enhanced human consumer, ready to fulfil the capitalist exigency to full exploitation of the earth.

In line with the general rise of the culinary, recent years have also seen a resurgence of interest in food in the contemporary art world – most emblematically, perhaps, in the work of Rirkrit Tiravanija. The 'relational' paradigm, with its emphasis on the convivial potency of non-object-based art practices, finds a natural home in the social setting of cooking and eating. This has also occasioned recent revisitations of the work of Gordon Matta-Clark, and the restaurant FOOD which he co-founded in New York in 1971 with **Carol Goodden**, who we interview in this volume. An undecidable, experimental project, FOOD engaged equally the multiple social, economic, convivial and material aspects of cookery and eating. But what was its relation to Matta-Clark's more well-known work, in particular his architectural interventions? In our interview with Goodden, we explore the extent to which the artist's interest in disrupting structure and breaking down closed spaces to produce new forms of communication, can be related to a more general concern with alchemical or culinary transformation, exemplified in early works such as his agar pieces and fried photographs. Here Matta-Clark's work is read as addressing the metabolism of the urban environment, where buildings and cities digest and are digested, as part of a universal culinary process: in the words of one of Matta-Clark's notes, reproduced alongside the interview, 'building materials as nature's food – build to feed the worms an organic eat-a-tecture'...

Recounting the origins of FOOD, Goodden depicts a city that invited an exploratory art practice taking as its 'point of departure' not only 'the whole of human relations and their social context' (Nicolas Bourriaud's aspiration for a relational aesthetics) but ways in which they are intricated with other (urban, architectural and alimentary) fabrics under this common culinary or alchemical principle. FOOD clearly staged the culinary, but Matta-Clark blended it with practices that make his city a very different territory, in truth, to the cities in which international contemporary art practice stages its convivial events in galleries (ironic exemplars of the 'independent and private spaces' Bourriaud hoped to escape). In exploring transformations beyond the preparation and consumption of food, FOOD pioneered conceptions alternative to the mere preparation and consumption of artworks. As Goodden suggests, for Matta-Clark FOOD was 'a grinding, regurgitating, consuming thing', a work whose ingredients and methods surpassed the restrictedly artistic or culinary.

The collective **AO&** offer another example of how the restricted practice of the culinary can provide a locus for the exploration of broader processes of production, communication and consumption. As we learn in our interview, AO&'s 'perverse' endeavour to fully inhabit the problem of food production operates through a deliberate and painstaking disclosure that makes possible an enhanced perception or phenomenology of the act of cookery. AO&'s meals do not stop at providing striking gastronomic experiences for diners, but operate as carefully-controlled experiments in the communicational potencies of the dinner table.

Crucially, AO&'s practice involves within the ambit of 'food preparation' the personal sourcing and assembly of all 'ingredients', including cooking materials, the preparation of the site, and the forging of connections with a network of producers. Hence they ask, 'Where is the edge of the pot?', preparing the way for a generalised culinarism that reaffirms the centrality of an expanded notion of architecture found in Matta-Clark's work.

AO&'s practice may, indeed, fulfil chef **John Cochran**'s demand for a 'flat cookery' that acknowledges its non-human participants. For Cochran, received practices of cooking – the haute cuisine chef's as much as the fast food burger-flipper's – 'distort ontology', creating an instrumental caricature of the objects they employ. Chefs, like philosophers, therefore, maintain uninterrogated 'ontological commitments' determined by their praxes. An 'object-oriented' approach to cookery, Cochran insists, would recognise that objects have powers that exceed our intentional interactions with them, and open itself up to this continuum of objectal powers.

In his examination of two 'revolutionary' contemporary food movements that claim to liberate themselves from normative models of cookery – Molecular Gastronomy and Slow Food – Cochran finds they fall short of this ideal: Molecular Gastronomy investigates the chemical composition of foods only to manufacture sensory fireworks, producing professional chefs and professional consumers alike; Slow Food lavishes its sentimental attentions on the social and cultural import of foods only to draw them into a global economy. In both cases supposed radicality supervenes upon an image of culinary thought that plays into the hands of an economically-driven professionalisation of the culinary, at the expense of amateur experimentation. Both are found wanting, missing the insight that 'food continues to translate you, and you continue to translate food, even after swallowing'.

Cochran's demand to open up the practice of cookery to this extended 'translation' raises the question of how one makes oneself 'a good meal' for the outside, detecting or inviting nonhuman contingencies into cookery. It is perhaps worth pointing out that this is not to be achieved through mere promiscuity or practices of 'openness' based on the aleatory or free expression. Paradoxically, it is AO&'s meticulously controlled culinary regime that, operating in varying settings, quietly affords an insight into what it is to cook and to eat.

In his contribution, **Manabrata Guha** expands upon the notion that sensitivity to the culinary powers of objects can offer egress from a spontaneous 'image of thought' into a wider continuum, an open system whose chemical, military, logical and modal dimensions he unfolds in his essay on 'The Chemistry of

Para-Tactical Engagements'. Guha reports on recent efforts at the weaponization of the massively potent *Bhut Jolokia* chili, finding the military project to harness its non-lethal power to incapacitate and disorient indicative of a strategic shift on the part of a state attempting to contend with a new threat, the 'enemy of all'. Outlining the futile nature of this employment of the *Bhut Jolokia* as a means to enhance an ill-adapted military model, Guha turns instead to the traditional culinary usage of the chili to reveal more fundamental lessons for the transformation of the schema of battlespace and the rise of a new vague and inherently synthetic adversary that renders political reason impotent, globally and locally.

For Guha, the insurrectionary subject is the synthetic distillate of the unbound continuum or 'the open', a singular field through which all chemical fusions and transformations pass. In the figure of the 'enemy of all', war is revealed to be far deeper than the political, the battlefield far broader than any number of discrete spaces that the state or contemporary military theory can envision. Since the synthetic horizon of the continuum is a trans-modal web that smoothly and gradationally blends the question of universal constituency (the open) with the question of tacticity (the opening of discrete fields), the battlefield is always conceived as a gradient that focally reflects the free expression of war and the unbound global battlespace within regional and discrete battlespaces strategically mapped out by the state according to the legacy of political thought. For this reason, for Guha, drawing on the mathematico-philosophical work of Fernando Zalamea, the battlefield of the insurrectionary subject is a regional approximation of the universal continuum or the open, whose exact boundaries are blurred, logic vague and topos purely synthetic. The insurrectionary subject of the global battlespace does not resist assimilation, but on the contrary, adapts a vague modal geometry so as to soften its particular edges and turn into a 'transplant' capable of inhabiting the state's discrete battlespace as an agent of catalysis, fusing the state's axiomatic structure with the non-axiomatic and unmasterable geometry of the global battlespace.

It is this chemical softening of exact characteristics and recapturing of the open (continuum) within the discrete horizon that Guha finds manifested in the traditional recipe for *Bhut Jolokia* chili pickle, whose vague identity (itself the outcome of the chemical fusion and synthesis of different global-local modalities) makes it a perfect supplement or side-dish that stealthily unpacks a wide range of culinary sensations within the unsuspected consumer, 'a catalysis-engineer that exposes particular and discrete entities to a sensorial continuum'.

Here, as in Gerrard's work, local chemical or culinary phenomena give us to understand how the open universal continuum reflects into (or experiences) itself through various complex transitions, modal fusions, global-local surgeries and transplantations whereby contingencies, possibilities and actualities are welded together or transplanted within one another: Hence, for Guha, as for Grant, the 'chemical paradigm' marks out a synthetic domain that precedes (without excluding) the chemistry proper of elements, reactions, and so forth.

Rick Dolphijn adopts another culinary approach to the contemporary 'state of emergency', analysing how the changing alimentary regime of the military anticipated and accelerated the rise of biopolitical governance through continual intervention. According to Dolphijn, the militarization of the world's diet and the territorialization implicit in dietary programs have resulted in the emergence of a terrestrial dietary/military continuum whose vague and synthetic elements are 'terroristsoldiers' (Guha's 'enemy of all'). The more the nourishment of the state and the soldier is drawn from the chemical earth, the more they become synthetic in nature, as interior and exterior become blurred; and the harder it becomes to distinguish them as discrete recognizable entities: this 'new continuum' becomes manifest in the terroristsoldier, who is figured in every individual and whose diet is the entire synthetic landscape of the earth. Dolphijn points to current olfactory research as a critical stage in this process since it involves topologically-'pointless' interventions similar to those involved in the 'self-cooking' of the *Bhut Jolokia* pickle (whose method itself echoes the Baconian experiments and Arabic poisons collected in the Appendix to this volume).

Dolphijn's and Guha's contributions expose the wider stakes of this intrusion of the chemical (continuum) into the political sphere and its discrete battlespaces: For both writers, the exploitation or weaponization of the culinary or the chemical by the state unwittingly exposes the latter's strategic political horizon to an open and contingent expanse that proves detrimental to the strategic and military integrity of the political reason manifested in the architecture of the battlespace or the biopolitical horizon. This highlights, above all, the veritable potency of the culinary: Since all chemical and culinary entities are already open to (and open us to) the rest of the chemical continuum through complex syntheses, interphased spaces and vague boundaries, and since the continuum is a non-axiomatic landscape, such entities throw the axiomatic structure of politico-strategic reason into incoherency – registered as an expression of a war already-there. As Dolphijn explains, this traumatic incursion, pioneered in the military sphere, has generalised consequences: here, as in the history of nitrogen, 'military intelligence speed[s] up modern life', bringing into play 'wholly other physicochemical, organic and anthropomorphic contours of the earth'.

According to Grant, the fundamental tenet of the 'chemical paradigm' demands we accept that no chemical process is identified and 'made available' without chemical intervention, 'regardless of whether that's done by chemists or by nature'. Dolphijn and Guha's texts show us that, indeed, it is always the continuum 'itself' that opens up the chemical horizon, allowing its local exploitation to 'take place', but that its unmasterable synthetic power always threatens to exceed and overwhelm this instrumentalisation.

In accord with this discovery that human cookery takes place within a prior (in Guha, even 'pre-ontological') complex that is already 'culinary', in his contribution **Richard Wrangham** deepens the notion that 'it is cooking that makes us human' – his thesis being that the advent of cookery is one of the major drivers behind the development of the human brain. In identifying the consumption of cooked food as an *evolutionary commitment* and thus a *dependency* – a 'decision' made for us and that determines our destiny – Wrangham reveals how the human culture of cooking belongs to nature's chemical and physiological horizon. For this reason, cookery must be seen in the wider context of a culinary continuum that includes the contingencies that formed the human as such, in advance of the cultural machinations that then become necessary to fulfil the energy acquisition requirements of an exploding population (Gerrard, FIELDCLUB). From a human point of view, cooking may be a cultural phenomenon; but from the point of view of nature, as Grant points out, this distinction cannot be made; we are cooked as well as cooks (*for years I thought I was cooking all this up, but nature was telling me what was on the menu ...*).

Perhaps the voluntarist, preferentialist nature of gastronomic consumerism may be disturbed by Wrangham's demonstration that we do not (as a species) have a choice about whether or not to cook; there is therefore indeed 'reason in the roasting of eggs', but it also follows that reason and its emergence is (as Nietzsche argued) of a piece with other (intestinal and colonic, for example) peculiarities that revolutionised the human metabolism and ultimately provided the conditions for both gastronomy and alloplastic chemistry. As Grant states, 'nature can be produced by thought precisely because thought cannot be produced outside of nature. But this alters what "thinking nature" means'. It also, we may add, alters, or even reverses, what a 'thinking of cookery' may mean – '*coquo, ergo cogito*'.

In 'Theorizing Cuisine from Medieval to Modern Times', **Vanina Leschziner and Andrew Dakin** chart the epistemic shifts implicated in the movement from a medicinal to a hedonic model of eating. Their contribution demonstrates how the norms of developed gastronomy harbour complexities occluded by their omnipresence and apparent transparency. Prevailing gastrological norms (in Leschziner and Dakin's example, the separation of sweet from non-sweet) exist at the intersection of many influences, where emergent sociological, institutional and epistemic conditions drive the exploration of alternative conceptual articulations of the 'phase-space' of possibilities provided by basic chemical, physiological, nutritional and adaptive factors. Thus, a culinary object such as sugar, with its basic chemical valence for human physiology, provides a kind of pivot around which, historically, differing conceptual structures are articulated – its 'endo-relational powers' (Cochran) exceeding the 'exo-relations' which any one of those ordering structures assigns it.

We should of course recall here FIELDCLUB's demonstration of how this plasticity with regard to what is 'edible' is augmented – to the point of reversibility (the transformation of whey from waste to ingredient) by the advent of ever more sophisticated commercial chemistry and constant innovation in markets. This plasticity opens the way to an experimental gastrological practice that could be related both to the exploratory 'flat cookery' recommended by Cochran and to the naturephilosophical experimentalism recommended by Grant: A cookery that addressed gastronomy in such a way would not rest with exhibitionist displays that inverted or recombined cultural norms (thus

Leschziner and Dakin's judgment on Molecular Gastronomy), but that would map out the landscape formed by zones of interference between 'objects' of different types (chemical, physiological, hedonic, institutional...) so as to discover new routes within it.

A curious demonstration of the possible scope of such a discipline comes in the form of the 'synaesthetic cooking' proposed by **Sean Day.** Day introduces us to the complexities of various types of synaesthetes' experience of flavour in relation to colour and language, demonstrating how the synaesthete's peculiar talents extend the culinary palette into a trans-sensory 'synthesaurus' that is at once polyphonic, polychromatic and trans-modal. Molecular Gastronomy has, famously, experimented with the integration of different senses (not only olfactory but visual and aural) into dishes. Day's synaesthesia prompts him to call for culinary practice to engage further, not only with the sciences that are able to analyse and synthesise its materials, but also more fully with neuroscientific research that could inform a more systematic approach to the interaction of different sensory components. This expanded form of multi-sensory cookery would transmodulate gustatory sensation; but, as Day observes, since synaesthesiae are often cemented in contingent individual associations, it could result also in culinary events – such as the 'phoneme-to-flavour' and 'flavour-to-colour' recipes he and James Wannerton propose – whose gastronomic appeal extends to only one person.

Following Day's recipe for 'Light Cyan', **Jeremy Millar**'s 'Black Cake', in an edition produced especially for this volume, is based on a recipe passed on by Emily Dickinson in an 1883 letter. We know, from contemporary accounts, of Dickinson's culinary skills; which are matched, of course, by the strong sense of the domestic in her poetry. But while the poetry can feel somewhat fragile, the same could not be said of her cake, which promises to be substantial indeed, and somewhat ill-suited to the taking of tea in an Amherst townhouse. Millar's rendering of the recipe allows us to think of the poetry differently, once more: beneath the fragile and hesitant procedures of the everyday and domestic, lurks the black earth [*al-chem*] of substantial transformation.

As we know from Claude Lévi-Strauss – a constant reference throughout this volume – we eat not just physical food, but also symbols. In his contribution to the volume, **Eduardo Viveiros de Castro** examines the extreme point at which the culinary meets the symbolic – cannibalism. An excerpt from his recent *Cannibal Metaphysics*,[1] the text reflects the reconsideration of anthropological perspectivism advocated in the book: Where anthropologists have sought to see 'from the native's point of view', Viveiros de Castro argues that their attempts to do so, paradoxically, have been limited by a very culturally-specific form of perspectivism. He proposes that within cannibalism, we can discover another remarkable example of a developed and socially-functional form of perspectivism: 'anthropophagy as anthropology'.

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[1] *Métaphysiques Cannibales* (Paris: PUF, 2009).

Refusing an account of cannibalistic 'sacrifice' as divine expiation, Viveiros de Castro examines the ways in which the devouring of captives also amounts to an inhabiting of 'the enemy's point of view' on the self, with consumption of the other playing a central role in the social construction of identity. In this 'movement of reciprocal determination' by the enemy's point of view, Viveiros de Castro sees a 'mechanism for the ritual production of collective temporality': the '"interiority" of the social body is integrally constituted by the capture of the symbolic resources of the "exterior"'.

In recounting the determining events for his reconsideration of sacrifice, and his consequent proposal to expand the field by 'structuralising' the thinking of sacrifice as a thinking of forces rather than forms, Viveiros de Castro prepares for further developments in *Cannibal Metaphysics*, where he advocates Deleuzian Becoming as a more favourable conceptual resource than Lévi-Straussian sacrifice for asking 'what [it] is [...] that is devoured' when one human eats another. (Reading of Viveiros de Castro's contribution should be supplemented with Aparecida Vilaça's account (in the

Appendix) of the 'gustative pleasures' of cannibalism and 'ingestion [as] a fundamental classificatory operator [...] intrinsically bound to the notion of predation'.)

Eugene Thacker offers another perspective on cannibalism: Agreeing with Viveiros de Castro that the crucial point is whether the eaten body is a 'thing' or not – since in order to become food, corpses must be symbolically rendered into objects – Thacker relates the cannibalism theme to Anaxagoras' examination of the paradoxes of corporeal resurrection. How can the virtual integrity of the resurrectable material body be squared with the corpse's evident reprocessing through the anonymous continuity of material transformation (Matta-Clark's 'primeval cannibal chaos')? For if the body persists as resurrectable and thus as individual throughout its trituration and consumption by other organisms, throughout the 'culinary transformation of matter' through which 'the very materiality of the world is continually "cooked" (and eaten)', this would ultimately render every act of eating cannibalistic. Thacker finds Athenagoras' problem echoed in Bataille's notion of the discontinuous human's thwarted attempts to access 'divine' continuity – an access which, for Bataille, is approached in our relation both to food and to the corpse (here, as in Guha's argument, eating is associated with a threat to 'somatic integrity').

Thacker resists the temptation to expand a restricted notion of cooking to a generalised culinarism-as-anonymous-transformation, turning instead – via his reading of Bataille's theory of religion – to the notion of a 'desolate cookery' rooted in a negative concept of life and which (in an oblique departure from Cochran's credo) calls for an 'abject-oriented ontology'.

As Cochran points out, an expanded, acute sensitivity to the culinary situation is a necessity rather than an option for those medically constrained to intentionally regulate their metabolism. Constrained to exercise such 'mangé management' (to appropriate Matta-Clark's phrase), they have the same keen sense of the 'alchemy' involved in food preparation and digestion that Goodden indicates as having instigated Matta-Clark's inquiries. More extreme forms of discipline, and concomitantly acute levels of bodily awareness, are the subject of **Dorothée Legrand**'s contribution. The self-administered regimes of anorectics, she argues, sensitise us to the fact that eating is always a locus for the administration of the self. Introducing a move toward a deep (intra-subjective) phenomenology of consumption (in general) and eating disorders (in particular), her contribution emphasises how identity is produced through dietary discipline: diets are not simply eating programmes or schedules, but rather sets of procedures or recipes for the production of identity. As Legrand demonstrates, this relation between the diet and (self-)production is manifestly highlighted in anorexia, where ‘eating nothing’ translates into a series of complex semiotic, phenomenological and cognitive procedures for the subject with regard to the production of identity – ideally of an integrated identity that would be a miraculous ‘victory over digestion’ (Thacker).

Following from Thacker’s observation that ‘to eat is always to […] incorporat[e] oneself into the realm of anonymous […] processes’, and Guha’s insistence that the culinary continuum harbours a ‘threat to somatic integrity’, Legrand demonstrates that in the act of eating, the multidimensionality of bodily self-consciousness is foregrounded; we experience ourselves not only as subject but simultaneously as object and as anonymous material. As she meticulously sets out, this daily reminder that ‘each of us does nothing but carry a corpse about’ (thus Thacker’s epigraph, from Philo) can precipitate precarious existential experiments whose aim is to fully integrate the self through a process of ‘constitutive self-negation’ – a building of identity through an ‘infinitesimal’ process of subtracting self-as-object from self-as-subject. Such ‘intimate projects’ of ‘controlled transformation’ involve a culinary ascesis, but one that is based in a tortuously acute sense that eating involves the maintenance of the self qua constitutive tension between self-object and self-subject; or – in Bataille’s terms, as discussed by Thacker – between continuity and discontinuity.

As Legrand argues, the anorectic in a certain sense presents us with the truth of food, potently distilling the problem of 'the demonstration of one's existence' in the face of the 'narcissistic wound' inflicted by the knowledge that one must incorporate the anonymous in order to pursue the subject-self's ideal of integrity.

For Hegel, the externality of the food and its objective exactness provided the digesting subject with a dialectical opportunity to reclaim its identity on behalf of the subject.[2] But for Legrand, as for Guha and Thacker, food enforces a form of exteriority that cannot claim such exactness. The subject is vague and already-indistinguishable, and here it is food that becomes a 'mirror' in which one sees oneself 'from the enemy's point of view'. Legrand finally suggests that anorexia may emerge as symbolic process from the frustrated intersubjective demand that food be given, not as need-fulfilling object, but as a gift that feeds desire. Here, perhaps, is the fundamental function and ploy of gastronomy and its cultural overvaluation – the cultural exacerbation in discourse and culture of a necessary obfuscation of our relation to food, obscuring the anonymous, objectal dimension of subjectivity to which eating exposes us.

As in the martial alimentary regimes described by Dolphijn, for Legrand, consumption itself becomes a form of production (of identity) from the inside out, in '(non-)eating projects representative of one's subjecthood, and thereby constitutive of it'. Food produces the subject-as-object, and a 'new people for a new earth'. Legrand's understanding of consumption also recalls Ferenczi's account of assimilation as 'alien transplant', recalled by Guha in his 'exegesis' 'Serving the Open' (in the Appendix). For Ferenczi, eating and consumption create a polyvalent or nested chemical/culinary structure: Food is a foreign body that cannot be wholly identified in terms of its capacity for absorption (food simply as nutrient that is wholly reintegrated within the system) or for wastage (food as something which distinguishes the object from the subject, where all that is wasted is no longer part of the subject). While for Hegel eating ends with the overcoming, through digestion, of the foreign body that entered the sphere of the living being, and results in the dialectical reclamation of the individuality and being-for-self of the animal, Guha, Ferenczi and Legrand identify digestion as an interiorization of xeno-economical relations, wherein the subject – far from reclaiming its subjectivity – is chemically transformed by an object that resists full assimilation. In this sense, all food, no matter how well-cooked, is poisonous. Awareness of this xeno-economical space of extra-subjective chemistry, of which the subject is now seen to be a product, fully schizophrenizes the culinary cogito 'I am what I eat', just as the powers of its continuum vex the cookie-cutter battlespaces of the state. The dialectical valence of food for the subject, in its attempt to conclude its reality and self-relatedness, is challenged by this new model of assimilation in which food, the interiorized object, can no longer be distinguished as a discrete or exact body that can be either fully assimilated or conveniently ejected. Food, the agent of repletion, is instead vague (Guha) or ambivalent (Legrand), suggesting an economy of consumption in which the digesting subject cannot bring its relation to its food to any conclusive resolution. The identity that the consumer or the subject produces for itself through digestion is the result of devouring the object or food; but also the result of being internally devoured by it (Ferenczi) – as the terroristsoldier is consumed by the new chemical earth he is put to work on. In this sense, thinking in terms of a philosophy of nature, we might revisit the recapitulation thesis – characterised by Grant as a 'dynamics of the totality of nature' – as a process of 'eating the ancestors' (Ferenczi), a process in which digestion is never complete, in which traces – alien insiders – remain within, encrypted pathways into the labyrinth of the chemical continuum: this would be a 'chemophilosophy in the recapitulationist sense' (Grant) in which 'the discrete and the particular is always infiltrated by 'the open' (Guha).

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[2] See G.W.F. Hegel, *Hegel's Philosophy of Nature*, ed. M.J. Petry (London: Allen and Unwin, 1970), vol. 3, 162-4.

Here we return to the theme of our previous volume; for it becomes clear that a culinary materialism opens up new vistas for geophilosophy. Nietzsche demanded that thought be 'true to the earth', extending the genealogical method so as to ground culture and thought in the stomach and on the terrain to which it is adapted (an aspiration satisfied in a different way by Wrangham's thesis). But Nietzschean genealogies only chart the history – after all, a restricted, localized history – of the surface; it will demand a further 'Copernican' effort to extirpate from philosophical thought the last vestiges of the human's spontaneous image of its dwelling place.

To be truly terrestrial, one must renounce the superficiality of the encrusted model of geophilosophy. Culinary materialism sets against *geophilosophy* as the philosophy of or for the earth – a thought that is 'true-to-the-earth' – *chemophilosophy* as a universal philosophy – a thought whose *topos* is an earth that is 'true-to-the-universe' (that is, an earth synthetically envisioned within the full spectrum of the open continuum). It is only this universalist earth that can serve as the veritable plane of thought upon which a chemophilosophy – a philosophy that opens up the earth to the continuum – is conceived. Chemophilosophy therefore marks the transition from geophilosophy to a philosophy whose earth belongs to a unified and open continuum whose regions are vague, gradationally open to various spectra that lie beyond the manifest surface and body of the planet. Within the continuous environment of the continuum, earth is then understood analytically *and* synthetically. If, for pre-Copernican alchemy, the earth was the foundation of all elements and the mother of all, containing within herself the seed of everything mineral, vegetable and animal, the chemical revolution – still in progress under the auspices of astrobiology and neurochemistry – subverted the centrality of earth to chemistry. By establishing that compounds can be synthesized across different domains, and subsequently by emphatically linking the particulate to the chemical, biological and psychological, the chemical revolution rediscovered the earth, not as mother of life or receptacle of celestial rays, but as a fuzzy and synthetic region of the chemical continuum, the outcome of a local 'recipe' that enjoys no synthetic or analytical privilege over the space beyond it. We can thus understand this volume on 'Culinary Materialism' not only in terms of a radicalisation of 'Geo/Philosophy' (**Collapse** VI) but also as a continuation of the legacy of the 'Copernican Imperative' (**Collapse** V) – that orbital subversion which also shatters the alchemical parental hegemony of *sol* and *luna* over the earth. The cardinal ingredients of this subversion can be read in Newton's recipe (in the Appendix): the homogenization of nature as one (continuum), combined with orbital humiliation (gravity), puts the earth into a new culinary relationship with itself: The gravity of the unanchored earth becomes at once a means to extend the chemical continuum of the earth and its compounds to the culinary landscape and the realm of taste and sensation, and a mortification of the earth by its own natural compounds and elements – earth literally cooked to death.

It is this decentralism that loosens the earth to the extent that the unheard-of syntheses discussed by Gerrard, FIELDCLUB, Dolphijn and Guha become possible; and as for the gastronomic products of the kitchen, the same kitchen that provided the conditions – historical (Grant) and pre-historical (Wrangham) – for scientific experiment and enquiry, their savour (as Grant anticipates) can and must now be understood in the very terms of the *activity* of the continuum revealed by that enquiry.

DAN MELLAMPHY AND NANDITA BISWAS MELLAMPHY develop such a post-geophilosophy, rethinking planetary 'ecology' as an 'ec[h]ology' wherein the thinker is 'translated back into nature' as its echo, and where the planet 'feasts upon itself'. Connecting the ourobouric or ovoid figure of this autophagy to the Nietzschean will-to-power, this ec[h]ology escries the *al-chem*, the black earth, as a *stomachos* or 'pit of blackness' – what Guha describes as the 'self-churning' continuum. It is also a vermicular thinking: as the worm translates all things back into black earth (see Darwin's recipe, in the Appendix), Nietzsche suggests that to be true to the earth is to be retranslated and to retranslate back into the 'terrible ground-text of *homo natura*' – a '*hideous gnosis*' that, once again, involves the poisonous contemplation of one's incorporation into/as anonymous process.

Mellamphy and Mellamphy's demonstration of the persistence and continued pertinence of alchemical thought sets the stage for our concluding contributions, which both advocate the compositional (perhaps even synaesthetic) kernel of philosophical thinking expressed and explored most resolutely in the hermetic tradition of alchemy, a tradition that bridged astronomy, medicine, gastronomy, mathematics, optics and art, and was conceived in the philosophical and proto-scientific furnace of such figures as Jabir ibn Hayyan, Arnaldus de Villa Nova, Ramon Llull and Nicole Oresme.

Although in the transition from proto-science to modern science and with the birth of modern chemistry, the alchemical ladder of nature (*scala naturae*) was effectively toppled and the hermetic tradition dislodged from the centre of philosophical inquiry to the margins, philosophy's compositional kernel and its culinary ability to globally combine analytical loci of thought and coalesce incommensurable ingredients so as to mediate the universal experience of a bottomless nature was never fully abandoned. The compositional ambition of philosophy and its engagement with synthetic environments, mixtures, synoptic perspectives, spectra of knowledge and modal transits (contingency, potentiality, possibility, necessity ...) across the continuum of nature, has been reappropriated and extended by Novalis, Schelling, Peirce, and most recently by Fernando Zalamea and Gabriel Catren. In the alchemical tradition, the synthetic and compositional valence of elements or local fibres was tested by a process known as *tinging*, whereby metals were introduced to fire in order to reveal their transmutational hierarchy (tints or tones) and synthetic powers on the basis of a projection of the spirit or redness of fire or the Sun. For these latter traditions, philosophy's synoptic and compositional kernel systematically unfolds the synthetic threshold and compositional valence of all local fields of thought and the universe according to how the omnipresent and open universal continuum flows through them and comes into 'focus'. Therefore, philosophy becomes an 'alchemical paradigm' in itself that 'tinctures all thought and nature',[3] and in doing so, deepens the reflexive and trans-modal self-experience of the open universal continuum, bottomless nature, or 'b[l]ackground' (Mellamphy and Mellamphy).

In line with his study of an open or non-Cantorian continuum built on Peirce's late logical thought, involving topics such as the continuum, the topological basis of logical distribution, modal geometry and synthetic thought, **Fernando Zalamea** has in recent years pursued a mathematico-philosophical project committed to a *de-rigidification* of thought. For Zalamea this de-rigidification cannot be properly undertaken without having a systematic mathematical account of the unbound continuum. Absent any observation of the mathematical universe and the labyrinth of the continuum, philosophy's ontological and epistemological claims tend to lean toward one aspect or regional partition of the continuum, and accordingly rigidify the continuum in one way or another. Philosophy in this way becomes a myopic discipline that sways either toward realism or idealism, synthesis or analysis, integration or difference, thus becoming incapable of radically thinking compositions, mixtures, contaminations, decompositions, transitions of nature to culture, cultural fusions and transits – in short, the full chemical spectrum or culinary constitution of the universe. In other words, without maps and compasses to explore and survey the landscape of the continuum, philosophy ultimately fails to develop a synoptic view constituted of both analysis and synthesis[4] – it falls prey to the same kinds of distortions that Cochran describes as being at work in Molecular Gastronomy, that recent return to the ancient bond between science and the culinary whose overanalytical jellies tend to disappoint; or worse, like fusion cuisine, it succeeds only in ineffectually aping the trans-regionality that is its vocation. As is the case with 'rigidified' philosophies, failure to achieve a deep and synoptic scope consigns such efforts to cultural myopia: dabbling in or 'applying' science or cultural difference, they remain unable to deepen their cultural and gastronomic aspects in relation to a universalist chemical horizon capable of giving rise to culture or cultural experiment.

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[3] F. Zalamea, *Peirce's Continuum: A Methodological and Mathematical Approach*, available at: http://files.acervopeirceano.webnode.es/200000068-48c2649bc4/Zalamea-Peirces-Continuum.pdf, 61.

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[4] For a view, both detailed and panoramic, of cultural mixtures and compositions in relation to contemporary mathematics and its transmodernist implications, see F. Zalamea, *Ariadne and Penelope: Webs and Mixtures in Contemporary World* (Oviedo: Ediciones Nobel, 2004).

The recipes Zalamea contributes to our volume (to be taken with a pinch of salt) examine, firstly, the failed recipe for thought that aims only at an astringent clarity; and secondly, the *villageoise* constitution of a transmodernism fit to counter such *petit cuisines philosophiques*.

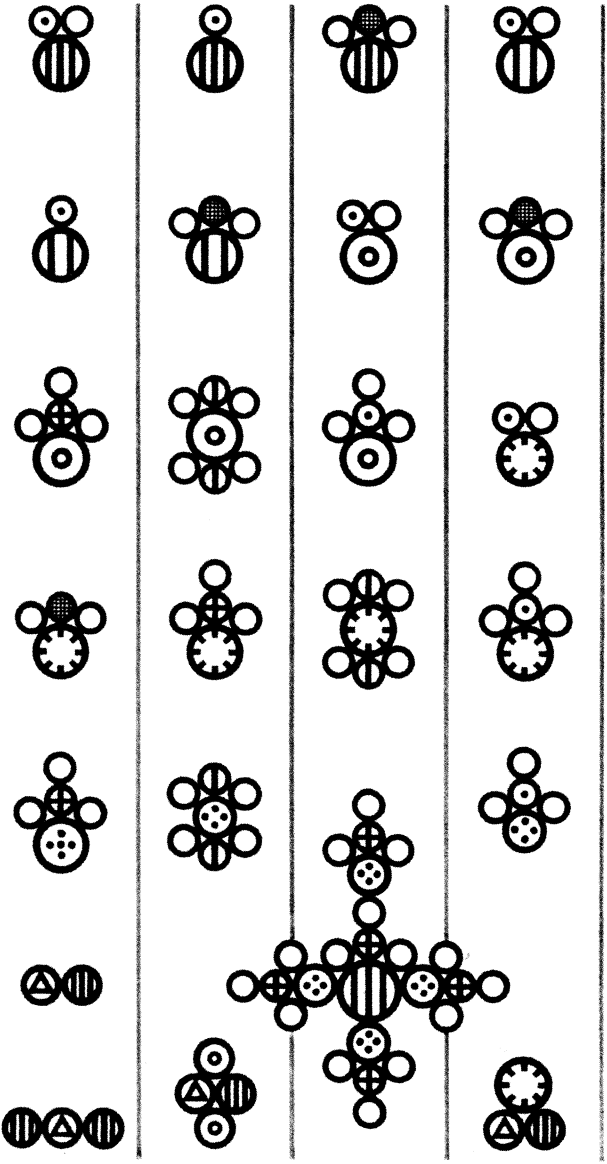
In Zalamea's recipe for a transmodern thought, so in **Gabriel Catren**'s 'alchimirical' instructions for baking a philosopher's stone. In instructing us in the contemporary procedure, Catren presents philosophy in terms of the alchemical *tinctura universalis* discussed above. The result is as much a polychromatic and polyphonic – that is, broadly universal and non-trivial – unfolding of the real as it is a synaesthetic, even psychedelic, experience of the culinary. In an epistemic exacerbation of the deregulation of the sensory faculties advocated by Day, Catren proposes that the transmodern vocation for philosophy consists in a 'true-to-the-universe' regime counteracting the 'spectral decomposition of experience' prismatically produced by various modes of thought; his black earth is a concretion effected by the 'polychromatic mediators' of a 'philosophical synthesizer'.

It is evident that the various alchemical operations, absorbed into the mundane activity of cookery, can then become metaphorical tools for a generalized culinarism; yet to satisfy oneself with this metaphorical transport is to fail to realise the more fundamental pertinence the latter could achieve. In Catren's alchimirical cauldron as in Zalamea's transmodern tatin, the procedures indicated to operationalise and concretise regional echoes of the universal culinary spectrum are stripped of all metaphorical reference to the restricted practice of cookery. Instead they invoke the abstract operations that contemporary mathematics uses to synthesise its complex variety of confections and recipes (Freyd's allegories, sheaves, fiber bundles, etc.) from the elemental materials of the continuum. This points the way toward a refinement of a transcendental 'chemical paradigm', a culinary materialism that not only escapes the 'reductionism [of the] culinary [...] analogous to anthropism' (Thacker), but entirely renounces dependence on any empirical model.

This volume, together with the Appendix of recipes, should be taken as a preliminary exploratory exercise

– to be continued by the reader – in the mathematico-philosophical vista of culinarism revealed and brought into focus here. A prospect that certainly answers to the original recipe for this volume (from which, however, the editors have not resisted straying); but which, thanks to the transmodern spirit of our contributors, surpasses it, suggesting not only a culinary thematics for philosophy outside bourgeois gastroculture, and a variety of new perspectives on cookery itself, but a true 'proliferation of *possibilia*' (Guha); a taster menu for the unheard-of philosophical feasts, bouillabaises and concoctions heralded by a chemophilosophy, alchimery, or culinary materialism.

Robin Mackay and Reza Negarestani
Vienna and Seremban, June 2011.



The Chemical Paradigm

Interview with Iain Hamilton Grant

Iain Hamilton Grant, one of the four philosophers who spearheaded 'Speculative Realism',[1] *is distinguished by being the sole proponent among them of a renewed philosophy of nature. He has argued convincingly*[2] *for the erroneousness of the modern and contemporary dismissal of the* Naturphilosophen *who sought to think the absolute according to the generative power of nature, integrating knowledge of the contemporary deliverances of the sciences into their speculative systems.*

Collapse spoke to Grant about this indistinction between philosophy and science, about the particular importance of chemistry as a new model for the thinking of nature, and about the pertinence of the culinary for a contemporary synthetic philosophy.

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[1] See Appendix to **Collapse** III.

[2] See I. H. Grant, *Philosophies of Nature after Schelling*, 2nd edition (London: Continuum, 2008), 19-21.

Collapse: In the context of this volume on *Culinary Materialism* – cookery as a possible model for or provocation to philosophical thought, as an activity as unique to humans as philosophical thought, we would like to delve into the specificity of chemistry, and to understand why you have proposed it in various places in your work as a particularly important model for thinking. In particular you re-examine its importance in the age of 'natural philosophy', when the sciences had not yet attained the success necessary for them to extract themselves from philosophy, and yet were making momentous, and demonstrable, discoveries about nature.

Firstly, what constitutes the specificity of chemistry as a science - and how does this distinguish it from physics as a model for thought?

Iain Hamilton Grant: There are two things that serve – particularly in the era you mentioned, but also I think beyond that – as what we could call a 'chemical paradigm' for thinking. The first is that it gives an additional dimension to the empirical domain, a dimension that the other natural sciences – bar medicine – didn't have. Medicine simply involves working out animal economy – circulation, patterns of blood lymph and so forth, and so involved messing around in the interiors of bodies; chemistry involved messing around in the interiors of bodies that had no such organic complexity. It involved a messy experimentation, a grubbing around in the earth - whence the word *alchemia* derives (according to some): the 'dark earth' [*keme*] of Egypt becomes *al-chemia*, becomes *alchemy* and then *chemistry*.

So that's one thing about chemistry: it gives an additional visceral dimension to the empirical, which at one and the same time enables chemistry as a practice to have a specificity that separates it from the other natural sciences, and gives an additional character to experiment. And this is the other, more conceptual side of the question: in all the other natural sciences, certainly around the eighteenth century, there is *nothing* that compares with the *model of knowledge* that chemists were proposing: analysis is one part of the equation, but one understands nothing until synthesis has taken place. In other words, it's not just about understanding the 'nature of nature', not just about metaphysics – its about *recreating* nature. That synthetic ambition is unique to chemistry – it's about production as well as analysis. And the idea that knowledge is only complete once production has taken place, is something that informs Kant's immediate inheritance from chemistry. He mentions this in terms of experiments with calx, especially in relation to Georg Ernst Stahl, a noted vitalist of the era, but also someone who had insisted that to analyse calx was one thing, to resynthesise it was precisely the goal of chemical knowledge.

So it's those two dimensions – the additional elements of the empirical and the additional elements of the conceptual and thus of the experimental. The empirical side is to do with messing around in bodies with internal complexities which are both *irreducible* and *non-organised* (in organic sense). And the other side is that, as a model for epistemology, there is nothing that substitutes for chemistry's ambition to synthesise its products as well as analyse them.

C: Regarding this 'grubbing around in the earth', Dumas says: 'the science of chemistry was born at the potter's wheel, in the glazier's workshop, the blacksmith's forge and the perfumer's salon.' We would, of course, like to add that all of these practices were most likely born in the kitchen. For instance it has been suggested that chemistry was 'invented' with the burning of malachite, which would release molten metals that would run out from under the cooking pot ... Which is to say that chemistry has this relation to everyday praxis. Would be right to say that at the root of the still-reigning hegemony of physics as a model for the philosophical thinking of nature is the fact that the Greeks categorised chemistry under manual work – under *logistika* – separating it from theoretical speculations on the nature of things? So that, although chemistry may be the oldest science, its lowly origins preclude it from being recognised as the most fundamental, and this conflict continues to resonate through our contemporary epistemologies?

IHG: The normal stratification of the sciences in terms of fundamentality has physics at the bottom, and chemistry as the intermediary between it and biology; and thereafter everything else is merely subdepartments of those. Although there's a really fascinating sense in which no-one really knows where chemistry lies on the spectrum of the sciences. But as you say, there is an immanence of chemistry to life not merely understood in the abstract, but understood in terms of the most concrete practices: one could create a glorious spectrum of chemical activities, from breathing, to the osmotic porosity of our skin in respect to liquids with which we come into contact; but on the other hand, this quite abstruse range of human activities involved in the production of things; and again it's the element of production that distinguishes all of these.

If you look at the alleged fundamentality of the physical sciences, this is still regarded as a Platonic dream. One finds it in even in the criticism of naturalism as Platonism by authors such as John McDowell recently: physics is still considered not just as the domain of armchair theorists but as this linear speculative model intended to serve as the fundament for everything else, if only we can pull the theory back together, if only we can find the Grand Unifying Theory ...

C: The physicist-platonist would, presumably, argue that in attributing any fundamental role to chemistry, one would confuse ontological with historical or anthropological priority; in which case the question then becomes, what *do* we include in ontology: if ontology includes the structural principles of the synthesis of matter, then chemistry is ontological, since the greatest achievement of modern chemistry lies not in breaking down the elements, but, as you say, in identifying invariants in the way they can be *assembled* – isomerisation, the fact that different compounds can be made of the same elements yielding different properties.

IHG: The elements of ontology are produced, naturalising historicism while denaturing critique, so to speak. This is a favoured response of the late eighteenth century philosophers of nature (Ritter, Steffens), and retains its pertinence so long as the question can still be put. What remains, however, is priority.

C: Historically, how do thinkers in the period you are particularly interested in work out that priority?

IHG: If one rehearses the order of priority on the basis, not of ontology or in terms of philosophical anthropology – and a brief parenthesis on that: there is a fascinating extent to which you could deliver chemistry as the furthest reaches of a philosophical anthropology *à la* Heidegger; you could really develop a question of Being as posed by elements, in so far as these are immediately involved in the exchanges that constitute us physically. Another way perhaps of looking at the animal/world distinction, where a further stratum might be interposed between them in order to generate both animal and world, and to sustain them. In this, the idea of animal economy might again be important. At the outer limits of philosophical anthropology, you could do something like that with chemistry which would be fascinating. Here there are the beginnings of a reversal that is quite interesting and which neither relies on *Dasein* nor on somaticism; this reversal is Schelling's account of *what is involved in sensation*, which is what he calls a 'chemical dynamics'[3]: He sees the fundamental elements of sensation as being what happens when you have exchanges, when there are possibilities of fundamentally chemical exchange; although physics may be viewed as fundamental in terms of providing light, in terms of the sun, astrophysics and so forth, there is nevertheless a process of exchange that constitutes the very Sun.

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[3] 'Chemistry is nothing else but sensory dynamics', *Ideas for a Philosophy of Nature*, SW II, 323-4 tr. E. E. Harris and P. Heath (Cambridge: Cambridge University Press, 1988), 257.

So, the idea of ontological priority being attached to physics rather than chemistry rests on a version of linear production that chemistry confutes, and this is why we could comfortably talk about, as it were, the genesis of all things, in chemical terms, or at least in terms that directly reference chemistry.

So the other side of that is, I think, that there is this fascinating question that arises in the context of the thinking of the philosophy of nature at the end of the eighteenth and the beginning of the nineteenth century: this question is basically 'what is nature' – one of the most fundamental questions, the Greek question obviously, the question of the pre-socratics, also the question of Aristotle, and Plato's question. The answer they all give is that nature, *phusis*, is generation first and foremost – it's not such and such an entity, object, structure or whatever, it's *generation*. So, for example, even Plato, in the *Timaeus*, when he talks about nature, talks about the *generation* of things. There are structural elements in it – he does talk about fundamental ontological elements in the constitution of things presented as the 'world soul', although it is important to note that for Plato 'soul' is *arche kineseos*, the source of motion, rather than *substance* – but they are elements of the *constitution* of things, and the science of the constitution of things is, in the terms in which we are discussing, a chemical science – it involves exchanges, it involves reciprocity.

So, the question 'what is nature', 'what is *phusis*', is answered by the Greeks as '*genesis*'; and for the eighteenth century *Naturphilosophen*, that also becomes the dominant paradigm. And what's interesting is the relationship between the changes that are taking place in the nomenclature for chemical elements post-Lavoisier – changes that, if you like, lend those elements the appearance of metaphysical simples – and the role chemistry plays in changing the thinking of the scientists and philosophers of the period concerning how to pose this question of nature, and what kinds of terms it would be satisfactory to answer that question in. The interest there is centred around this basic question of *what is a chemical element* on one hand, and *what is a chemical process* on the other. The set of nomenclatures that Lavoisier invented were intended to be simples that one could always analyse out of any process, through chemical intervention. But it's a mistake to regard these processes as being 'available' *without* chemical intervention, without processes of analysis and synthesis. Because the idea is, in effect, that the elements are constants in the process of breaking things down and putting them back together again, regardless of whether that's done by us – by chemists, scientists – or whether it's done by nature. So it is the entire process of analysis and synthesis that is the object of chemistry, rather than the element. And it's that reciprocal relation between analysis and synthesis that is key in rethinking nature, *phusis*, generation, in terms of chemistry rather than in terms of structural invariance or whatever.

C: Could we see the *Naturphilosophen*, and this dawn of a new productivist, synthetic model of knowledge, as transitional between the 'first' (rationalist) scientific revolution, and the massive industrialisation of chemical processes in the nineteenth century? If so, then what is their relation, and that of chemistry, to the romanticism that is contemporaneous with the latter?

IHG: Absolutely. And even in England, you could consider Humphry Davy's experiments on leather tanning, and the miner's lamp, all of these renowned practical solutions to practical problems. But the problem of engagement is being posed here – the question of what is happening when there is any engagement whatsoever in nature. Now 'romanticism' is a misnomer in two crucial respects: as regards romantic natural science, the immediate scientific paradigm that comes to mind is biology. The replacement of mechanics with some form of organics is the story that is told, and it's wholly misleading. If you look at the biologists, they're not reducibly biologists, indeed the word 'biology' only becomes current only in about 1802, considerably later than a lot of this so-called 'romantic science' was happening. Consider for example someone like Kielmeyer (who taught Cuvier – he was not a nobody in the context of the natural sciences!) In 1793, he wrote a discourse on the proportions of forces, which is ostensibly – or is recounted in books of the history of science as – the first proposal of the Mekkel-Serres law, the recapitulation thesis, that ontology recapitulates phylogeny. However, what he's actually after is what has been characterised by Timothy Lenoir in terms of a Laplacian dynamics of the totality of nature – from geogeny through to noogeny, from the production of planets through to the production of thought.

This question about recapitulation is a question about the fundamentality of the cell. In microbiology the question of levels is quite simply: what's basic and what isn't? If the cell isn't basic – and it isn't, phylogenetically (that is, in the genesis of phylla at all), it's a late acquisition, and is highly conditional (there are all sorts of conditions required) – then what is the unit of analysis sufficient to reveal any relation between phylogenesis and ontogenesis? And it's quite clear that this question is evident in Kielmeyer: he was asked by Windischmann: Is it possible that creatures recapitulate not just from the plant to lower animal to higher animal, in the development of species; but actually recapitulate the entirety of earth history? In other words, how many processes have to be gone through in order that later creatures emerge rather than earlier?

And it strikes me that once you admit that prospect, you very quickly lose any particular somatic referent to pin the basics to. That's chemophilosophy in the recapitulationist sense – the bottom drops out of the picture, the element drops out of the picture, and in place of that you have a non-determinable series of recapitulative cycles.

So, once again, it's a mistake to see the romantic notion of science in terms of biology. This is what defines romanticism, I think: it's not this or that aspect of nature, but nature as such and as a whole. The reason no-one's a Cartesian is the total supplanting of this or that part of nature with the idea of nature as a whole: *nothing* that happens is *not* a part of nature, by definition – otherwise it wouldn't happen. And this includes the most ridiculous of adjuncts, what Aristotle would calls 'accidents' and therefore non-essential components. It's that elimination of the distinction between necessary and accidental.

C: During the period we are discussing, we find a *confluence* between chemistry – before it really had a word for itself – and philosophy. It wasn't just philosophy *reflecting* on chemistry.

IHG: No; in fact the idea of separating the two was as alien to the *Naturphilosophen* as it was to those who overtly opposed them: who opposed them fundamentally on grounds that cannot be reduced to either the philosophical or the scientific. I don't just mean that in a modern sense, I mean simply that the model of knowledge across the community of investigators of the problem of nature does not rely on one set of tools rather than another. And one can identify two reasons why that would be the case, neither historical, both conceptual: One is that, to see the production of concepts as being in any way separate from the production of other natural phenomena is bizarre. No-one's a Cartesian by the end of the eighteenth century; at best what you have is attempts to generate the phenomena of life by artificial means – hence the importance of Galvani's electrical experiments with the voltaic pile, for both philosophers and scientists. There was a German term, *Naturforscher*, which we translate as 'natural scientist' , but 'student of nature' is the direct translation, and that's probably the best way to refer to people working either side of the conceptual schism, as it were But as I say, there's no way of separating them. The reason, firstly, is that no-one regarded thought as being alien from the rest of the processes of production that take place in nature. But secondly, the idea that conceptual activity constitutes or is limited to a reflection upon pre-established entities, simply doesn't cash out in terms of practice. There's a terrible tendency in the history of science to rewrite periods that we don't agree with in terms of what we do. So if you look at some of the essays in the mid-twentieth-century, up to about 1975, on the speculative philosophy of nature, on the one hand they are full of venom about the work of the earlier period; on the other hand they want to say that anything that might have been of value in it, was in fact arrived at by different means. But this is actually a staggering admission: if there is more than one means to arrive at a given product, whether this be urea or concepts, then why resist the opportunity to pursue that? And the business of the study of nature could not: If there is nothing that is *not* a part of nature, then any starting point, anywhere, of any nature whatsoever, is going to arrive, if not at the same conclusions, then at parallel conclusions, or at conclusions that stand in certain structural relations to other conclusions, to other investigations ... Once again, the model is one of production rather than just understanding, and so we're not dealing with epistemology, we're dealing with fundamental meta-physics, which rests *in* nature *qua* production, rather than simply being *about* it.

C: The birth of chemistry in culinary praxes that we have postulated, is extended by later developments of chemistry which were to a large extent industrially-driven; and implications of the 'synthetic interventions' of chemistry continue to unfold now in the biochemical and biomedical sciences. A key moment was in 1838 when Wohler made urea in the laboratory, and the way this is presented make it clear that this is an early example of the sort of experiments that are the stuff of indignant media outcry: Wohler exclaims, 'I can make genuine urea without using the kidneys of man or beast!' – an incredible revelation, and one that should perhaps be numbered amongst Freud's 'great humiliations' of man ...

IHG: Yes, and it is the model of *production* rather than mere *understanding* that is the basis of the 'chemical humiliation'. This recalls OncoMouse™, about which Donna Haraway made such a delirious noise[4] ... and also the synthesis of skin – all repetitions, precisely, of the production of urea – piece of piss!

C: Which contradicts the retrospective illusion that earlier science was somehow *purer*, was merely concerned with analysis and understanding; and that it is only in late modernity that we come to the point when we are pushing it too far, and creating industrial monsters ... in fact it's always been about tinkering with the creation.

IHG: Yes, hence the apologias with which works of natural science – and of philosophy, it should be said – open; hence the discounted questions; hence

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[4] D. J. Haraway, *Modest_Witness@Second_Millenium. FemaleMan©_Meets_OncoMouse*™ (New York: Routledge, 1997).

Newton's otherwise unforgivable dualisms: they have at least an historical, sociological explanation. But I think, in addition, the model of science as being about understanding, about analysis, is regrettably impoverished.

And the same question, I think, can be posed to philosophy: to what extent is philosophy just sitting on the sidelines, wondering how we can understand X, rather than entering into a process of investigation, the investigation of thinking nature but not thinking nature reductively: nature can be produced by thought precisely because thought cannot be produced outside of nature. But this alters what 'thinking nature' means.

It's about experiment not simply in terms of results, but in terms of design, in terms of what sorts of interventions provide what sorts of reaction – Bacon understood that, but what do we take from Bacon? Merely the rejection of Aristotle.

C: The notion that there is an 'overcoming' of aristotelianism – an overcoming of qualitativism – in the quantitative approach to chemistry?

IHG: Exactly that notion, but it rests, of course, on unacknowledged occlusions: certainly Aristotle's physics and zoology and so forth are inherently qualitative in ways that acknowledge it as nothing other than a description of nature. However Aristotle's account of the natural world is itself parasitic on the rejection of various structural models, various abstract models that one finds in Plato for example. So, not simply the example of mathematics, but the idea that there aren't abstract models that coexist alongside Aristotelianism, and indeed that are made out of Aristotelianism after the neoplatonists' synthesis: the compromise between Aristotelian physics and Platonic physics is made precisely in terms of abstract models of production and cycling and exchange of 'phenomena amongst themselves' – phenomena on their own, so *things* rather than phenomena, really. All in terms of a dynamics. So the idea that there would be a period that we could call 'Baconian' that begins to supplant qualitative description by means of abstract modelling, I don't think is an accurate portrait of the history. However, given that something does happen, and that Bacon is doubtless a substantial contributor to that, we have to ask what it is to which they're responding. And some of the continuities between Cartesianism and the medieval precursors, late Aristotelianisms – to what extent are they purely qualitative, to what extent do they become not merely quantitative but highly abstract. So the grammar, the logical grammar of objects, ceases to be the syllogism, substance and its accidents, that Aristotle presents.

C: Let's now try to test this suggestion that physics and chemistry might represent two different paradigms or models for philosophy: The model of physics envisions a philosophy that deals with analysis into ultimate entities, whereas a 'chemical paradigm' would include a certain experimental component and a 'synthetic ambition' for thought. Can we challenge this simple dualism by exploring the ways in which physics, in fact, is continuous with chemistry (is there, in fact, any specific point at which we can disjoin them?); doesn't physics itself incude its own chemical way of thinking?

Consider the 'cosmic cooking processes' that generate the universe as differentiated, before there is 'chemistry proper'): If gravitation precedes heat and elements (the general requirements of material chemistry and cooking processes), then it deepens the chemical horizon, from that of processes and matter to that of the continuum itself: Gravitation creates a new form of modality in the universe, outside the qualitatively homogeneous continuum. Whereas we usually associate physics with the qualitative homogeneity of spacetime, we should note that gravity serves as the universal thermodynamic motor of complexification, and synthesises the 'ingredients' that generate regional contraction or intensification and thus local syntheses. So gravity could be seen as the force which creates a bi-modal web: universal-local, generic-particular; revealing the gradational spectrum of the continuum wherein transitions and transports along complex modalities unfold as modes of cohesion, liquefaction, production and synthesis ... at which point the objects of chemistry 'proper' emerge. In this case, the 'chemical paradigm' would not belong to chemistry, since there couldn't be a chemistry unless physics was already a synthetic rather than a nomological science.

IHG: If chemistry opens up the paradigm of the synthetic as a way not simply of doing 'philosophy of science' but of doing philosophy of nature, then yes; clearly there's a chemical way of thinking about physics.

Do we understand chemistry and physics as representing different extensive domains, or as having different extensive quanta with regard to their field of objects – being ontologically more or less comprehensive? If that were so, it would suggest that chemistry is in fact related to a circumscribable domain of nature. What then would be the status of thinking synthetically about physics? If it remains analogical, then we're back at the situation of being able to talk about nature only analogically, in its fundaments, exactly as Kant could; we're no further along than Kant's biologism, even though we're calling it chemistry. It cannot be merely analogical. Therefore it cannot be the case that this synthetic paradigm that belongs to chemistry can be limited to the chemical domain: it must be actually instantiated in gravity. And if this is the case, then are we merely talking about a chemical paradigm for thought, or are we talking about a chemical process? You see the same thing with [cosmologist] Lee Smolin talking about whether the laws of physics in the early universe are the same as the laws of physics in the late or middle-aged universe. If they are the same, regardless of time, then what precisely is the status of evolution in terms of nature? Is it just the exhaustion of local possibilities with respect to inherently contingent particular spatio-temporal creatures or entities? Or does it apply to nature as a whole? If to nature as a whole, then it cannot be the case that the laws of nature are the same in the early and the late universe. So there you would have a biologism that would extend to the totality of nature. I think it would be a question therefore of by what means we could conceivably manage the relationships between local and universal with respect to chemistry and physics: Is there a conceptual apparatus that could do that without in fact creating the correlationist problem; without creating, as it were, a reality that sits outside of what can only be referred to analogically by dint of access by, let's say, a restricted creature, or a synopsis that fails with respect to the totality?

The other way of thinking about it is to talk about particular processes, particular expressions that manage or do not manage to achieve a certain degree of extensity with respect to the all. That's how I prefer to think of it. I talk about the 'extensity test' in *Philosophies of Nature After Schelling*. I thought about this as a practical programme for doing the history of philosophy. You could take various philosophical systems and ask, how far do they reach, what do they exclude; so you measure the success of ontology by virtue of what it excludes. And anything that excludes is manifestly wrong – a basic Schellengian principle – and invites a problematic of either eliminativism or productivism on the one hand, or of hyperinflationism with respect to a presumably limited ontology on the other. So the test of extensity merely says, where's the biggest metaphysics ...

Stengers and Bensaude-Vincent, in their work on the history of chemistry,[5] do write about chemistry as being the science that invents its own universal, and they invoke Schellingian aid in doing so. And there is something interesting about the 'invented universal' – it's doing the same undercutting, but with respect to constructivism, any constructivist solution of the sort that you find in various neokantianisms, but also I think in various strands of contemporary philosophy, many of which make claims beyond their fundamentally Fichtean metaphysics.

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[5] Bensaude-Vincent writes: 'Chemistry creates its own object, manufactures its Universal'. 'Lavoisier: Eine wissenschaftliche Revolution', in Michel Serres (Ed.) *Elemente eine Geschichte der Wissenschaften* (Frankfurt am Main: Suhrkamp, 1994). 671. See also B. Bensaude-Vincent and Stengers, *A History of Chemistry A History of Chemistry*, trans. D. van Dam (Cambridge MA: Harvard University Press, 1996).

C: What are the implications of *extinction* for a chemical paradigm of nature and chemophilosophy? If proton decay really occurs, then this means the end of chemistry proper. How can chemophilosophy get past chemistry proper, and the regime of matter, without essentially dismissing materialism?

IHG: If 'materialism' is reducibly and exclusively about bodies, then we do indeed have a chemical philosophy, but a chemical philosophy of the sort that Lavoisier dreamt of, and indeed beyond the sort that he dreamt of: a nomenclature that represents the primary bodies of the universe, which are immutable, etc. So, it's only in such an instance that proton decay would result in a challenge to chemophilosophy. Whereas if matter is more than body, then it follows that this isn't the same type of problem at all. If it makes sense to talk about materialism in the context of anything other than body, then it's a very interesting question. Plato, for example, does not talk about 'Idealists' in *Statesman* (273b5) – the word is *asomatoides* – the incorporealists. And the Stoics obviously picked this up. So the really big question is what comes first, powers or bodies; must powers inhere in bodies, or are bodies consequences of powers? If powers inhere in bodies, then powers do not explain the origins of bodies; and therefore we have a fundamental dualism between powers and bodies. If bodies are the products of powers, then not only do we heal the dualism, but also the decay of the body then tells us nothing about the nature of matter.

C: Thus we arrive at field theory, which you discuss at length in *Philosophies of Nature After Schelling*.

IHG: And this relates directly to the history of chemistry – electrochemistry, electromagnetism, Faraday ... the issues of the identifiability of processes stem not from bodies, but from fields and the interactions they have as their consequences: particular realisations and instantiations in particular bodies. The idea is that if being incorporates more than just body – and if it doesn't, then the origin of bodies is incomprehensible – if it does, therefore, incorporate body *and* powers, powers sufficient to make bodies, then we have this dualism: if being therefore incorporates anything more than bodies and powers in a dualistic relation, it must be powers first, and bodies later. And if that's the case, then the ontological bases are not this or that body, but powers that coalesce and accrete in them.

C: We could bring this back to the question of gravity's cauldron again ...

IHG: Yes, and Plato: *Sophist* 247e – 'I hold it as a mark of being that it consists of power'.

C: Does the pursuit of a philosophy of nature ameliorate the anxieties attendant upon scientific eliminativism, leading to an inclusivism that satisfies the intellectual instinct for the 'universal' in a different way? So that rather than scientific thought being (as in Ray Brassier's *Nihil Unbound*) a trauma that dispossesses us of everything we 'knew', it becomes a means to engage in a more 'Ferenczian' examination of traumata as cosmic elements that are already indwelling, bored through us, that compose us?

IHG: I think the anxiety of loss, the anxiety of disenchantment in certain post-Sellarsian eliminativists, and certain strategies for *re*-enchantment, have this in common: that if the sciences are able to achieve this elimination, it rests on the assumption that ontology is subject not only to scientific determination, but to scientific *revision – at the level of ontology*. In other words, that there are no entities left over to which folk psychology may have referred, or to which animists may have referred. In other words, we no longer even have to ask the question of what is it that animated these rocks in order to make such and such an event to occur – because that rests on a mere misunderstanding. However, does this mean that at any level we have achieved the elimination of animism? One strategy in this (and I take this to be the one that rests on the interminable reciprocity of nature and culture) is the Adorno/Horkheimer one, which is to say, as the response to positivism, that this brave new world is as animistic as can be imagined: The archons continue to haunt the surface of the earth even as they're ensconced around ocean-floor volcanic vents. But on the other hand, what is it that reduces the local conditions at every level for every phenomenon whatsoever to 'mere' conditions as opposed to entities and processes that in fact take place? So in other words, what's the status of the tunnelling or boring? There are several kinds of real tunnelling or boring. Some of them result in real trauma for animals able to talk about it; some result in areas of Cornish fenland that are unable to support life; some of them result in the deaths of animals that have been sent down to collect the tin from it; some of them result in a species of magical realism such as Novalis dreamt of, such that he sought to write an encyclopedia not simply after the image of the Diderotian disenchantment of superstitious nature, and not simply to respond by re-enchanting nature; but to provide a system capable of *everything*. So, what is the scope of universalism? Is it to establish *the* universal, such that everything else becomes a particular determination of it, in Spinozist manner, and to give universal names, or to give it a hinge such that the name might not be insufficiently determined by the actuality. Or is it in fact to continue to be part of the process of the whole self-manufacture? The universal manufactures itself – it is not manufactured by chemistry – I think that would ultimately be my answer to Bensaude-Vincent and Stengers.

C: There is a certain affinity between what we have described as the 'chemical paradigm' of thinking, and the legacy of 'universalism'. In the latter, thought begins with the mixture and the mixed rather than the elementary, from ratios of magnitudes (de Villa Nova, Bradwardine), from combinatorial configurations (Llull), from compositional potencies (Novalis) and from synthetic bundles of incommensurable fibres or ideas; thought must proceed from these mixtures in order to approximate or (re)produce the universal. We can go so far as to claim that chemistry is the first synoptic philosophy, in that its starting point is the full spectrum of nature as a universal mixture, or more precisely a unified continuum where the synthetic *topos* and the analytic *locus*, the universal and the regional, are mediated. So there must surely be an intrinsic relation between chemophilosophy and universalism. But is this relation simply a matter of observing how chemistry proceeds in the production of universals?

IHG: What immediately occurs to me about the universalism problematic – the problem of universals and particulars – vis-à-vis thought beginning with the synthetic, or indeed with the analytic, is something like the following: The universal, as contrasted with the particular, entails precisely the same kind of ontic restrictions that the particular does. In other words, if there is a universal, or indeed many universals, then it entails precisely the restrictedness of those universals to being particulars once again – particulars of a certain sort, i.e. ones that cover many. It's not clear that this would satisfy the demands of a properly synthetic or indeed synoptic philosophy.

I am interested, though, in the idea that chemistry is a synoptic philosophy that proceeds *from* the full spectrum of nature. It boils down to the following question: Does nature consists of particulars or not? And if it does consist of particulars, then, if thought begins with a mixture, then it's a mixture of particulars, ultimately, to which we would want to reduce it. If nature does *not* consist of particulars, on the other hand, then particulars are abstractions from, or processes of, the very nature that thought tends to synthesise, analyse, or synopticise with. And it strikes me that nature *cannot* therefore consist of particulars, precisely for the reason that chemistry is a synoptic philosophy – a philosophy that both synthesizes and self-analyses. In other words, if chemistry is properly a science of nature: if it offers itself as a model for thinking nature, a model for thinking nature that refuses an upper limit to synthesis or a lower limit to analysis, that begins *in medias res*, from the universal which is given as universal and of which the synoptic philosophy itself is an expression.

C: From the time of Lavoisier's chemical revolution onwards, we can see that there is an implicit connection between chemistry and political thought. Whilst the socio-political is recaptured and understood within the chemical continuum, the political chemistry underpins certain strains of philosophies of Nature which fundamentally determine the characteristics of modern European philosophy. How do you see the influence of chemistry on political thought and political chemistry on philosophies of nature since the inception of modern chemistry?

IHG: There's a really fascinating question about nomenclature – Lavoisier as being simply a 'nomenclaturist' of the elements. And the kinds of battles that were contemporaneous with that – Gay-Lussac, for instance, the anti-phlogistical crew and the phlogistical crew and so forth – they're all battling away, and one way that that's been regarded by historians of science is as a regional politics of scientific advance. Clearly it would be foolish to disregard that perspective entirely.

On the other hand, I want to know exactly how far we can take the analogy – or rather, how far we can take the *reality* – of a chemical politics, or a political chemistry. For example, it seems to me that if politics has a chemical basis, and let's say for example that it takes place independently of animals capable of political interactions, then and then only would it be possible for it to escape any kind of chemical base – but, assuming, therefore, that politics is of a chemical base, then what would it mean to talk about a political chemistry, other than a derivatively secondary parasitic account of the discovery of this or that element, or the domestic ownership of various chemical paradigms, of various means of doing chemistry? But that would surely entail a renewedly reciprocal relationship between chemistry and politics, such that the one determines the other, at the cost of the latter determining the prior. At which point, we have no direction; there is no relation anymore between politics and chemistry at all. That, I'd suggest, destroys both politics and chemistry, rather than, as it were, situating the political as an interestingly complex region, dare I say, of chemistry.

So there is that reciprocity problem, I have a worry about there being such a thing as the politics of chemistry that's approached in anything other than a metaphorical way. So the question I would want to ask in response, is: At what cost do we get a politics of chemistry? Are we talking about the politics of how chemistry happens to have been conducted in certain places at certain times? Because if so, then there clearly is a 'politics of chemistry'. But if we're talking about anything more substantial than that, such that it's determining the limits of the thinkable, or the limits of the actual, or the limits of what is, then we must be talking about a very bizarre form of politics that takes its cue from creation narratives of one sort or another ...

C: This is part of your general caution with regard to precipitate politicization.

IHG: Yes: under what conditions is it established that the conceptual is subject to ownership by its users? I'm aware that the cost of this is a species of Platonism, but I think the grounds for the refutation of Platonism have been grossly exaggerated!

C: Nevertheless: if political models of early chemical thought used to be the French Revolution and various affect-driven forms of socialism and class struggle, what would be the political model of contemporary chemistry in which chemical humiliation has been wedded to neuroscientific humiliation and planetary capitalism has its own chemical paradigm (from circulation, consumption and transformation of fuels and minerals to producing its own nature for the horizon of thought)?

IHG: One comes across this in Marx, where *Wechselwirkung* – 'metabolism' – is a constant trope. It's in the *Grundrisse*, it's in *Capital*, it's in the *Early Manuscripts*, and it's in the later scientific work. So the one thing that undercuts the althusserian rupture is precisely metabolism – which suggests one of two things: either Marx is an arch-romantic, in exactly the same way that Nietzsche is, thinking about *Bildung* in precisely the sense of the formative processes that take place in 'life', in living nature – and there are good grounds for making such a reading of Marx – or, that this really is a mere metaphor. And Marx himself is conflicted about it, insofar as he's a politician of *lebensrealismus*, believing that only certain types of entity can possibly be conceived of as being alive – 'Nature builds no machines', he says in the *Grundrisse*.[6] Equally there is no such thing as an automaton that moves itself – this is entirely a specious species created by the engines of capital for ideological purposes. And I'm simply not sure what it means to suggest that there is anything other than a *metaphor* of circulation that capitalism uses; just as there's a 'survival of the fittest' narrative that capitalism uses, and so forth. At which point, what is the additional question here? What is the real question at the basis of this – can there be a politics of nature such that the latter is derivative of the former?

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[6] '[N]ature builds no machines' writes Marx in *Grundrisse* (trans. Martin Nicolaus [Harmondsworth: Penguin, 1973], 692).

C: From a socio-cultural angle, cooking is distinguished from nature's generative and synthetic processes, which span all cosmological processes. But from the point of view of nature, such a distinction is regional and myopic: Nature's self-cooking simply doesn't distinguish itself from culture or the culinary art. For Freud and Ferenczi, this relation between nature and culture is not merely limited to the synthetic field of cooking; it also holds true for eating and consumption. With that said, is it still possible to give a rigorous and systematic account of the culinary art without falling into the myopic realm of gastronomic fetishism? – Within the generative and universal nature, how can consumption and cooking, the gastronomic and the culinary, be distinguished from one another?

IHG: I'm intrigued by the point at which nature's 'self-cooking' arises, and the notion of fetish. For Freud as for Evans-Pritchard, for the late nineteenth-century anthropology of primitive societies, fetishism is precisely what results from an animist metaphysics. Things are alive, fundamentally, they're animated by spirit that moves them, and so forth. So it seems to me that the idea that nature cooks itself is already fallen prey, if not to a gastronomic, at least to a culinary fetishism. So the general question of fetishism is that it must be balanced against some species of panpsychism or panbiologism – maybe the antithesis of the fetish would be precisely the demonstrability of panspermia.

But there's a fascinating point here about the relationship between two sides of a problem: One situating gastronomy with respect to cosmology – or cosmogony, more importantly; and the other about extending the culinary all the way back to cosmogonic origins. There are two sets of problems there: one is that cosmogony would surely assert that the culinary, if it's the same as the origin of all things, defeats fetishism a priori in so far as it means that the entire universe simply is cooking itself; and the gastronomical is simply the differentiator between toxin and nutrition – a very long way down the chain, if you like. Or, if that's not an overextension of the culinary model – which it might well be, along the lines of my responses to the previous question – then on what grounds do we assert a 'self-cooking' of nature? It's a peculiar image, if you think about it – it's a schizogenic rather than a cosmogenic image. It's the self-production of cookery at the origin of time – which I agree can be thought, but at various well-known costs.

C: All that you have said about chemistry could be applied to your own philosophical work, which could be read entirely as a riposte to the notion that philosophers have a right to dismiss all questions of the history and contingent stratification or organisation of matter and thought – Kielmeyer's 'dynamics' – by way of ontologies (whether 'fundamental', mathematical, subtractive, or whatever) which *still* claim that there's nothing philosophically interesting about such 'accidents' or their metaphysical treatment. What's interesting about Quentin Meillassoux's point of view is that he takes this to new heights, claiming that even the laws of nature are accidental, non-necessary, not just their products. Let's attempt to crack open the Speculative Realist alliance in a new direction – what would be your counter-position here?

IHG: The short answer is that natural history is entirely, necessarily contingent; however, necessitation happens as a component of that.

C: Necessitation is contingent ...

IHG: ... Not the other way round: Necessitation takes place within contingent universes, and that would be necessarily true of any universe generated by any kind of process whatever.

C: Since for Meillassoux, contingency embraces not only the unreason of becoming and productivity but also indefinite states of frozen fixity, then maybe we should ask how chemistry could cope with these latter states, that are bereft of any processual dynamics? Is chemophilosophy able to think such an account of contingency?

IHG: So: If we accept that chemophilosophy is synthesis, and that synthesis has no upper or lower limits, then are there laws governing its development, and if so, are they universal with respect to that entire synthetic process? They would be, if and only if they were not themselves subject to synthesis, *which has no upper or lower limits* – which suggests that there cannot be laws that are co-extensive with the process – the laws must be emergent from it – that would be the difference.

C: Wouldn't that be consistent with Meillassoux's construction of hyperchaos: even randomness is a valid 'quotation' of hyperchaos – there is a hierarchical 'lamination' of laws and meta-laws at different levels (so that, for instance, randomness is regular and lawful at a meta-level). But hyperchaos is the intellectual intuition of the collapse of this whole stratal system – a 'pure chronics' – which makes possible to think a 'hard-edged' flipping from one state to another, from one regime of law or lawlessness to another, without reason. Is that 'intellectual intuition' of absolute contingency something unthinkable within a synthetic paradigm?

IHG: Does a chemophilosophy in fact rule out the sort of radical contingency that would have no determinable consequence? Is process, in other words, too rooted in nature to allow access to the kind of intellectual intuition that one can read from Meillassoux? I've rephrased the question in a loaded way, I guess: to say 'is it too rooted in nature' presupposes the nature of nature such that it would not be subject to the same sort of hyperchaotic possibilities of a sudden hard-edged change.

I don't see that there's any inconceivability to the idea that processes are suddenly emergent, immediately emergent, that there is spontaneity, and so forth, in the midst of natural process. There's an interesting parallel, actually, with a process that derives from Kant and the problematic of the transcendental account of causation. If you ask the question, what is the synthetic a priori, it's very easy to answer that in terms whereby the synthetic a priori becomes nothing more than an epistemology. But Kant's own account vitiates this: he says later on that the extendability of practical reason into the domain that theoretical reason cannot tread is one prospect for the transcendental, and therefore for the realization of synthetic a prioris, that is not simply epistemic, but practical. But then we have, at the conclusion of the Third Critique, this moment of terror in the face of the absence of finite rational beings from the surface of the earth; at which point it becomes clear that the stakes of the transcendental are *the re-engineering of causality such that time becomes a creature of finite rational beings*, rather than the other way around. And there's a clearly interesting consequence that flows from this with regard to the current question: If causality is subject to radical reorganization such that prior and posterior, ground and consequent, are entirely reorganisable, then what are we asking about when we ask about causality? Are we asking about anything that has any implicit a priori form that is subsequently realized – or does the re-constructibility of causality, the non-necessity considered in relation to causal form, does the number of possible causes, of thinkable causes, subject the very idea of causality to such indeterminism that the arrow of time is removed, at least potentially, that there being any cosmogenic process whatsoever becomes just one among many radical contingencies? Clearly it does; but crucially, this is on the back of an initial experiment which runs thus: is it possible that causality can be thought by finite rational beings in such a way as to make finite rational beings the causes rather than the consequence of causal processes? And it depends fundamentally, I would say, on an answer to that question, whether or not the species of radical contingency is *cosmologically* instantiable in the way that it might be intellectually intuited for, let's say, an *ontological* project. But if that's the case, if there is that difference, then what is the relationship between cosmology and ontology? And all of a sudden, we're back in the domain of metaphysics, which must have an account of the relation between ontology and nature, at some point.

So I think there's a similarity in the experiment about the re-engineering of time and cause ...

It seems to me that what allows the questioning of the distinction between ontology and metaphysics is simply the thesis that there is something that is necessary, whatever that might be. If one starts from the question 'what is necessary?' and answers that with 'nature' – i.e. a more concrete rather than material response to the question 'what is necessary?' – then one has to ask, what is necessary about nature? To which the only possible answer would be: that there is one, or not – a bivalent solution. Now, one can't claim the absolutely necessity of nature; therefore it must necessarily be that nature is contingent. But nature is also *composed* of contingency: manifestly nature could be otherwise. Xenobiology has made an impact not because it studies actual alien life on alien worlds, but because shows that it can't be ruled out in principle that biologies respond differently to different environmental conditions, and so on. So, the idea of experimentation in the production of different natures is a forerunner to its analysis here – again, a chemically-inspired account.

C: In-vitro, in-silico, or even in-ratio synthesis before or without analysis.

IHG: Exactly, or with an analysis that takes place after the event – look at the various manifestos about artificial life, for example.

C: So in the absence of the fundamental hypothesis that something must be necessary, the periodic table, posited on the basis of its contingency, becomes the figure of knowledge: 'these are the ones we've found so far'.

IHG: The periodic table is never settled, so who knows at what point one is dealing with discovery and at which point invention? This is something that Stengers and Bensaude-Vincent deal with in their history of chemistry – that chemistry is entirely concerned with inventing both its universals and, even if only through nomenclature, its own beings. Ontology as a process of production, heterogenesis, is prior to Being, in that sense. To complete the point, if contingency is necessary for any nature that is possible, then necessitation takes place within a given nature such that in that nature it ceases to be possible to produced otherwise than, in fact, it is. However, how many ways there are to produce that nature is open to question. And that's why there are chemical, philosophical, and physical, biological and ecological accounts of what it is that nature is. Start anywhere, and ask: what are the contingent processes of necessitation that characterise this nature?

C: Questions which the culinary situation presents in microcosm: one can start anywhere, to discover what are the fundamental 'elements', and one cannot distinguish between discovery and invention in the kitchen.

IHG: I could answer that with an anecdote: One of Isaac Asimov's novels *Robots of Dawn* consists of a character who grows up on earth in what are called 'metal wombs', with no exposure to the outside, because the outside's a shit place. In the process of the narrative he goes to this place called Aurora where they grow fruit, and his immediate reaction is that 'there was something offensively carrotty about the carrots'. Now, for that character, for Elijah Bailey, clearly there is a process of discovery in terms of the responses of his tastebuds: he ceases to look at it in terms of pleasure or familiarity and starts to look at it in terms of sensation. And there's an interesting question about the effects of chemistry, culinary chemistry as it were, on sensation, that he is exploring as a matter of experimentation.

As an extension of this thesis, culinarism in general might operate an interesting affront to taste, which would be simply that it is not about pleasure, it's about the possibility of sensation. There's an entire Sadean algebra of possible chemical combinatorials.

C: Perhaps we could imagine some culinary version of the experiment Ritter made – in the Schellingian conviction that (as you describe above) sense experience is derived not from intellect at all; but rather sense experience, and intellect with it, is derived from physics – whereby he attached a battery to his eye ...! In any case, there's already a kind of asceticism that goes with 'developing a palate' – one foregoes pleasure in order to be educated – although to speak of this i as an education that is arrested at different points for different individuals would be to assume a kind of teleology, when in fact there is a whole field of perversions available ...

IHG: Deferred gratification through education ... I think of Freud's troubles with identifying qualitative and quantitative dynamics in the relationship, for example, between intensity as a raw measure of differentiation, and pleasure and pain. His conclusion is that no such distinction is possible – that is, there is no quantitative absolute point at which qualities become the qualities they are.

C: Indistinguishability of pleasure and pain at high intensity – the Vindaloo Principle?

IHG: On the other hand, to pursue the fictionalisation line, one could imagine a *Crash*-type novel about the sensations of which tongues, stomachs, eyes, skin, are capable – entirely to do with the characteristics of food, a kind of *piling in* rather than a *piling up* ...

C: Orwell achieves a kind of culinary horror in *Coming up for Air*, where the abject indeterminacy of an ersatz sausage is the apotheosis of the oppressive, malignant atmosphere:

> The frankfurter had a rubber skin, of course, and my temporary teeth weren't much of a fit. I had to do a kind of sawing movement before I could get my teeth through the skin. And then suddenly – pop! The thing burst in my mouth like a rotten pear. A sort of horrible soft stuff was oozing all over my tongue. But the taste! For a moment I just couldn't believe it. Then I rolled my tongue round it again and had another try. It was FISH! A *sausage*, a thing calling itself a frankfurter, filled with fish!

Totally Lovecraftian, this pulp icthyoid horror ...

IHG: In Beckett's *More Pricks than Kicks*, Belacqua talks about toast that shatters like glass, to be spread with stilton that is not to be used until it walks on its own:

> He looked sceptically at the cut of cheese. [...] He rubbed it. It was sweating. That was something. He stopped and smelt it. A faint fragrance of corruption. What good was that? He didn't want fragrance, he wasn't a bloody gourmet, he wanted a good stench. What he wanted was a good green stenching rotten lump of Gorgonzola cheese, alive, and by God he would have it.

C: After the divergence from a common origin of 'grubbing around' (in your apt phrase, since it etymologically connects shallow digging – supposedly superficial inquiry – and the 'scraping together' of 'grub'), in postmodern food science's obsessive pursuit of new combinatorial resyntheses and novel 'mouthfeels', the culinary, and chemistry and its 'tinkering', are reunited, in this productive perversity.

IHG: You should visit a Scottish sweet shop, they seem to excel in the production of foodstuffs that are truly grotesque – quite shocking.

C: Children have a paradoxical combination of fussiness about food and a taste for the most aggressively synthetic products. *Tunnocks Teacakes*, also a modern Scots delicacy, I would have thought of as an early example of chemically-inspired (quite literally) food production – what is the foam stuff inside them?

IHG: I've no idea. Cavity wall filling? … I was thinking of *soor plooms* – they're little globules of boiled sugar filled with such excessive quantities of lime-*like* substances as to make them totally and utterly unpalatable. The principle upon which these are sold is: see how many you can eat before you throw up.

AMMONIA (HABER-BOSCH STYLE)

First, clean the methane to remove sulfur oxide and hydrogen sulfide.

React the clean methane with steam over a catalyst of nickel oxide:

$CH_4 + H_2O \rightarrow CO + 3\ H_2$

Add air to convert any remaining unreacted methane:

$2CH_4 + O_2 \rightarrow 2\ CO + 4\ H_2$

$CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

Then use the water gas shift reaction to yield more hydrogen from CO and steam:

$CO + H_2O \rightarrow CO_2 + H_2$

Pass the gas mixture into a methanator, to convert most of the remaining CO into methane for recycling:

$CO + 3\ H_2 \rightarrow CH_4 + H_2O$

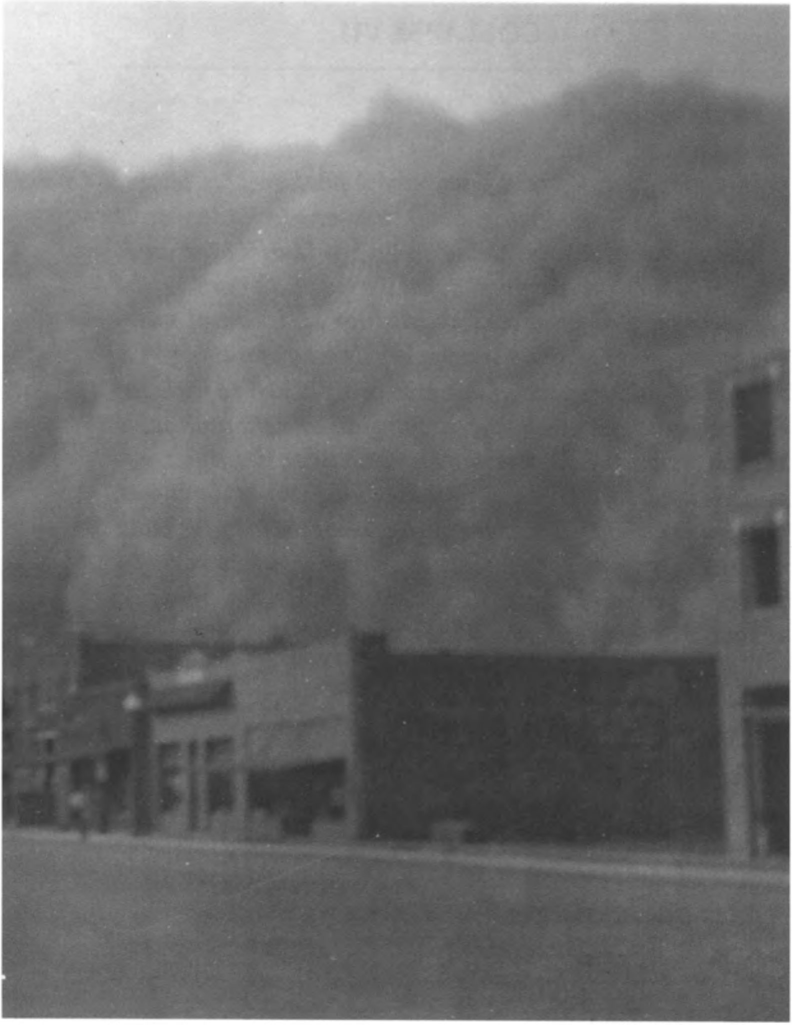
The methane and steam should now be entirely converted into carbon dioxide, steam, and hydrogen. To complete the ammonia synthesis, use an iron catalyst promoted with K_2O, CaO and Al_2O_3:

$N_2\ (g) + 3\ H_2\ (g) \rightleftharpoons 2\ NH_3\ (g) \quad (\Delta H = -92.22\ \mathrm{kJ \cdot mol^{-1}})$

This should be done at 15–25 MPa (150–250 bar) and between 300 and 550 °C, passing the gases over four beds of catalyst, with cooling between each pass to maintain a reasonable equilibrium constant. On each pass only about 15% conversion occurs, but any unreacted gases are recycled, so that eventually an overall conversion of 97% can be achieved.

Corn Bomb: A Short History of Nitrogen 1660–2008

John Gerrard and Michael A. Morris



INTRODUCTION

In 2006, John Gerrard discovered a photographic image, taken on April 14th 1935, of a vast dust storm travelling across Texas, in what were becoming the agri-industrial heartlands of the US. In the early decades of the twentieth century, the exploitation of petroleum enabled an agricultural intervention on an hitherto unimaginable scale, resulting in a hundred million acres of this area being ploughed within a twenty year period, thus destroying an ancient and stable grass ecosystem. The catastrophic result was a desertification of the landscape, and the creation of what came to be known as the Dust Bowl. The photograph became the basis for Dust Storm (Dalhart, Texas) [2007]*, a work which consists of a virtual portrait of the landscape as it stands today, reunited with a realtime 3D model of the historic storm placed as a slowly developing sculpture on the land. This work was first shown in Marian Goodman Gallery, NY in a project titled* Equal, that is, to the Real Itself*, curated by Linda Norden, in mid-2007.*

'Corn Bomb', written by Gerrard in collaboration with chemist Michael Morris, recounts the backstory of this traumatised 'dead zone'. At the centre of this plot is the discovery of the function of nitrogen in synthesizing organic compounds, and the development of the Haber-Bosch nitrogen-fixing process, exploited for the production of explosives, but which

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Preceding pages:
Dust Storm at Stratford, Texas. April 14th 1935.
PPC. Centre for American History, University of Texas at Austin.

also enabled large-scale production of the nitrogen-based fertilizer upon which the world's ever-growing population is now largely dependent.

In the following years, Gerrard returned repeatedly to this depleted landscape, making a series of works, including Grow Finish Unit (near Elkhart, Kansas) [2008], Lufkin (near Hugo, Colorado) [2009] *and* Oil Stick Work (Angelo Martinez / Richfield, Kansas) [2008], *all based on buildings and objects discovered within its vast expanse. The area across which the duststorm once passed is now home to new production units, whose enmeshing in automated networks of food production, reflected in their eery 'virtuality' and geographical disengagement, is redoubled by Gerrard's precisionist modelling: Unmanned pig farms on the outer edges of mechanically-irrigated arable fields; melancholy post-peak-oil derricks sucking up the last reserves. Gerrard's works concern themselves with power in the broadest sense, epitomising the structures of power and the networks of energy that characterise the 'new earth' wrought by modernity.*

With these new facilities, the sterile surface of this land has once again been returned to 'productivity', packed with remote-controlled batteries that power hungry cities. Though currently invisible, the vast dead zones in the Gulf of Mexico, the result of the excess of nitrogen created in the region prompt the question of how long these batteries can last, thus announcing the next chapter of this geotraumatic saga.

A SHORT HISTORY OF NITROGEN

1660
World population stands at circa 500 million.
Robert Boyle, an Irish scientist and one of the founders of modern chemistry, is the first to suggest that air is composed of tiny 'corpuscles' or molecules. A keen alchemist, Boyle spent many years trying to turn iron into gold.

1675
John Evelyn, an English writer, gardener and diarist, suggests that rainwater is not pure but instead impregnated with a beneficial substance which he names 'celestial nitre'.

1772
Elemental Nitrogen is isolated by the Scottish chemist and physician Daniel Rutherford but remains unnamed.

1770
World population stands at circa 900 million.

1773
Carl Wilhelm Scheele, an apprentice apothecary from Sweden with no formal education, discovers 'fire air' (oxygen), an 'air' that supports combustion. He produces it by reacting aqua fortis (nitric acid) with

potash to produce a colourless gas. He also demonstrates that ‘common air’ consists of ‘fire air’ and a second component that does not support combustion and causes asphyxiation in animals. This he describes as ‘foul air’.

1774
Joseph Priestley, a Unitarian Church Minister and radical social reformer who went on to become one of the greatest chemists of his generation, shows that ‘fire air’ (oxygen) could support life up to five times better than normal air. He travels to Paris to visit the chemist Antoine Lavoisier, who the following year discovers and formally names oxygen.

1780
The onset of the Industrial Revolution in the United Kingdom creates a need for large quantities of chemicals in the form of soaps, bleaches, acid and dyes for use in the production of textiles.

1790
Nitrogen is formally named in Jean Antoine Chaptal’s *Éléments de chimie*. His choice of ‘nitrogène’ combines the Greek word νιτϱον [nitron] = sodium carbonate, saltpetre and French word gène from Greek γεινομαι [geinomai] = to engender, bring forth. It is also referred

to as Phlogisticated Air by Priestley, and Azote (or 'lifeless') by Lavoisier.

1800
Amount of arable land needed to feed one person for one year: 60 acres.

1827
The role of soluble forms of nitrogen in crop cultivation is outlined in the groundbreaking work of Justus von Liebig, known as the father of the fertiliser industry. He recognises that nitrogen is needed in a fixed form.

Note
The earth's atmosphere is 80% nitrogen, but this nitrogen is non-reactive. Each nitrogen atom is tightly bound to another (N_2). They must be split and 'fixed' to other atoms to form nitrogen compounds: either with oxygen (to form nitrates) or hydrogen (to form ammonia and other amines). Nitrogen is fixed naturally by bacteria that live in the roots of leguminous plants (clover, peas, beans and alfalfa), or by lightning strikes during which nitrogen bonds are broken in the air and bound to oxygen.

1846
The modern history of petroleum begins with the discovery of the process of refining kerosene from coal

by Nova Scotian physicist and geologist Abraham Pineo Gesner. In 1852 the Polish pharmacist Łukasiewicz improves Gesner's method by developing a means to refine kerosene from the more readily available 'rock oil' (*petr-oleum*) seeps. In 1853 the first rock oil mine is built in Bóbrka, near Krosno in western Poland.

1847
John Hutchinson, a 22-year old chemist and industrialist, recognises the importance of scale to economy in the chemical industry and acknowledges that chemicals are needed for domestic as well as industrial use. He opens a factory in northwest England (a region with salt deposits and a sophisticated canal network), and recruits three established chemists: Ludwig Mond, John Brunner and J.W. Towers.

1850
World population stands at circa 1,200 million.
Widespread farming on the Great Plains of the United States begins. The advances of the Industrial Revolution and the onset of commercialisation, augmented by a new understanding of the relationship between crop yield and nitrogen and the need to avoid soil depletion, radically changes farming practices across the world. With arable land under significant pressure to feed an increasing population, crop rotation

between crops and leguminous plants as well as the use of manure, guano and mineral nitrates to increase production become commonplace.

1854
Benjamin Silliman, a professor at Yale University, is the first to fractionate petroleum by distillation. His discoveries rapidly spread around the world. In 1861 Meerzoeff builds the first Russian refinery in the mature oil fields at Baku. Within a short space of time the area is producing almost 90% of the world's oil.

1859
Former railwayman Edwin Laurentine 'Colonel' Drake drills the world's first successful oil well in Titusville, Pennsylvania.
2,000 barrels of oil are produced this year in the United States.

1862
The Morrill Act is passed in the United States to establish State Agricultural Experiment Stations to develop modern techniques in animal husbandry.

1865
California's first productive well is drilled by the Union Matolle Company in the state's Central Valley.

1866-77
A cattle boom accelerates inhabitation of the Great Plains, leading to a series of land-related disputes between farmers and ranchers.

1869
4,215,000 barrels of oil are produced in the United States.

1876
German inventor Nikolaus Otto, working with Gottlieb Daimler and Wilhelm Maybach, develops the first four-stroke piston cycle internal combustion engine.

1879
Karl Benz is granted a patent for his two-stroke gas engine, based on the same technology as Otto's. A short time later, Benz designs and builds his own four-stroke engine. He develops his first automobile in 1885 and patents it in 1886. Soon afterwards it becomes the first automobile in production.

1879-1883
The importance of mineral fertilizers in crop production leads to dramatic increases in fixed nitrogen prices. Its sourcing becomes a major political concern. India, Norway and Egypt each discover resources of various nitrate-containing minerals, but by far the largest are

found in South America. Among them is a 220-mile long deposit of guano (fixed nitrogen laid down in the excrement of birds over millions of years) and saltpetre (potassium nitrate). The value of the mineral rights within this field is a direct cause of the War of the Pacific (1879-1883, also known as the War of Saltpetre) between Chile, Peru and Bolivia. The government of the United Kingdom sponsors Chile with financial support and arms on the condition of guaranteed exploitation contracts. Following the war's conclusion Chile establishes itself as the world's largest supplier of nitrates.

Companies from the United Kingdom soon own 70% of the Chilean nitrate industry.

1892

John Froelich develops the first successful gasoline-powered tractor, a machine that will ultimately welcome in the twentieth century and usher out the use of animal power. His company is later purchased by Deere & Company and becomes the John Deere Tractor Company.

1893

Patillo Higgins, a Texan businessman and self-taught geologist, founds the Gladys City Oil, Gas, and Manufacturing Company in the belief that modern industry will soon switch from coal to oil.

1898

Chile builds a vibrant economy on guano and saltpetre sales, accounting for around half of its GNP. Exports of copper provide an additional quarter. Over-reliance on these products quickly becomes a major problem. Original forecasts that the nitrate fields would last for 100 years or more appear optimistic as global demand for fertilizer begins outstripping supply. Sir William Crookes, a chemist and senior British government official, delivers a lecture titled 'The Wheat Problem'. It proposes that the world might face starvation if nitrate sources run out (a situation he forecasted would occur in 1921).

1899

Average annual consumption of commercial fertilizer in the United States: 1,845,900 tonnes.

1900

90% of the United States population lives on farms. Although Crookes's warnings regarding the diminishing resources of natural nitrate are initially ignored, the potential impact of a shortage becomes glaringly apparent within a few months. The expectation of war in Europe and the consequent stockpiling of explosives contributes to a steep rise in the demand for and price of fertilizer. Further pressure comes from the food industry, with crop yield in Europe having doubled over the course of the last century to feed rapidly-expanding populations. Nitrogen is available in Europe, but only in the atmosphere. At this point, neither plants nor humans can make use of it because a technically feasible method of fixing it in chemical compounds has not yet been discovered.

Note

The growing demand for nitrate, in part to produce explosives during the First World War, eventually caused the collapse of the Chilean nitrate market and the departure of large numbers of British extraction companies. The Chilean economy did not regain stability until the late twentieth century.

The demand for clean ammonia for use in the production of explosives and fertilizer led to the small scale development of two processes:

1. The arc process

($N_2 + O_2 \rightarrow 2NO$ $NO + \frac{1}{2} O_2 \rightarrow NO_2$)

which took place at temperatures greater than 1200°C. This was energy-inefficient and 1 tonne of fixed N_2 equivalent to 1500 kWh.

2. The cyanamide process:

$CaO + C \rightarrow CaC$ $CaC + N_2 \rightarrow CaCN_2$

at temperatures greater than 1000°C

$CaCN_2 + H_2O \rightarrow CaCO_3 + NH_3$

Although more efficient, the process was not as easy to operate or as safe.

1900
World population stands at circa 1,600 million.
Amount of arable land needed to feed one person for one year: circa 5 acres.
German funding for research into synthetic munitions-grade nitrate begins.

1901
On January 10, the first major oil well is discovered in Texas. A 'gusher' in Spindletop, near Beaumont, rises to a height of more than 150 feet (50 metres). Called 'Lucas 1', it flows for nine days before it can be capped. It begins delivering oil at an initial rate of close to 100,000 barrels per day, greater than all the other wells in the United States combined.

1905
The German chemist Professor Fritz Haber, then just 36 years old, publishes 'Thermodynamik technischer Gasreaktionen' (The Thermodynamics of Technical Gas Reactions) in which he details the iron-catalysed reaction of hydrogen and nitrogen to create ammonia at temperatures below 1000°C. Soon afterwards $N_2 + H_2 \rightarrow NH_3$ is patented as the 'Haber Process'. At this time Germany is still 95% reliant on Chilean nitrate.

1906
126,493,936 barrels of oil are produced in the United States.

1909
A dryland farming boom begins on the Great Plains with the arrival of itinerant, seasonal 'suitcase farmers', mining the land for valuable wheat crops but typically resident elsewhere. It will reach its peak in the 1920s.

1910
Considerable work is required to make the Haber Process commercially viable. 'The interest of a wider circle,' Haber later stated, 'has its source in the recognition that ammonia synthesis on a large scale represents a useful way to satisfy an economic need. This practical usefulness was not the preconceived goal of my experiments. I was not in doubt that my laboratory work could furnish no more than a scientific statement of the foundations and a knowledge of the experimental equipment, and that much had to be added to this result in order to attain economic success on an industrial scale.'

1910
BASF chemist Carl Bosch takes out patents on the use of high pressure and separation processes and moves the concept towards a manufacturing method.

The reaction requires high temperatures (750°C) and pressures and is energy-intensive. Bosch and Haber develop a process to fix atmospheric nitrogen and produce synthetic ammonia.

1910
Large, open-geared gas tractors are used for the first time for farming in the United States.

1913
The world's first commercial ammonia synthesis plant to produce mineral fertilizer according to the Haber-Bosch Process opens in Oppau, Germany.
Worldwide production of synthetic nitrogen: 7 arc plants (20,000 tonnes of nitrogen a year), 15 cyanamide plants (66,000 tonnes of nitrogen a year), and 1 direct synthetic ammonia plant (Oppau, 7,000 tonnes of nitrogen a year). The ammonia produced is converted to nitrate for use as explosives or fertilizers.

1913
The United Kingdom government (with the help of spies) initiates its own synthetic ammonia programme. Despite recognising the importance of synthetic production, they fail to recreate Germany's success.

1914

The assassination on 28 June of Archduke Franz Ferdinand of Austria in Sarajevo leads to the outbreak of the First World War. The United Kingdom government, which has its own nitrate source in India, expects that war will last just six months due to German munitions shortages. In order to prevent German access, a blockade of Chilean nitrate begins. Despite early successes in defying the British Navy, German ships are soon confined to home defence. The further development of domestic synthetic production suggests that Germany's munitions supply would last until early 1916. A combination of the Haber-Bosch Process to produce ammonia, and the Ostwald Process to convert it into nitric acid and nitrates, prolongs the war until 1918.

Note

All explosive production was based around nitrate, e.g. gunpowder (nitrate + sulphur + sugar), TNT = $CH3C6H2(NO)3$, and nitroglycerin = $CH5(ONO2)3$.

1915

Haber supervises the first gas attack in military history at Ypres, France, on April 22. Somewhere around 10,000 Allied troops are killed or incapacitated by chlorine on that single day. Poison gas remains a focus of Haber's work, and he leads the effort to develop and deploy mustard gas (dichlordiethylsulfide).

Haber's wife Clara Immerwahr, in 1900 the first female student at the University of Breslau to receive a PhD, expresses her objections to the use of chemistry for making weapons.
After attending a dinner on May 2 to celebrate her husband's appointment to Captain, Immerwahr shoots herself with his service revolver. The morning after her death, Haber leaves home to stage the first gas attack against the Russian army on the Eastern Front.

Note
In 1986 Fritz Haber (son of the chemist) and his second wife, Charlotte, published a book on the history of poison gas, *The Poisonous Cloud*.

1916
During the wartime boom in grain prices, petroleum-driven tractors remove 100 million acres of American midwest prairie grass cover to sow wheat. As a national defence measure to ensure the supply of nitrates used in the production of munitions, the United States Congress authorizes the construction of two nitrate manufacturing plants and a dam for hydro-electric power. President Woodrow Wilson chooses Muscle Shoals, Alabama as the site for both the plants and the dam, the latter of which will later be named after him.

1918
Following the conclusion of hostilities, Haber is awarded the Nobel Prize. He is a controversial recipient, having been named but found not guilty of being a war criminal.

Bosch, whom many think in fact made the greater contribution, would be awarded the same prize in 1931.

It becomes apparent that the German technology for ammonia synthesis is key to continued industrial growth and increased food production. The United Kingdom government hires the company Brunner-Mond to spearhead its research effort. Some time later Aldous Huxley visits their recently-opened and technologically-advanced plant at Billingham, north-east England.

The introduction to the most recent edition of Huxley's 1931 classic novel *Brave New World* states that the author was inspired to write the book (in which Mustapha Mond figures as a character) after this visit.

1920
World population stands at circa 1,900 million.

1922
The United States National Live Stock and Meat Board is founded.

1926
Muscle Shoals Fertilizer Company and the Muscle Shoals Power Distributing Company are created by a consortium of southern United States power companies to utilise wartime facilities for the production of fertilizer.

1926
A light tractor is successfully developed for use in farming in the United States.

1930s
An all-purpose, rubber-tired tractor with complementary machinery comes into wide use in the United States, particularly on the Great Plains.

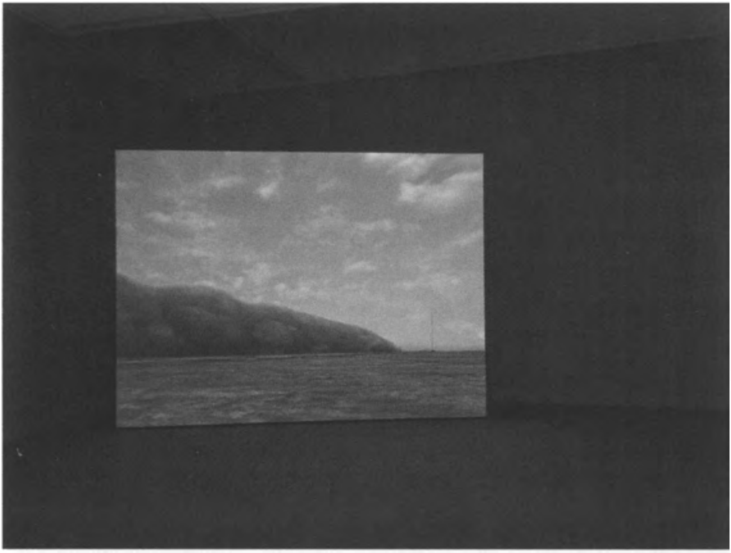
1931
A severe drought hits the midwestern and southern plains of the United States. Crops die and 'blackblizzards' (great walls of dust whipped up from overplowed and over-grazed land) sweep through the region.

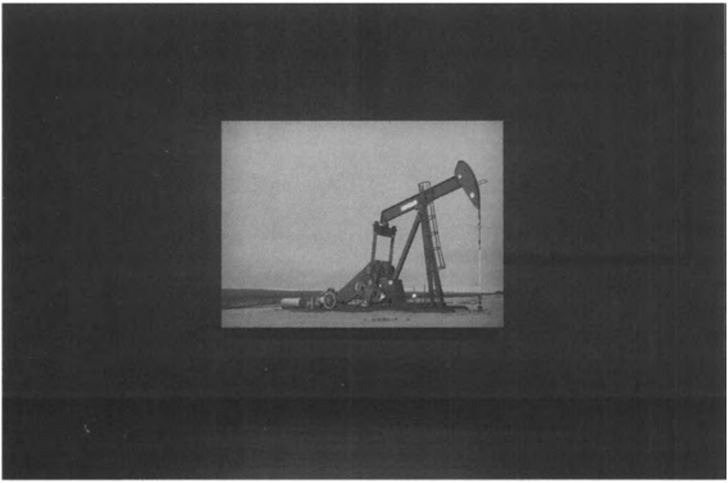
1933
Franklin Roosevelt takes office in the United States.

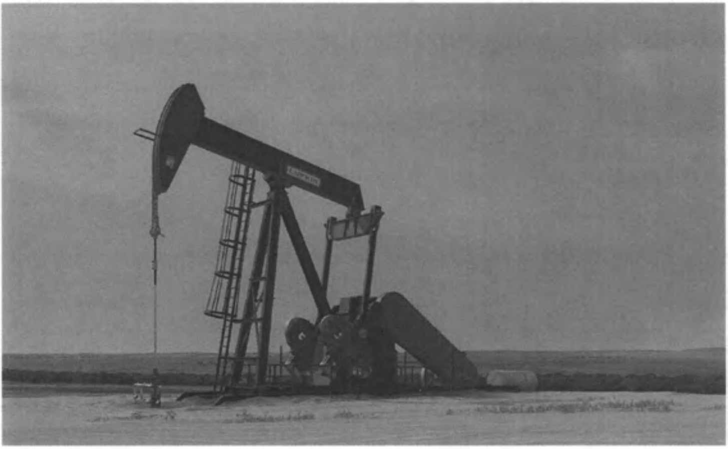
1934
An even more more serious drought, the worst in the history of the United States, affects more than 75 percent of the country. Dust storms spread across an area of 100 million acres (400,000 square kilometres), centred on the panhandles of Texas and Oklahoma, and adjacent parts of New Mexico, Colorado, and Kansas. This area becomes known as the 'Dust Bowl'.

1935
On April 14, now known as 'Black Sunday', the worst storm of the Dust Bowl occurs. Travelling at a speed of sixty miles an hour, it causes massive damage. 850 million tonnes of topsoil are blown off the Southern Plains during the course of the year. Millions of acres of farmland become useless, and hundreds of thousands of people are forced to leave their homes. Many travelled to California and other states in search of more beneficial economic conditions. Owning no land, others travelled from farm to farm picking fruit and other crops at starvation wages.

Facing Page:
Top: *DustStorm (Dalhart, Texas)*, 2007, Realtime 3D projection, 480 x 360 x 5 cm. Installation view, Directions: John Gerrard, Hirshhorn Museum and Sculpture Garden, Washington d.c., 2009. Curated by Kelly Gordon. Photograph: Lee Stalsworth
Collection: Daniel Sallick amd Elizabeth Miller.
Bottom: *Dust Storm (Dalhart, Texas)*, 2007







1939
Rain finally comes in the autumn, bringing an end to the drought. The outbreak of the Second World War on September 1 contributes to a regeneration of the United States economy, dragging it out of the Depression. The plains once again become golden with wheat.

1950
World population stands at circa 2,500 million.

1960
11 million tonnes of nitrogen fertiliser are used worldwide.

1970
32 million tonnes of nitrogen fertiliser are used worldwide.

1970s
The first 'dead zone' in the Gulf of Mexico is discovered. Nitrates leak into the Mississippi River from the fields of the midwestern United States, which in turn feeds directly into the gulf. Such zones, it is later understood, are caused by eutrophication – an increase of chemical nutrient compounds containing

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Facing Page:
Top: *Lufkin (Near Hugo, Colorado)*, 2009, Realtime 3D projection, 400 x 300 cm. Installation view, Thomas Dane Gallery, London, UK, November 2010.
Bottom: *Lufkin (Near Hugo, Colorado)*, 2009.

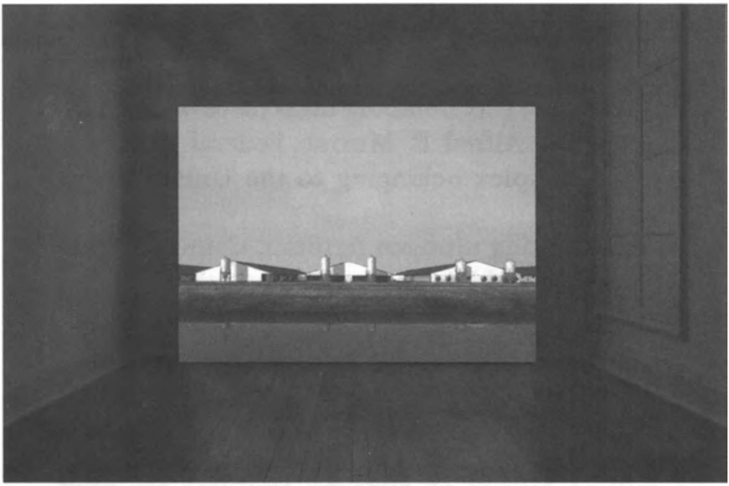
nitrogen or phosphorus within an ecosystem causing algal blooms which consume all available oxygen, thereby causing the death of all other organisms in the area.

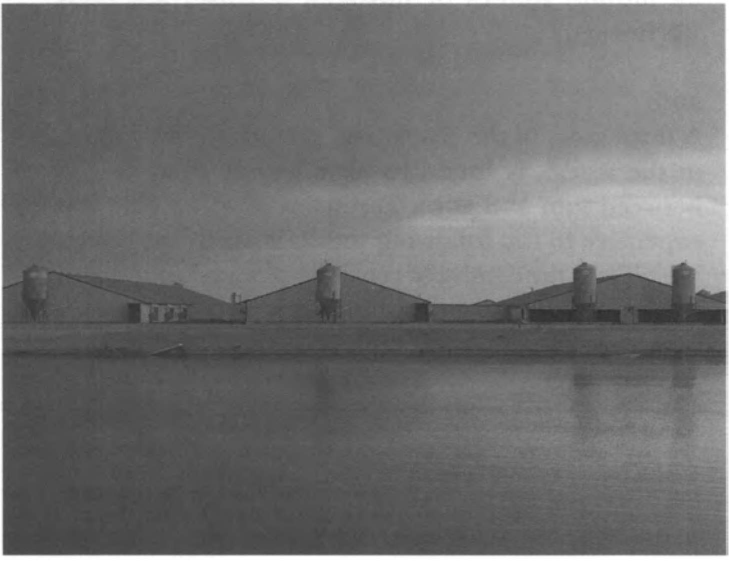
1980
World population stands at circa 4,400 million. Average meat consumption in the United States stands at 45kg per person.

1980
61 million tonnes of nitrogen fertiliser are used worldwide.

1990
Iraq invades Kuwait, leading to the First Gulf War. 79 million tonnes of nitrogen fertiliser are used worldwide. The amount of fixed nitrogen used in farming in the period 1980-1990 exceeds all previous use prior to 1980.
Somewhere between 50-60% of the global population now rely on fertilizer to eat. The nitrogen used in ammonia manufacture is derived exclusively from fossil fuels: as a consequence, the price of fertilizer has run parallel to that of oil for more than 70 years.

Facing Page:
Top: *Sow Farm (near Libbey, Oklahoma)*, 2009, Realtime 3D projection, 400 x 300 cm. Installation view, Thomas Dane Gallery, London, UK, November 2010.
Bottom: Artist's photographic documentation for *Sow Farm (near Libbey, Oklahoma)*, 2009.





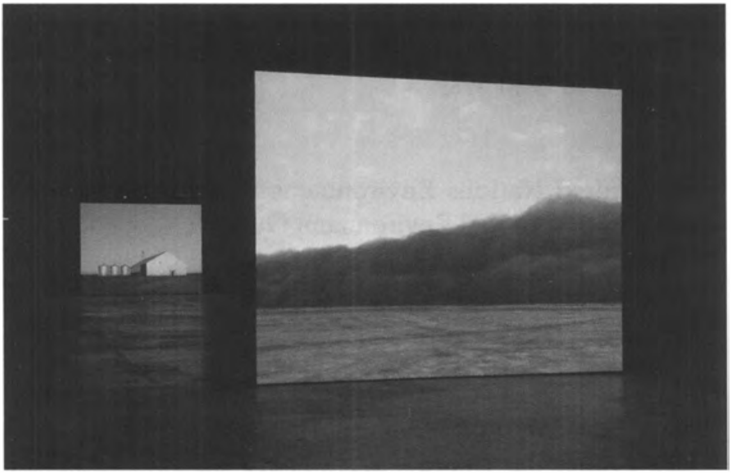
1995
The Oklahoma City bombing takes place on April 19, targeting the Alfred P. Murrah Federal Building, an office complex belonging to the United States government.
The attack, using nitrogen fertiliser, claims the lives of 168 people and injures over 800 others.

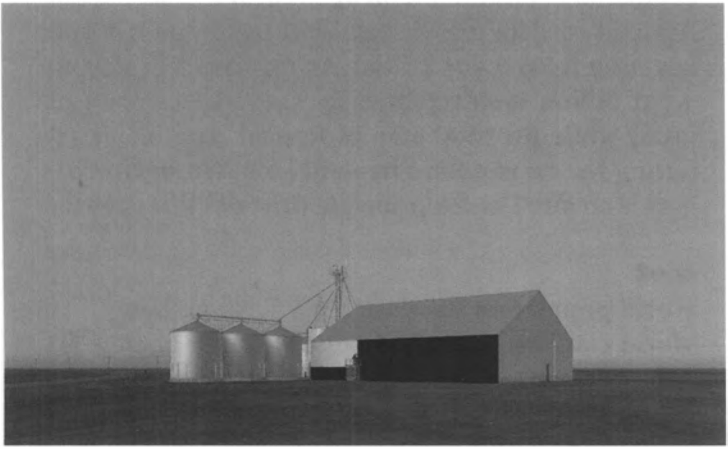
1997
World population stands at circa 5,900 million.

2000
82 million tonnes of nitrogen fertiliser are used worldwide.

2001
A dead zone in the Black Sea, previously the largest in the world, is found to have largely disappeared between 1991 and 2001. Fertilisers have become too expensive to use following the collapse of the Soviet Union and the demise of centrally-planned economies within Eastern Europe. Fishing again becomes a major economic activity in the region.

Facing Page:
Top: *Dust Storm (Dalhart, Texas)*, 2007 (foreground); *Oil Stick Work (Angelo Martinez / Richfield, Kansas)*, 2008 (background).
Installation view, 'John Gerrard: Animated Scene', Isola Di Certosa, Venice Biennale 2009. Curated by Jasper Sharp & Patrick Murphy / Rha Projects
Bottom: *Oil Stick Work (Angelo Martinez / Richfield, Kansas)*, 2008.





September 11 attacks on the United States, leading to the Second Gulf War.

2004
The United Nations Environment Programme publishes its first Global Environment Outlook Year Book. It details the existence of 146 dead zones in the world's oceans where marine life cannot be supported due to depleted oxygen levels.

2007
Total meat production in the United States reaches 40.5 billion kg. Exports account for 2.5 billion kg, compared to just 0.1 billion kg in 1970. Department of Agriculture data reveals that world grain production has risen from 0.905 billion metric tonnes in 1965 to 2.091 billion metric tonnes in 2007 (an increase of 131%) while the total area of farmed land increased during the same period by only 4.1%. Nitrogen fertiliser is credited as the principle driver of this growth.

2008
World population stands at circa 6,770 million.
World consumption of oil per day stands at circa 80 million barrels.
180 million tonnes of nitrogen fertiliser are used worldwide.

Amount of arable land needed to feed one person for one year: circa 1.8 acres.

400 gallons of oil are required to feed each United States citizen per year.

2% of the United States population lives on farms.

The manufacture of nitrogen fertiliser accounts for 37% of total energy use in agriculture.

405 dead zones have been found in lakes, seas and oceans worldwide. The most notorious dead zone remains the 22,126 square kilometre (8,543 square mile) area in the Gulf of Mexico. Other major oxygen-starved areas can be found in the Baltic Sea, the Adriatic Sea, the Gulf of Thailand, the Yellow Sea, and Chesapeake Bay. In addition, nitrate concentrations in rivers in the northeastern United States and much of Europe have increased 10- to 15-fold in the last 100 years.

Proceedings of the National Academy of Sciences published online warned of 'mass extinction in the oceans with unknown ecological and evolutionary consequences'.

July 31, 2008

The Washington Post carries a report on so-called 'jubilees' taking place on the Gulf Coast of the United States. Wayne Keller, director of the Grand Isle Port Commission, Louisiana, says that in recent years people all along the coast have used nets and poles to catch fish and shrimp which appear to ‘rush’ towards the shoreline. Driven by vast walls of deoxygenated and deathly water, there is nowhere else for the creatures to go. Huge numbers of them are barbecued along the coast amid scenes of celebration.

Corn Bomb: A Short History of Nitrogen 1660–2008 *was first published in the catalogue* John Gerrard: Animated Scene*, which accompanied a project of the same name at the 53rd International Art Exhibition, La Biennale di Venezia in 2009.* Animated Scene *was curated by Jasper Sharp and Patrick Murphy, and presented by RHA, Dublin..*
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PREPARATION OF WHEY FOR DIVERSE PURPOSES

Clarify whey and remove fines before routing fluid through a pasteurizer and into 10,000-gallon storage tanks. Pass the whey through an ultrafiltration system that boosts protein to 35%. The resulting protein concentrate should undergo chromatographic separation to extract and concentrate lactoferrin. Pump the 35% WPC to a diafiltration system to increase protein concentration to 80%. (The filtration system's PLCs should feed data via an Ethernet connection to the plant's control room. Clearly mark and code flow meters on the shop floor, and label flow direction through every pipe, to simplify maintenance and repair tasks.)

With protein content removed, move the remaining fluid to a permeate pasteurizer before undergoing reverse osmosis to remove two-thirds of the water. Bring the RO concentrate to 60% total solids with a falling film TVR evaporator. Next, pump the concentrate to one of five 6,000-gallon glycol-jacketed crystallizers.

After crystallization, send the fluid to a multi-stage drying system. Heat outside air with propane and mix it with atomized permeate pumped under pressure of 5,000 to 6,000 psi to the top of a 90-foot-tall drying chamber, after which, pump the material pneumatically to the top of a storage silo at at least 5,400 pounds an hour.

Whey To Go: On The Hominid Appropriation of the Pig-Function[1]

FIELDCLUB

The resourcefulness to turn byproducts into value-added products ranks among the food industry's most impressive achievements.

'THE VALUE-ADDED WHEY',
FOOD ENGINEERING MAGAZINE 02/01/2002

1. Whatever the cosmetic resemblances, the true secret of the pig's close relationship with the human lies in the fact that both species boast an augmented potentiality with regard to feeding. Arguably the most important of our many shared traits is our one-chambered stomach and uncomplicated digestive tract, which grants us both membership to that exclusive class, *omnivores.*

2. But whereas human omnivorousness is culturally circumscribed, the pig exhibits an egregious want of critical faculties. Consequently, our feeling of proximity to the pig cannot but be accompanied by a simultaneous revulsion.

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[1] A version of this paper was first published in *Antennae – Journal of Nature in Visual Culture*, 2009.

This gustatory exaptation, which informs the derisory folk-image of the pig as an ignoble glutton ready to devour any and all waste product, nourishes our sense of its uncanny nature, as an animal at once disturbingly proximate to us yet falling drastically short of human refinement. And yet (excepting cultures where it is anathematized as a two-faced – non-ruminant but cloven-hoofed – deceiver) the pig is forgiven its gluttony, as it alchemically transforms anything-edible-whatsoever into tasty nutrition for humans.

This furnishes the functional background for the paradoxical status of the pig in folklore and religion, as both venerated producer and feared devourer, and completes the description of what will be discussed below as 'the Pig Function'. Our thesis is that contemporary developments can be read as destituting the pig of this, its 'own' function, and incrementally transferring it to the human.

3. An instructive index of the hominid appropriation of the Pig Function is provided by the historical emergence and resolution of 'the whey problem'.

Capitalism, characterised by its ability to transform problems into opportunities, has exploited the uncanny relation between humans and pigs, employing technological prostheses to adapt the porco-hominid gastrointestinal convergence and bypass the critical faculties of humans, thus transferring the Pig Function to the human, and extracting a surplus value in the process.

4. Contemporary with the dawn of civilisation, the human consumption of animal milk can be dated to the beginnings of animal husbandry in the Near East. Over a lengthy period, early civilisations developed various milk derivatives, the processing of which inevitably led to byproducts.

5. Whey (a byproduct of cheesemaking, the colourless liquid left after the curds have been extracted) was long considered as waste. As long as the making remained a small-scale domestic affair, this waste could be disposed of inoffensively. Latterly, the domestication of the pig set the seal on a 'virtuous circle' of waste-disposal and meat production, with whey and skim milk serving as swine feed (Fig. 1, Section 4).

6. This solution barely survived the advent of industrial farming, with large-scale production of milk derivatives taking place far from the dairy of origin. Its value being too negligible for it to become a marketable commodity, whey was sometimes distributed back to farms as pig feed, but was more likely to be dumped in vast amounts into rivers, sewer systems, or onto roads or fields.

7. With ever-greater increases of scale, the 'whey problem' became more pressing. At this point the dairy industry began to seek a solution by way of extracting various components from whey for use in value-added synthetic products – 'leverag[ing] modern technology' to 'make the lemon of cheese production into lemonade'.[2] Today, enterprising dairy producers have developed multiple markets for whey, transforming the erstwhile waste product into a valuable commodity. Whey powder's lactose content, along with its texturising, water-binding, stabilising and fat-mimetic properties, makes it an important factor in many convenience foods including infant formula milk, coffee whiteners, salad dressings, cup-a-soups, cakes and pastries, candy, mayonnaise and crisps (Fig. 1, Section 5).

8. One of the most lucrative markets for whey is the production of whey protein isolate and concentrate powders as food supplements for the bodybuilding community, to whom its marketeers promise increased muscle mass (more recently, the same products have also been rebranded as pro-immune system, anti-aging formulae). Delivery of these supplements involves the use of advanced technology to refine whey in order to extract the highly bioactive peptide ‘subfractions’ of whey such as lactoferrin, glycomacro peptide and lactoperoxidase, which are found only in extremely minute amounts in the original milk protein. To this end, various processes such as ‘Cross Flow Micro Filtration (CFMA®), ultra filtration (UF), micro filtration (MF), reverse osmosis (RO), dynamic membrane filtration (DMF), ion exchange chromatography (IEC), electro-ultrafiltration (EU), radial flow chromatography (RFC) and nano filtration (NF)’[3] are employed.

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[2] 'The Value-Added Whey', Food Engineering Magazine 02/01/2002, at http://www.foodengineeringmag.com/Articles/Feature_Article/9cb66c903 42f8010VgnVCM100000f932a8c0.

9. In a paradoxical turn, with US exports of whey reaching £435 million in 2000, the market for whey-based ‘designer protein’ has become more valuable to manufacturers than the staple dairy products themselves – as reflected in the industrial cheesemaker’s motto, ‘cheese to break even, whey for profit’. Concerns have even been raised that the overpromotion of and increased demand for whey may lead to overproduction of milk, and a devaluation of traditional dairy products; although industry-funded researchers find such concerns weigh little against the economic benefits promised by the continued expansion of whey markets.[4]

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[3] W. Brink, ‘The Whey It is’, at http://www.bodybuilding.com/fun/willbrink3.htm.

[4] http://vivo.cornell.edu/individual/vivo/individual20909.

10. The 'recipe' that prefaces this text describes the stages of production in an innovative whey-processing plant. It is notable that this process still excretes its own waste products; namely the fluid from which all the crystallized solids have been removed. However in this case such waste is put to ingenious use:

> By the end of the process, virtually all solids have been removed, leaving only 155,000 gallons of water. Some of that water is routed through a polisher, then through a UV system before being chlorinated for use in plant wash down ...[5]

11. Thus, incremental industrialisation and redistribution of the means of production has seen humans usurping the role of the pig in productively absorbing whey. Sophisticated instruments of chemical analysis, together with the development of new 'luxury' markets, have allowed the Pig Function to be transferred to humans via a highly complex technological apparatus. A synergy between synthetic food-production processes and culturally-augmented desires has rendered whey palatable to the human, who is thus prepared to inherit the Pig Function, enjoy it, and pay for it.

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[5] 'The Value-Added Whey'.

12. Such byzantine embellishments of the simple 'virtuous circle' of the whey-consuming farmyard pig bring irresistibly to mind agrosophist[6] Waylon Susskind's definition of Extravagance:

> By 'extravagant' we understand, from the Latin *extravagare*, a 'wandering outside': The concept combines the notion of an *expenditure* lacking all restraint (the solar economy as destiny of entropic abolition) and an *errancy* (owing to the legacy of material accretions) whose product exhibits excessive elaboration, even absurdity (from the point of view of the most economical route to that destiny).[7]

According to Extravagance Theory, in striving to dissipate the disequilibrium that results from energy being trapped within the constraints of a legacy of material accretions, energetic systems generate new, overcomplex structures. Susskind, the pioneer of Extravagance Theory, asked whether we could understand a psychic process such as Festinger's 'cognitive dissonance' within such a perspective, with reference to Freud's original thermodynamic model for psychoanalysis:

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[6] For historical background documents on agrosophy and neo-agrosophy, see http://www.fieldclub.co.uk/.

[7] Susskind, W. 'The Principle of Extravagance' (Newton Abbott: Maphusis Press, 1968), 133-4. See also Susskind, W. 'Capital, Extravagance, and Excess', *Neo-Agrosophical Transactions* 1:3, 1976.

If the mind is understood as an energetic/economic system with tendencies toward concentration and dispersion, and problems or 'complexes' in which psychic energy becomes trapped or knotted, then its elaborate *symptoms* would be the result of frustrated processes of re-equilibriation. Festinger understands cognitive dissonance as precisely a kind of tension (between two or more cognitions) or intensity, demanding resolution or dissipation.[8] The mind will find a way, no matter how extravagant and circuitous, to discharge tension, to relieve pressure, and Festinger's studies address various otherwise inexplicable cognitive contortions that can result from the adjustments through which persons attempt to achieve the required dissipation.

For Susskind the crucial point is that these adjustments also tend to contort the surrounding milieu; so that in attempting to *solve* the problem (dissipate the intensity or dissonance), one often *changes* the problem, engendering new disequilibria, new dissonances. The essentially entropic 'process of re/equilibriation', seeking to discharge problems or differences, since it is always already implicated in its own prior productions, only frustrates itself, becoming the source of further, ever more 'extravagant' novelty, difference, or intensity.

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[8] Festinger, L., *A Theory of Cognitive Dissonance* (Stanford: Stanford University Press, 1957).

13. Evidently, the attempts described above to 'solve' the 'whey problem' (itself only the product of a previous 'solution', etc.) answer to such a description. We would concur with Susskind's contention, for too long dismissed in neo-agrosophist literature as a mere aside, that *'the hominid appropriation of the Pig Function presents a striking index of anthropogenic Extravagance'*.[9] In what follows, we shall explore in more depth the context and history of this appropriation.

14. In the peak period of reliance on the pig as a semi-domesticated food source (after the Roman period, up to the eleventh century) pigs were taken to 'pannage' by swineherds (Fig. 1, Section 2), to forage on acorns in forests (the Domesday Book measured woodland in terms of how many pigs it could support).

Pannage employed what were essentially domesticated wild boars to process beechmasts, acorns, and fungi (all foodstuffs relatively unpalatable to humans and only eaten by them in times of severe crop failure). In a certain sense, then, the pig was already being used to exploit by-products of the forest ecosystem that would have 'gone to waste'.

15. Nevertheless, the notion of pigs feeding on *human* waste only emerged later (Fig. 1, Section 3), in part as a by-product of deforestation and the advent of industrialisation. The gradual reduction of woodlands after the Norman Conquest, and the restriction on times of the year that pigs were allowed to roam free in them, were major factors in the decline of pannage.

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[9] Susskind, *Extravagance*, 212.

The erosion of the forests heralded a significant intensification of the Pig Function, as pigs were absorbed into household economies and became 'the Husbandman's best Scavenger, and the Huswives most wholsome sink; for his food and living is by that which will else rot in the yard [...]; for from the Husbandman he taketh pulse, chaff, barn dust, man's ordure, garbage, and the weeds of his yard: and from the huswife her druff, swillings, whey, washing of tubs, and such like, with which he will live and keep a good state of body, very sufficiently ...'.[10]

The Enclosures Acts, eliminating common land and limiting access to the remaining woods, produced a flow of deterritorialised labour power, with these husbandmen compelled to become labourers first on farms (as cottagers with a pig kept in the backyard) and later in factories, leading to the mass exodus from the countryside and the growth of the cities. In many cases, in a last ditch attempt to hang on to the autonomy to which they were accustomed, they took with them their pigs, which continued to perform their function by eating the family's waste.

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[10] G. Markham, *Cheap and Good Husbandry* (13th ed, 1676), 100; quoted in R. Malcolmson & S. Mastoris, *The English Pig: A History* (London: Hambledon Press, 1998), 36.

The value of this waste disposal only added to the importance of an animal that yielded a range of appealing foods, and was for most cottagers the principal supply of animal fat that was 'relatively non-perishable and affordable'.[11] Every part of the pig was used:

> While local custom and tradition affected the details of dealing with the dead pig and disposing its various parts, the general practice was certainly to use, in some way or other, as the folk saying put it, "everything but the squeal".[12]

At this point in the process of deracination-by-capital, for both country and city labourers the pig could represent the difference between prosperity and abject poverty.

16. The mid-nineteenth-century expansion of the cities led to problems of sanitation and the outlawing of the city pig (a scape-pig? But this question must be reserved for another time...). In this period, with the rise of commercial farming, pigs became an indispensable organic machine-part in breweries and distilleries in London and in large-scale dairies in other areas:

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[11] Malcolmson and Mastoris, *The English Pig*, 115.

[12] Ibid., 109.

'[I]n Farms where there are large Dairies, 'tis necessary that to each Cow there should be an Hog, for the Offals of the Dairy' (Fig. 1, Section 4).[13]

More intensive methods of pig-husbandry therefore developed in an unplanned synergy with other concentrated food-production processes that provided them with bulk foodstuffs such as whey. Only because of the earlier developments discussed above did the pig appear typecast as a natural candidate for this waste-disposal role. And, as we have seen, its position in this new techno-ecosystem – its status as sole representative of the Pig Function – was far from being assured for perpetuity.

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[13] Bradley, *Gentleman and Farmer's Guide* (1732), 77; quoted in Malcolmson & Mastoris, *The English Pig*, 37.

AVIAN INTERLUDE

A third party bears witness to the co-implicated history of pigs and human agriculture, and the transference of the pig-function to humans: The robin. It is in England's island ecosystem alone that robins became 'the gardener's companion' – a tame garden bird fond of accompanying humans in their horticultural pursuits. When deforestation and the hunting to extinction of wild boar stripped robins of their previous habit of attending upon boars, waiting for their foraging to turn up the earth and excavate worms and grubs, their habitat shifted and they became companions to humans instead – particularly in the garden, where humans fulfilled the Pig Function, turning over the earth to uncover their morsels.

Norse mythology already anticipates the porco-sapient affinity attested to by the robin, describing how the peculiar rooting action of the boar's terminal snout disk provided a model for the plough, and thus initiated mankind into agriculture. With the introduction of a ring in the snout to prevent the pig from routing and destroying crops, did not early-modern farming practice unknowingly terminate its own mythical foundations in the name of efficiency, becoming a simulacrum, a copy destitute of its original model ...?[14]

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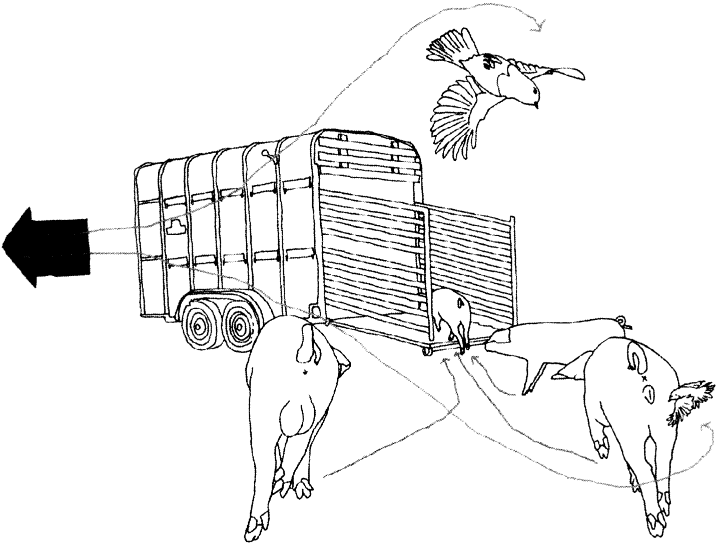
[14] Malcolmson & Mastoris, *The English Pig,* 76.

This assault on the mythic core of pigdom is not only a striking vindication of our thesis, but also a stark indicator as to the profoundly ominous nihilistic undercurrents subtending the hominid appropriation.



17. We have seen that the radically omnivorous pig we love to despise – the 'greedy pig' – is largely an artefact of Extravagance, a cultural animal co-evolving with, and catering for the appetites of, industrialised and urbanised humans. Although it has ancient roots, the Pig Function was fully developed only during early capitalism, through an opportunistic harnessing of the animal's latent potentialities.

The Pig Function, therefore, cannot be said to 'belong' to the pig at all. Actually-existing pigs, far from being – as in the popular imagination – the very model of an uncritically omnivorous creature enthusiastic to hoover up every kind of trash, whether whey powder or other animals' excrement – merely incarnate a function nurtured by mankind. Mankind, however, is destined to usurp the pig's role and incarnate this function itself – *because pigs have no spending power*. So long as pigs monopolise the function that bears their name, they prevent it from becoming a locus for the extraction of surplus value. In short, as fat as it may be, the pig is an intolerable retard when it comes to expansion. A hostile takeover is well overdue, in order for the Pig Function to fulfil its true economic potential.

Far from being instinctively exaptive, the pig was a reluctant domesticate, tempted out of the forest by the waste spilling over the rim of human society. Consider, nonetheless, the transformations that our interspecies romance has brought about: From wild boar to pig, with a concomitant change in the imaginary (from noble forest animal with more in common with wolves than cows[15] [Fig. 1, Section 1] to derided farmyard fatty) in parallel with the move from hunter-gatherer to agriculture.[16]

Although the 'remarkable change in phenotype' over the ten thousand year period since agricultural domestication[17] is irreversible, there can be no doubt that when it becomes possible, our Extravagance will see us eat our own shit – and pay for it – and the pig will finally be decoupled from the function that has temporarily borrowed its name, released from the labyrinth of Extravagance to wander its own porcine path once again. For capitalism, that great problem-solver and supreme engine of Extravagance, is more omnivorous than the pig.

IRONIC POSTSCRIPT: THE HUMBLE ACORN

What of pannage? In its golden age, pannage had formed part of a complex forest ecosystem. The rare examples of such ecosystems that survive today supply the top-end specialist luxury 'foodie' market. A website marketing *jamón ibérico de belotta*, an astronomically-expensive ham made from acorn-fed pigs who roam the forests on the Spanish-Portugese border, gushes:

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[15] Ibid., 5.

[16] Ibid., 2.

[17] See L. Andersson, 'The Molecular Basis for Phenotypic Changes During Pig Domestication', in U. Albarella, P. Rowley-Conwy, K. Dobney & A. Ervynck (eds) *Pigs and Humans:10,000 Years of Interaction* (Oxford: Oxford University Press, 2007), 42.

> This brings us to the humble acorn, known as the 'bellota'. Many centuries ago, the rulers of western Spain decreed that each town and village should create pastures studded with oak trees, called the *Dehesa*, for the long term stability of the region. This forest/ pasture continues to serve many purposes. The Holm and cork oaks provided firewood for the people, shade for the plants and livestock, cork products, and acorns (*bellota*) during fall and winter. During the spring and summer cattle and sheep graze the fields. During the fall and winter, when the acorns are falling from the trees, the pigs are released to fatten up. This ancient human-created ecosystem survives intact to this day.[18]

The same site offers 'True Acorn-Fed Iberico Cured Shoulder' for sale online, for the princely sum of $34.50 for 4 ounces. Feeling extravagant?

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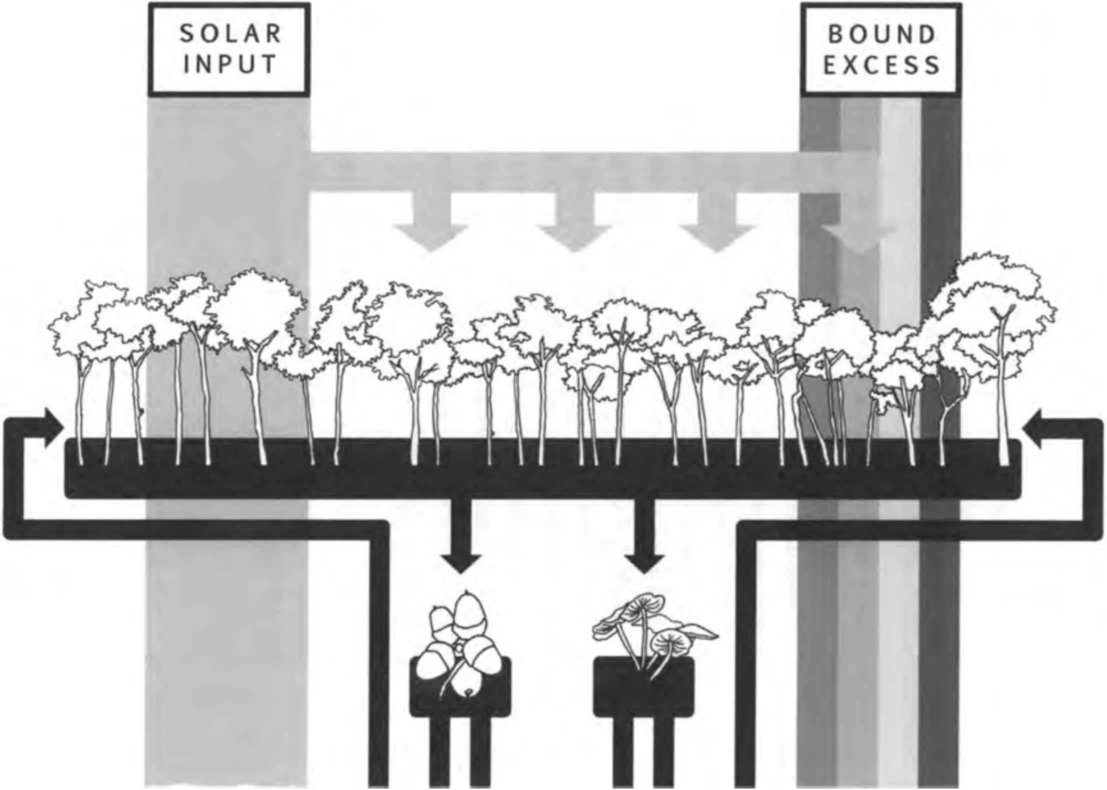
[18] http://www.jamon.com/iberico.html.


SOLAR INPUT
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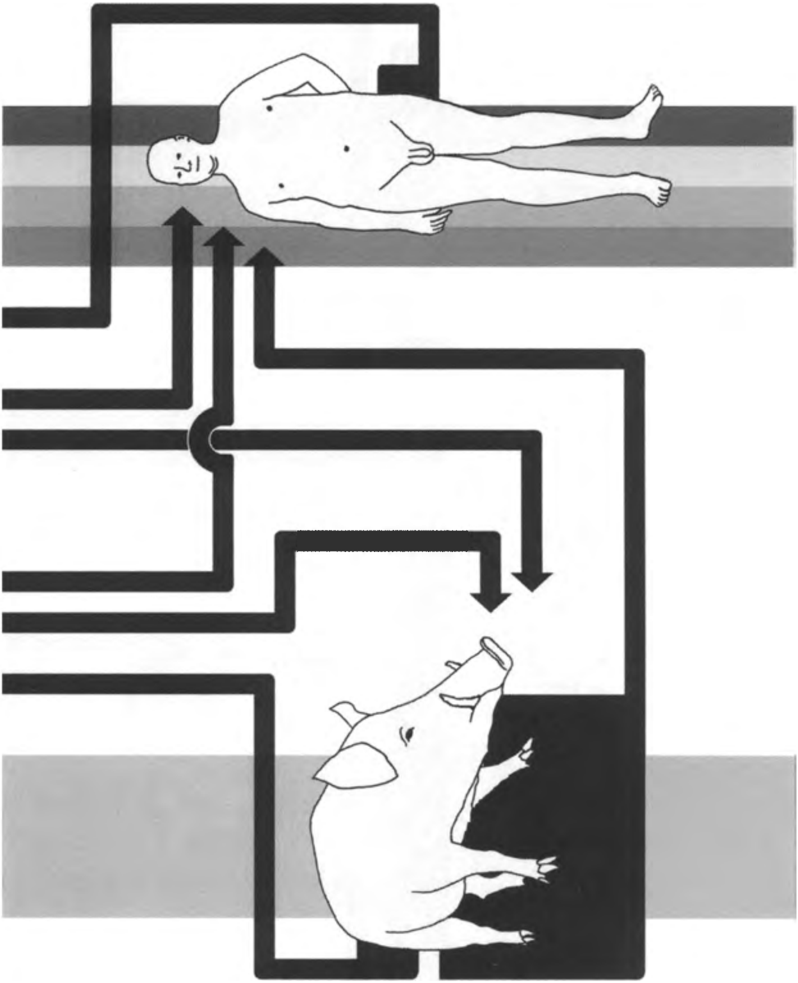
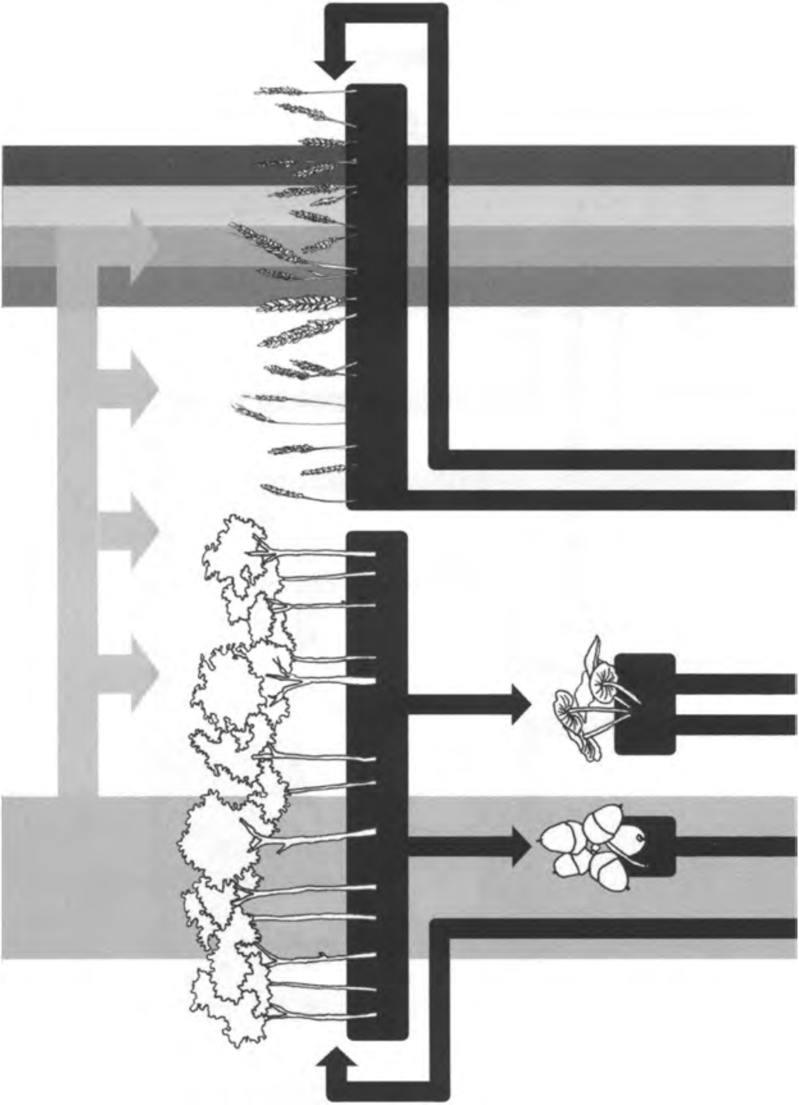
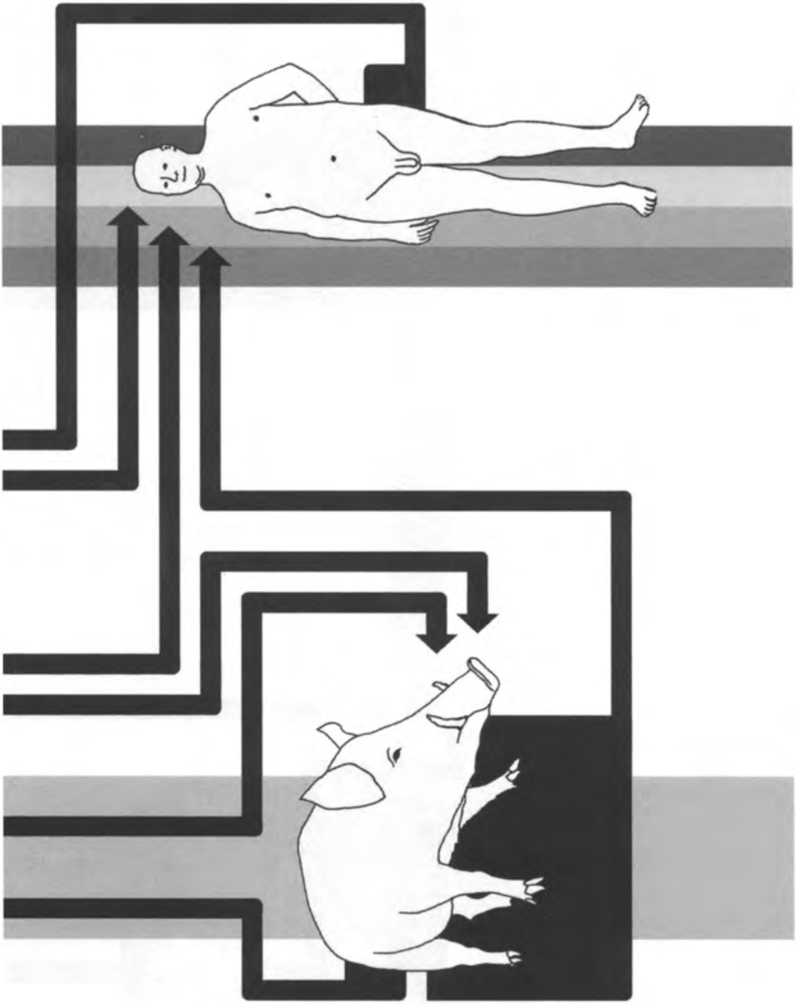
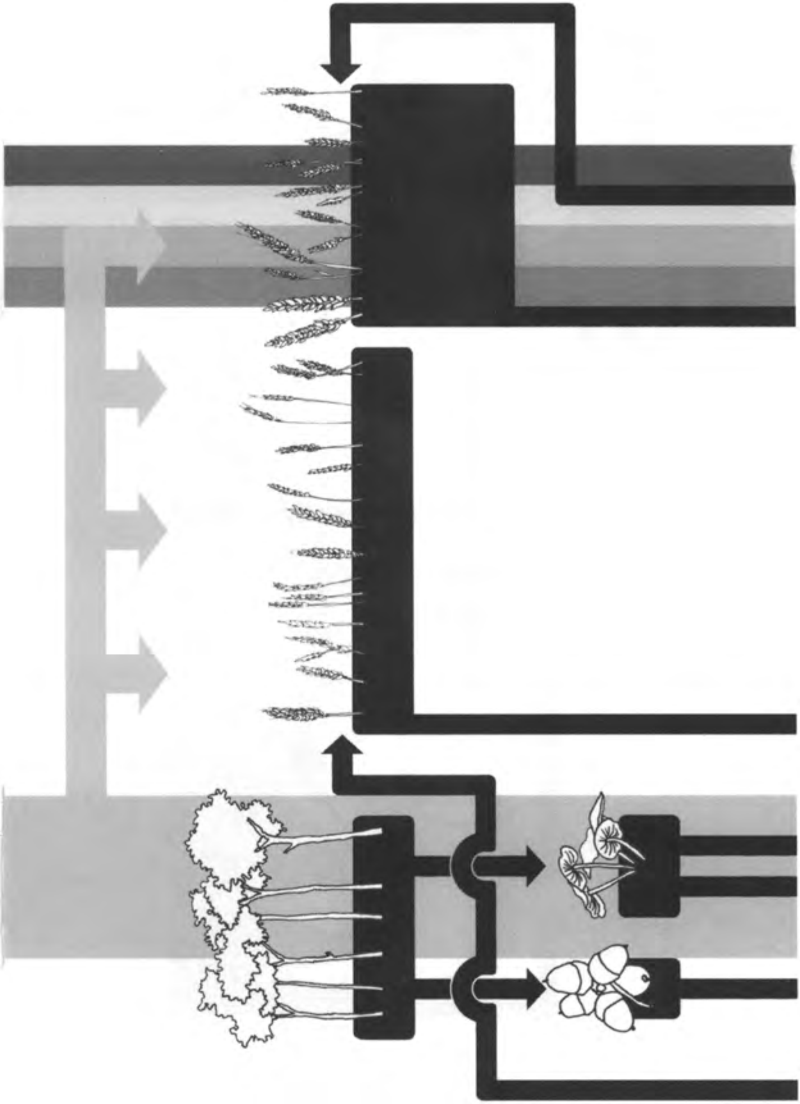


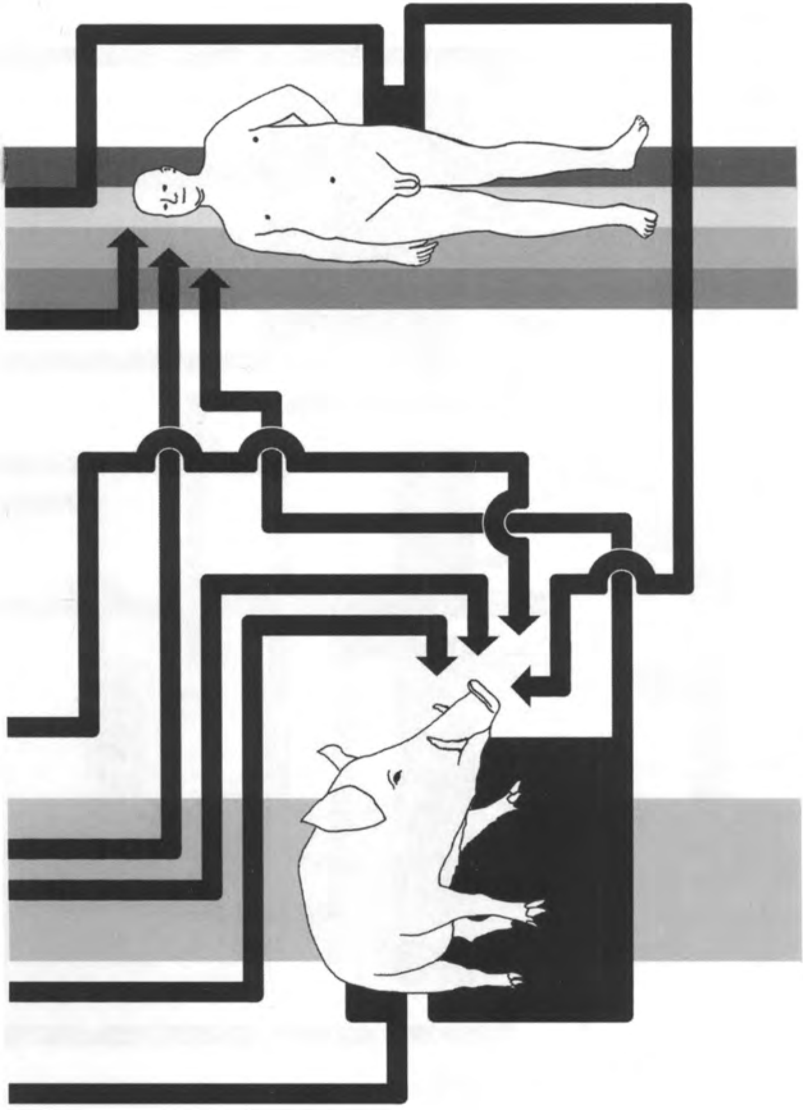
Fig. 1. Historical development of Extravagance in the Pig Function.
1. Forest porcosystem BP [Before Pannage]



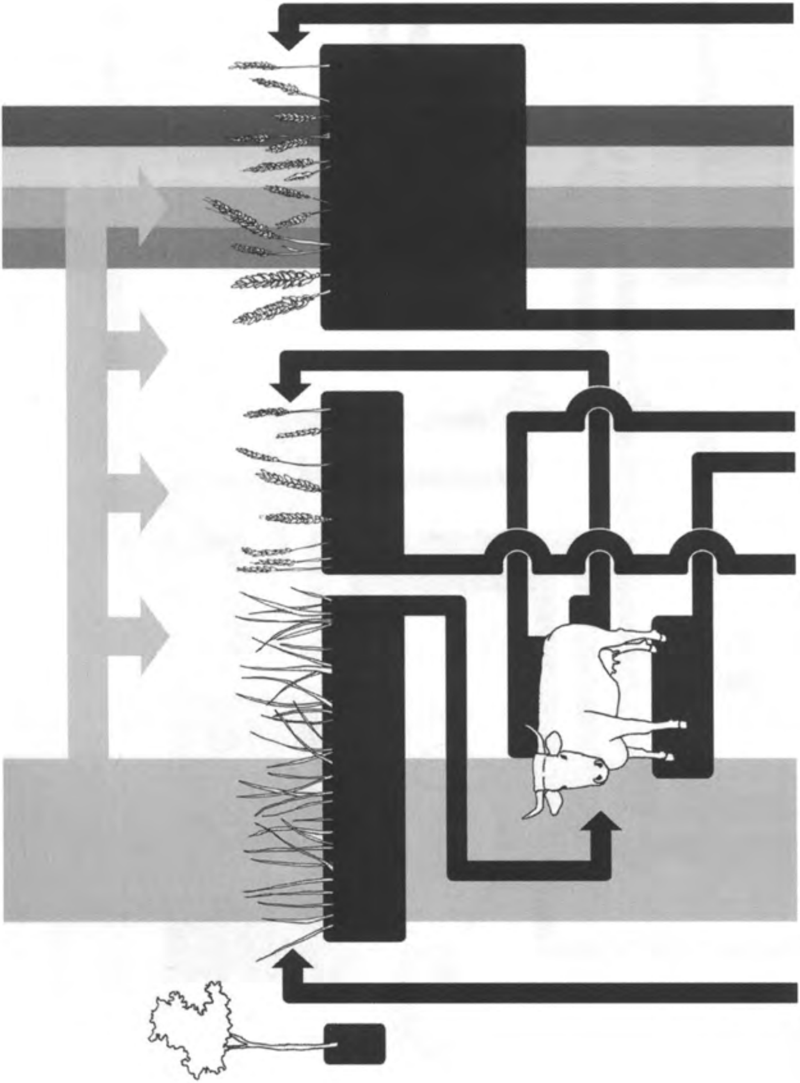


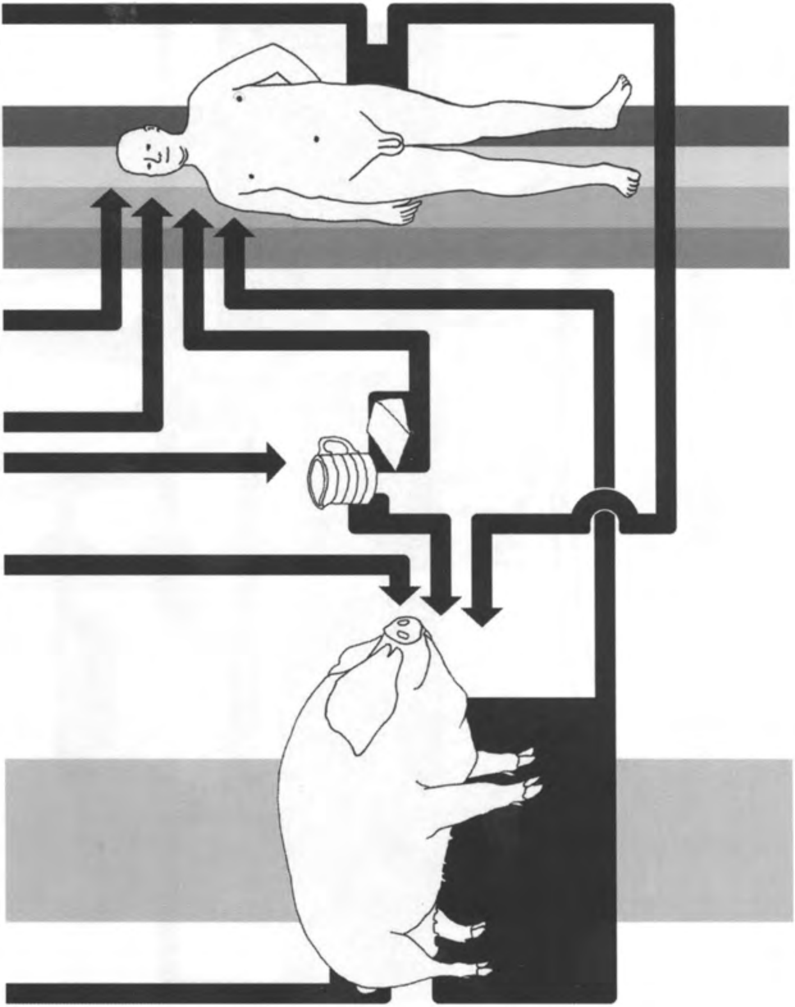
2. Heyday of pannage
(Roman period – 11th century)



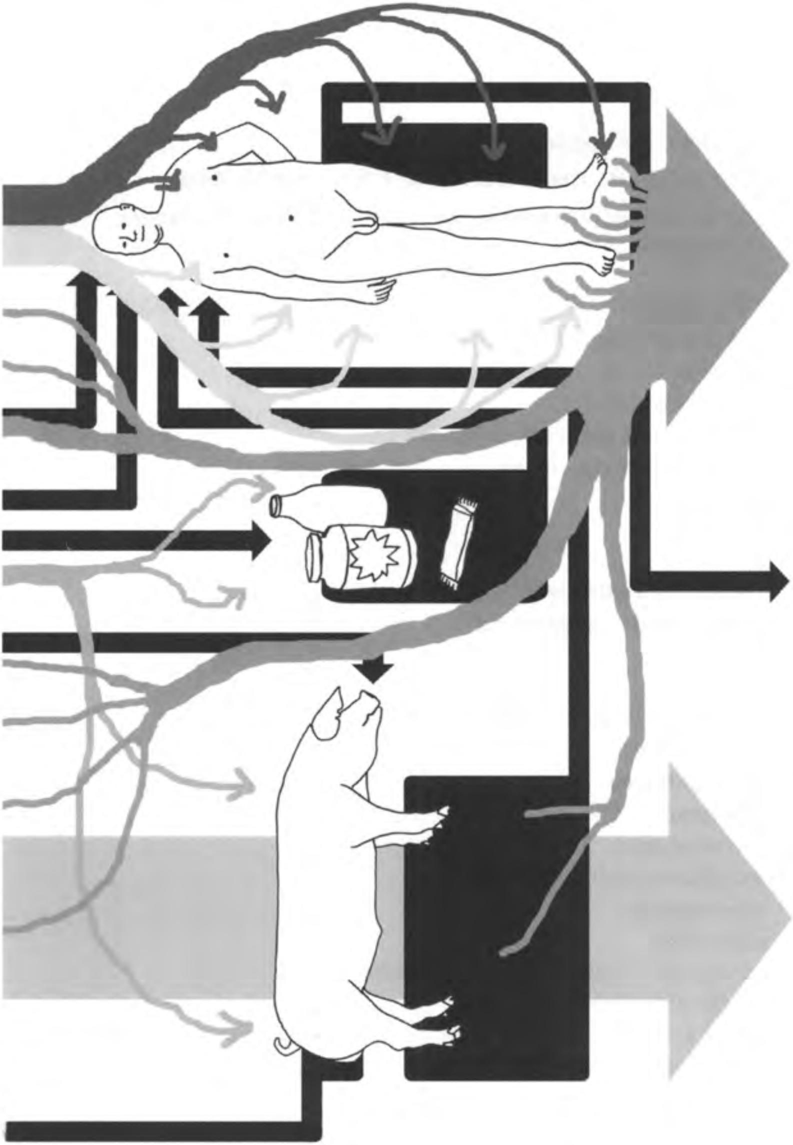


3. Decline of pannage
(Norman conquest – 16th century)





4. Proto-Industrial Pig
(16th – mid-19th century)



5. Porcine Extravaganza:
Industrially-augmented function transferral period (20th century)

A TASTE OF HOME:
THE HOOAH! CHOCOLATE CHIP ENERGY BAR

Has an optimal 4:1 carb-to-protein ration. Provides 17 vitamins and minerals.

Corn syrup
soy protein isolate
fructose
maltodextrin
fractionated palm oil
unsweetened chocolate
rice flour
dextrose
glycerine
cocoa (processed with alkali)
whey protein concentrate
dates
raisins
barley malt extract
soy lecithin
natural flavor
rice bran
ascorbic acid
d-alpha-tocopherol acetate
niacinamide
zinc oxide
tocopherols added to protect flavor
pyridoxine hydrochloride
riboflavin
thiamine mononitrate
folic acid
vitamin B12

The New Alimentary Continuum

Rick Dolphijn

> *As you might have expected, I have a message for you from control.*
>
> ZILLATRON *LORD OF THE HARVEST*

AN ECONOMY OF SPEED

On 25 October 1832, President Andrew Jackson signed an order that was to replace the rations of rum, whiskey or brandy, as they had been given to his soldiers before, with sugar and coffee (Army General Order No.100). Jackson's Executive Order was recognized by Congress in July 1838. Since the 1820s, Secretary of War John C. Calhoun had already warned against the harmful effects of alcohol for field operations, favouring coffee instead, yet the actual replacement of alcohol with sugar and coffee, at the rate of four pounds of coffee and eight pounds of sugar per 100 rations, cannot merely be seen as a negative response to alcohol consumption. The change from alcohol to caffeine was the first sign of a new economy of violence which increasingly controls the world today. It is an economy that is all about speeding up the strategies and tactics of the now omnipresent battlefield.

It should be noted that neither sugar nor coffee were products of mass consumption at that time. By introducing them to the military diet, into *solde*, President Jackson invented the first of a whole series of revolutionary weapons through which (US) military intelligence speeded up modern life. For although designed for military use, these weapons all became customary mass consumption products. It was World War One, in particular, that introduced sugar and coffee (and also chewing gum), together with their economy of speed, to every household around the world. Turning every body into the body of a soldier, the twentieth century thus became the time in which all of these military, alimentary machines, that had remained largely virtual for so long, turned viral. Radically new undercurrents have spread throughout the earth, breeding new life that today controls all the mouths in the world, feeding them Martial Law, creating a universality that is determined by notions of warfare, subjectivity and territoriality. Virilio is right to insist that in our days the fabric of war is everywhere. It has sunk deep into the earth, into every object, into all of us. But his 'Pure War'[1] is not just to be found in and around technique.

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[1] P. Virilio, *Pure War* (Los Angeles: Semiotext(e)/Foreign Agents, 1983).

Claude Lévi-Strauss[2] had already told us that nutrition and alimentation (and not copulation) conceptualizes space (and not time), making edibles (virtual as they might be) the most elementary of all hyperobjects, the primal strata, the first and foremost of the 'phenomena of thickening on the Body of the Earth'.[3] This new military regime too, starting by replacing alcohol with caffeine, reaches well beyond proposing us particular products to consume. Its desire to speed up every body is also enacted by setting out new paths of food preparation (the microwave oven and more recently, flameless heating) and of ways to keep products fresh at all times (canning, sterilization, and more recently, zein packaging). But these are only a few of the formalizations and quantifications produced by the machinery that today keeps *everything* in a permanent state of emergency, as Virilio would put it. It has brought us wholly other physicochemical, organic and anthropomorphic contours of the earth, opening up a whole new and unforeseen arsenal by means of which life on earth is controlled and will proceed.

Today, as part of the First Strike Rations, US soldiers are offered large amounts of carbohydrate (maltodextrin) and caffeine – presented to them, of course, in a much more refined way than was the case two hundred years ago. Field marshals in our times are given mocha energy bars fortified with 200 mg of caffeine, or chewing gum with 100 mg of fast-absorbing caffeine per piece, along with central nervous system stimulating d-amphetamines (commonly referred to as 'speed') and Modafinil, a (new) synthetic drug currently being tested by the Defense Advance Research Projects Agency (DARPA). In line with these new rations, the discourse surrounding food additives has of course taken a more 'scientific' (read 'Taylorist') turn over the years. Tests with modafinil discuss the increase of cognitive performance in sleep deprivation situations,[4] its thermogenetic and aggression-increasing effects. Today, the US Army proudly informs us about its improved caffeine additives,[5] claiming to have increased soldiers' 'usefulness' from 48 to 68 hours (when taking a piece of gum every two hours). The chewing gum is named 'Stay Alert', which nicely summarizes what the large amounts of caffeine are supposed to do: to maintain the troops in a perpetual state of emergency. *Stand up straight. The enemy is here.*

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[2] C. Lévi-Strauss, *The Origin of Table Manners* (Chicago: Chicago University Press, 1978), 190.

[3] G. Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: Minnesota University Press, 1987), 502.

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[4] See for instance J.V. Baranski, R. Pigeau, P. Dinich, I. Jacobs, 'Effects of Modafinil on Cognitive and Meta-Cognitive Performance' in *Human Psychopharmacology: Clinical and Experimental*, Volume 19, Issue 5, 2004: 323-32).

[5] Committee on Military Nutrition Research, Food and Nutrition Board, Institute of Medicine, *Caffeine for the Sustainment of Mental Task Performance: Formulations for Military Operations* (National Academies Press, 2001).

FRAGMENTS OF THE HISTORY OF THE FUTURITY OF WAR

Although of vital strategic importance, alimentation is still poorly developed in military theory. Famously, Napoleon is supposed to have said that an army marches on its stomach; but, at least in the occidental tradition, military theorists prefer to pay homage to the work of Carl von Clausewitz (1780-1831), whose strategies of the battlefield only mention the soldier's body when it comes to the question of shelter.[6] His famous adage 'war is the continuation of politics by other means' is certainly still valuable for us; but in approaching this notion of politics from the alimentary point of view, we should not focus too much on the Apollonian romanticism of Clausewitz and instead (for a start) turn to his Dionysian predecessor, Frederick the Great of Prussia (1712-1786). Frederick, an artist, *bon-vivant* and very successful military leader, was perhaps one of the first generals in the West to emphasize that 'the first object in the establishment of an army ought to be making provision for the belly, that being the basis and foundation of all operations'.[7] This indeed is a very different point of departure to that of the Clausewitzian tradition.

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[6] General Carl von Clauzewitz, *On War* (Brooklyn, NY, Brownstone Books, 2009), 116.

[7] See T. Foster. *Military Instructions from the Late King of Prussia to his Generals* (London: Cruttwell publishers, 1918), 7.

Our minor alimentary history of warfare then brings us to William Tecumseh Sherman (1820-1891), the famous general of the Union army in the American Civil War, who, following the aforementioned President Jackson, seems to develop Frederick's politics further, stating that:

> [t]he feeding of an army is a matter of the most vital importance, and demands the earliest attention of the general entrusted with a campaign. To be strong, healthy, and capable of largest measure of physical effort, the soldier needs about three pounds gross of food per day, and the horse or mule about twenty pounds ... Probably no army ever had a more varied experience in this regard than the one I commanded in 1864-65.[8]

With Sherman, Frederick's emphasis on alimentation was rewritten dramatically. Frederick considers the food intake of soldiers 'the basis and foundation of all operations', in other words as the most important *preparation* for the battle to come (food) or *celebration* after it is won (alcohol). The Executive Order by President Jackson, as echoed in Sherman's style of warfare, however, has accelerated into a continuous set of *interventions*, into continuously taking action via alimentation, thereby actually making alimentation a *central means* of warfare (deterritorializing dominant ideas on logistics, strategy *and* tactics). Sherman fully included the body of the soldier as part of a total machinery that no longer has time to prepare for a battle to come or to celebrate when it is over. With Sherman the soldier is always already actively intervening. Sherman gave us the soldier who has to keep on drinking coffee and chewing gum.

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[8] In O. Connelly, *On War and Leadership: The Words of Combat Commanders from Frederick the Great to Norman Schwarzkopf* (Princeton, NJ: Princeton University Press, 2005), 24.

Military historians had already noted Sherman's ability to move deeply into enemy territory fast, which again draws our attention to the new weaponry he made use of, the new idea of the motor he applied. It is remarkable that, in terms of the semiotics of warfare that still dominates academic thought in this area, Sherman appears only as the merciless general who so successfully practiced a scorched earth policy against the Confederate States (during his March to the Sea, for instance). This was only his rewriting of Sun Tzu's famous claim that 'each pound of food taken from the enemy is equivalent to twenty pounds you provide by yourself'.[9] Sherman understood the black earth, the chemistry of distribution. He knew that to control the alimentary continuum he had not only to feed his soldiers continuously; he had also to starve the enemy forces. To control alimentation is to control life.

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[9] Sun Tzu, *The Art of War* (Boston: Shambhala, 1988), 28.

In Sherman's generalization of the alimentary principles we can spot fragments of a style of warfare that emphasizes a control of *life as a whole*. Sherman's new strategies prehended the new processes of subjectification that were to dominate the earth and to alter its synthetic and chemical horizon accordingly. Of course the promotion and development of performance-enhancing foodstuff comes with the activation and addition of desirable enzymes and micro-organisms as well as the inactivation and exclusion of unwanted enzymes and micro-organisms from edibles and from the earth. But this politics of speeding up is a *human* endeavour, as it comes with a reterritorialization of the entire earth (and all of its possible life) upon these new (accelerated) processes of subjectification. Adding organic micronutrients such as Vitamin C might accelerate the human being, it does not affect the animal. Or even worse: adding Glyphosate (a systemic herbicide) to our foodstuff (such as soy) kills competing weeds, but is also toxic to aquatic organisms and especially amphibians.

Sherman's military style in the end burns the earth as it creates, feeds, breeds, enriches, grafts, as it accelerates a new earth to come. It once again shows us that a *military style* has never been just a blackboard strategy 'designed in order to achieve some end', such as Wylie and Caldwell Wylie consider to be a common ground for military styles in literature.[10] Rather we agree with them when they conclude that '[w]hat is necessary is that the whole of the thing, all of war, be studied. The fragments of war, the minor parts of strategy, the details of tactics, are quite literally infinite'.[11] Military styles are to be defined pragmatically or empirically as a set of 'mechanism-independent, structure-building singularities ... capable of being incarnated in many different physical mechanisms'.[12] Sherman's first attempts to control life as a whole are still very elementary compared to how this is practiced by US military intelligence in the twenty-first century. They do however announce this whole, total politics. His experiments do not anticipate the contemporary scenario, but they were the first attempts to grasp its motor.

Todays Meals, Ready to Eat (MREs) – the field rations served by the US Army to its troops in combat – and the machinery that surrounds them (crucial parts of it developed by the Soldiers System Centre in Natick, Massachusetts) perform the quantum leap that fully achieves the economy of speed. The new alimentary continuum has now installed itself, distributing a chemical and synthactical whole that accelerates all. It became fully operational in January 2003, when

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[10] Rhodes, James F., *History of the United States* (Vol. V. 1864-1865, Ch. XXIX) [1904] (Port Washington, NY: 1967), 14.

[11] Ibid., 12.

[12] M. DeLanda, *War in the Age of Intelligent Machines* (NY: Swerve Editions, 1991), 18.

Donald Rumsfeld, the illustrious State Secretary of Defense in the first George W. Bush administration, concerning the torment of Mohammed al-Qahtani at Guantanamo, approved of new 'interrogation methods', many of them already described in the Army Field Manual. Apart from putting them in isolation, changing their sleep schedules, and making temperature adjustments in order to disorient them, Rumsfeld also denied them hot rations and limited their intake to MRE products.[13] The interrogation log of detainee 063 (al-Qahtani) from 23 November 2002 already shows this new policy in action: '0755: The detainee ate the entire MRE plus an extra cereal bar'.[14]

ALIMENTARY REGIMES

Agamben concludes that '[w]hat is new about President Bush's order is that it radically erases any legal status of the individual, thus producing a legally unnamable and unclassifiable being. Not only do the Taliban captured in Afghanistan not enjoy the status of POWs as defined by the Geneva Convention, they do not even have the status of people charged with a crime according to American laws'.[15] Rumsfeld's new interrogation methods seem to practice this biopolitics; his take on the deregulation and acceleration of the tormented body is indeed in no way obstructed by civil rights. Furthermore, and this is perhaps of even greater importance, here the prisoner and the soldier are being controlled by *the same weaponry* (the MRE). It no longer matters whether the body in question belongs to a US civilian or to someone else. Rumsfeld's tactics of immanently speeding up (and slowing down) the body through MREs reveal to us the new ideas of territoriality that come with the control of the biosphere, excluding or even removing *zoé*. All must be controlled.

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[13] Stuart Taylor Jr. and Benjamin Wittes, 'Refining Immigration Law's Role in Counterterrorism', in B. Witten (ed.) *Legislating the War on Terror: an Agenda for Reform* (Washington: Brookings Institution Press, 2009): 289-345, 305.

[14] Interrogation log detainee 063. Viewed at: http://ccrjustice.org/files/Publication_AlQahtaniLog.pdf (last visited 5th of May 2011).

As the proper (Foucauldian) archaeologist knows, digging further into the fertile soil will inevitably recover the villain – the outsider that endangered classical or feudal power – as well as the delinquent – the insider that fell short and must be treated accordingly. Just as there is more than one type of criminal to be found in the earth, Deleuze and Guattari, following Virilio, show us that all processes of grounding imply the production of a certain type of soldier, a style of hunting, a way of catching the prey. It all started with the nomad-soldier, the hunter, who invented war.

War was accidently invented by animal-raising nomads as a consequence of the machinery, the kinetic energy of the hunted animal that was now being conserved. And it was this process (this style of conservation) that was reinvented several times in history. Most importantly this meant that the dominance of the nomad-soldier was succeeded by the peasant-soldier and the citizen-soldier[16] that are in one way or another related to the aforementioned villain and delinquent. The hunter comes into being at the moment he '... captures the force of the hunted animal',[17] introducing us to an alimentary economy of violence that has reinvented the earth ever since. Conserving the kinetic energy of the hunted animal – or rather the particular *style of conservation* – thus gave form to the earth, installing the regime of the nomad-soldier that was succeeded by the peasant-soldier and the citizen-soldier,[18] introducing us respectively to the villain and the delinquent.

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[15] G. Agamben, *State of Exception* (Chicago: University of Chicago Press, 2005), 3.

The various types of soldiers Deleuze and Guattari conceptualize can, then, be addressed as *alimentary figures* that come with new styles of conservation, new ways of catching prey. The initial force of the nomad hunt is the pure, raw and untamed alimentary force. The peasant soldier, inventing sedimentary continuity (spatiotemporal fixation) introduces us already to a very different regime of consumption, by means of which a territoriality is introduced that places war at its margins (which thus have to be protected). The citizen soldier, by inventing the city *and* the countryside (the capitalist opposition between consumption and production) fights for surplus and needs land in order to enlarge the hierarchy.

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[16] Deleuze and Guattari, *A Thousand Plateaus*, 399.

[17] Ibid., 396.

[18] Ibid., 399.

Yet, as history is neither universal nor finite, there have always been a multitude of war machines crawling around (in and out of) the surface of the earth, some more successful than others, some more resilient, more powerful, more capable of acceleration. Deleuze and Guattari already mapped many of them, some quite far removed from the more conventional definitions of war common in literature (which is why Paul Patton proposed to reconceptualize their 'war machine' as a 'machine of metamorphoses').[19] Think of the war without battle lines, proper to the Chinese game of Go, and compare this with Simoons analysis of the dominancy of the Han-Chinese:

> In their southward migration, the Chinese, a literate people who had the only system of writing in East Asia from the second half of the second millennium BC until the second century AD, faced a similar situation but acted very differently from the Anglo-Americans in their westward expansion across the United States. Whereas the Anglo-Americans largely

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[19] Paul Patton, *Deleuze and the Political* (London, New York Routledge, 2000).

> eliminated or displaced the aboriginal inhabitants, the Chinese commonly settled among, and ultimately absorbed them.[20]

This wholly other strategy, at work in the past as it is today (with the emergence of Chinatowns, with the current consumption by China of Africa) practices a very different type of 'warfare'; or at least, it hunts differently, works by means of a very different notion of territoriality (and of alimentation, for that matter).

But even if we 'limit' ourselves to studying warfare (a small minor consequence of the war machine), it is not too difficult to see various new styles or chemistries appear. Especially in the last fifty years, in which Occidental battle traditions have more and more been challenged by other styles which had been successful in warding off their hunting techniques with remarkable ease. First, the Vietnam war saw the French (and the US Army) '[c]onfronted by an opponent who offered neither a front not a solid rear to target…',[21] but instead invented jungle-space and expanded it into many unknown dimensions – think of the Cu Chi tunnel systems. How different this jungle notion of territoriality is from the way the civilian-soldier intends to cultivate its own land: No two-dimensional Cartesian grid here, that needs its lines to separate the inside from the outside, the good guys from the bad guys (consumption from production, city from countryside). The Cu Chi tunnel systems are nothing but a mirror of the interlacing drainage and irrigation canal systems that has traversed this part of the earth for ages. The flows of water, of the undulating surfaces of the paddy fields (*sóng lúa*) follow this earth, its winds, its rocks, its Mekong floods. The civilian-soldier turned war increasingly into a capitalist demand for *Lebensraum*, a desire for even more earth (square metres), for spaces of production. He had no understanding at all of *the wormhole-soldier* that, like a stream of water, continuously slips into another dimension. The wormhole-soldier comes close to what Deleuze and Guattari call 'holey space': it is *connected* to nomad space (the nomad-soldier) whereas it *conjugates* with sedentary space (the peasant-soldier).[22] Existing between the two, the hunt of the wormhole-soldier remains unseen, consequently its n-1 dimensionality constitutes a wholly new (unforeseen) weapon system.

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[20] F. J. Simoons, *Food in China: a Cultural and Historical Inquiry* (CRC Press, 1991), 1.

[21] M.A. Hennessy, *Strategy in Vietnam: the Marines and Revolutionary Warfare in I Corps*, 1965-1972 (Westport, London: Praeger Publishers 1997), 56.

With the War on Terror, we are confronted with yet another style, another chemistry of warfare that skirts around the powers of the US Army with even greater ease. In fact, it only needed a one-dollar razorblade in order to defeat all of the billion-dollar defence shields (SDI/SDIO/BMDO/MDA, better known as

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[22] Deleuze and Guattari, *A Thousand Plateaus*, 415.

'Star Wars') that US presidents since Ronald Reagan had launched in order to shield attacks from the Other. And again, this chemistry is first of all a new conceptualization of the earth: earth as xeromorphic desert. Negarestani calls this the Assyrian doctrine of War – 'not a geographical or even a political body, but a sentient process of desertification which can be grasped only by presupposing that war is an autonomous entity free from its provocateurs'.[23] As always, the War starts with the undercurrents, the powers of the Earth which we saw being opened up by the foregoing styles discussed above.

Compared to the multidimensional and *invisible* (alimentary) strategies of the Vietcong (hidden from the logic of the eye), the Assyrian style of hunting is *unvisible* (in full conformity with the logic of the eye) because of its clarity, or better even, because of the transparency of oil (that which speeds it up). For art historians have long told us that it is oil that enlightens everything, that oil equals pure enlightenment. Likewise in dietetics – in which oil, the fattiest of fluids, virtually carries all flavours within it, in full conformity with perception. Or in scientific terms, where '[f]at, it turns out, doesn't just have a flavour, it has *every* flavour. Whereas a sugar solution stimulates only five to ten percent of taste buds, fat stimulates ninety-five percent'.[24] When Negarestani then reminds us that 'Islam does not perceive oil merely as a motor grease – in the way Capitalism identifies it'[25] he suggests to us the *absolute* claim to territoriality and to unvisible presence that comes with this new style of the desert-soldier who, living the Kingdom of God, knows that '… all elevations must be burned down'.[26]

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[23] R. Negarestani, *Cyclonopedia: Complicity with Anonymous Materials* (Melbourne: Re.Press, 2008), 132.

In his performance of seeming-being, the good politician George W. Bush accused his 9/11 enemies of being 'faceless'. This – through Occidental eyes – might seem to refer to a kind of cowardice, but actually it perfectly captures the unvisible, oily, translucid face of Islam that has been staring at him ever since the devastation of Manhattan. Bush's 'analysts', as DeLanda would call them, 'in search for the well-defined patterns of behaviour in their activities …', with their convictions that 'these organizations perform their operations by the book',[27] obeyed the good old mesophytic capitalist war rhetoric, demanding the desert – the xerophytic (an)organism – to express itself, which would then allow them to turn it into the Other possible world to be conquered. Perhaps one day 9/11 (even more than 1989) will prove to have been the point of inflexion at which a biopolitical world order was cut loose from its capitalist calcomania. For now however, it is heating the capitalist system to its (topological) extreme.

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[24] B. Massumi, *Parables for the Virtual* (Durham, London: Duke 2002), 153.

[25] Negarestani, *Cyclonopedia*, 20.

[26] Ibid. 21.

[27] DeLanda, *War in the Age of Intelligent Machines*, 185.

IN FEAR OF THE TERRORIST-SOLDIER

The invisible and the unvisible h(a)unting of capitalist warfare through turbulence, friction (or frictional electricity), collision and attraction, actualized a 'schema of concretization', as Simondon[28] calls it, that is making our present day economy of speed fully operative. For how different is the soldier of today from the civilian-soldier that still pretends to roam the (Romantic) Occidental earth, so well situated in (for instance) the minds of the occidental bankers. And yet everyone knows that contemporary biopolitics has *always already* given us a style of hunting that has sprung from a very different earth, from a very different chemistry of cooking. Contrary to the citizen-soldier, this new regime no longer has any interest in the capitalist trick of temporarily placing criminals (called delinquents) outside of society; it also sees no reason to keep its soldiers on the inside of the State. Similarly, a dualist notion of territoriality (city and countryside, consumption and production) is of no importance anymore. Again, this is what Donald Rumsfeld has taught us with regard to the al-Qahtani case. For indeed, isn't the horrible conclusion we ought to draw from his new policy, that there is no intrinsic difference anymore between the insider (the civilian, the soldier) and the outsider (the criminal, the terrorist)? If there is one lesson to be drawn from the War on Terror as it we have watched it unfold for ten years now, it is that *there is only one terrorist-soldier*. We are all terrorist-soldiers. We all desire to eat/hunt this same earth with fear and are thus formed (subjectified) according to it.

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[28] G. Simondon, 'Technical Mentality', *Parrhesia* 7, 2009: 17-29, 19.

In this new type of warfare, in which the delinquent (the one different individual, that in the end is to be put back into society) is replaced by the terrorist (absolute destruction as at work in all of us), it is not the police (selected citizens) but the soldier that guards the camps (Agamben's territory). Yet he is also the only one who inhabits it. Similarly it is not the judge (the elected citizen) but the soldier that takes action against 'those against us', as George W. Bush labelled the exception: an exception which is at the same time the soldier. And again, this new type of warfare brings with it a particular cultivation of the land (as did nomadic, sedentary and capitalist culture).

In a way the terrorist soldier recalls the nomad-soldier, who, unlike the peasant-soldier and the civilian-soldier, knows no dualism, no division of labour. Yet at the same time it has become even more sedentary than the peasants and the civilians, who still needed their distribution routes to keep going. The terrorist soldier is everyman, is everywhere, includes everything. Even the nomad, barely surviving the capitalist regime, is included in this new continuum. The Israeli army openly admitted that the Deleuzo-Guattarian nomadic idea of 'smooth space' was used in their anti-Palestinian urban guerrilla attacks. 'You are either with us or against us'. All the different compartments familiar to us have folded into one. The terrorist-soldier is, in every sense, the critical threshold of contemporary biopolitics.

Agamben had already concluded that the 'camp', as he conceptualized it, is everywhere: '... the camp is the very paradigm of political space at the point which politics becomes biopolitics and *homo sacer* is virtually confused with citizen'.[29] The camp is everywhere, the State is everywhere and the warzone is everywhere and thus includes all bodies, *consumes* them. 'While prison law only constitutes a particular sphere of penal law and is not outside the juridical order, the juridical constellation that guides the camp is martial law and the state of siege ... As the absolute space of exception, the camp is topologically different from a single space of confinement'.[30] Agamben thus concludes that 'we are all virtually *homines sacri*'.[31]

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[29] G. Agamben, *Homo Sacer: Sovereign Power and Bare Life* (Palo Alto, CA: Stanford University Press, 1998), 171.

[30] Ibid., 20.

[31] Ibid., 115.

The camp is everywhere, and it has been everywhere for a long time. Agamben might prefer to analyse the concentration camps of Nazi Germany, for here (as well as the Soviet Union) the camp may have been introduced as a crucial element of State terror. But in the South African *Boer War* (1899-1902) and even in the American Civil War, similar crude biopolitical strategies were already in use.[32] Yes, in the American Civil War, starring the above mentioned General William Tecumseh Sherman, concentration camps played a crucial role, for exactly those reasons that Agamben conceptualizes in terms of a contemporary biopolitics: to secure the State of Exception. On 10 August 1864, General Grant reported to Washington:

> Every man we hold, when released on parole or otherwise, becomes an active soldier against us at once either directly or indirectly ... If we hold those caught they amount to no more than dead men. At this particular time to release all rebel prisoners North would insure Sherman's defeat and would compromise our safety here.[33]

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[32] See L.A. Horvitz and C. Catherwood (ed.), *Concentration Camps. In: Encyclopedia of War Crimes and Genocide* (New York: Facts of File Library of World History), 97.

[33] Rhodes, *History of the United States*, 499-500.

Biopolitics turned the outside of the State into the outside of the inside, the inside into the inside of the outside. The same goes for all bodies, ergo for all terrorist-soldiers. In the War on Terror, the Bush administration, representing humanity (the initial crime [9/11] as crime against humanity), thus repeatedly addressed all of us with those same words used by General Grant: 'You are either with us or you are against us'. In fear of the invisible and the unvisible, General Bush, more than anyone else, knows that his faceless enemy is everywhere and that the facialization of the soldier is always already highest priority. Not only in order to fortify the troops, but as an instant and necessary continuation of the State. Using fractal logic the State, or better state control, is by now essentially a fractal continuity that needs to travel deeper and deeper into spacetime. It controls by h(a)unting the body perpetually.

The Smell of Home

Virilio is right that this chemistry of warfare includes the clothing of the soldiers. They have become part of the weaponry giving form to the body of the soldier, today more than ever before: '... the latest combat outfit tends to be nothing other than a technological prosthesis that represents an updating of the armour of the chevalier, *the most evident sign of the resuscitated fighting* *body, it is the vehicle or the more precisely its speed...'*.[34] But this is nothing compared to how this new form of (biopolitical) warfare maintains itself through alimentation. Let us explore some of the novel chemistries, the radical topological or mereotopological re-creations of the earth, through which the terrorist soldier comes into being, through which this total war is effectuated.

Crucial is here the most volatile of the senses, the most immediate, the least linguistic, the least obstructed by in- or outside: smell. The Futurists (see their *Futurist Cookbook*) were the first to understand that the alimentary nature of warfare had little to do with the need to fill the stomach, but more with understanding the speed of smell. They knew that smell not only dominates the culinary but also drives the hunt. Or rather; the smell of death makes us hungry as it makes us fear. It is then for good reason that orthonasal stimulation, instantly reaching the olfactory bulb, is now a key focus in research activities in US Army laboratories and affiliated research institutes.

A company like ScentSational Technologies, currently bidding for the Army's $85,000 food packaging research contract, proposes the injection of scents into the MRE plastic wrappings as they're being molded. Stimulating the brain through the external nares of nostrils (rather than through the retronasal stimulation developed while eating) has been widely experimented with by fast food and instant coffee companies and has for some time also been very popular in the best restaurants of the world (for instance through so-called 'molecular gastronomy').

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[34] P. Virilio, *Negative Horizon: an Essay in Dromoscopy* (New York: Continuum, 2007), 86.

The economics of speed as practiced by the US army today considers orthonasal stimulation a key weapon in its topological definition of territoriality, in its conceptualization of the terrorist-soldier. For far more than the sights and sounds of war, it is the smell of fear that obstructs the speeding up of the body of the terrorist-soldier, which threatens the State from happening. Thus, the smell of home is the most crucial ingredient of MREs, of its packaging, and indeed of everything that concerns the alimentary event so crucial to (this particular style of) warfare.

Smell is the ultimate reterritorialization of territoriality in general. As Proust already taught us, it is smells that are '... more fragile but more enduring, more unsubstantial, more persistent, more faithful, remain poised a long time, like souls, remembering, waiting, hoping, amid the ruins of all the rest; and bear unflinchingly, in the tiny and almost impalpable drop of their essence, the vast structure of recollection'.[35] Smell's 'pointless' interventions (pointless as in, not making use of specific locations, specific identifiables) have the power to accelerate. This is a topological effect *par excellence*, as it proves that any particular point in Cartesian space(/time) is always already infinitely close to any other given point.

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[35] M. Proust, *Swann's Way. Within a Budding Grove*, trans. C. K. Scott Moncrieff and T. Kilmartin (London: Chatto & Windus Ltd, 1981), 51.

The imperial *spatium* defended by the peasant-soldier, and the capitalist *extensio* defended by the citizen-soldier, are being overcoded by a new spatio-temporal numerology of the State that considers all bodies *multiplicities in which to operate.* Its continual interventions secure and control, paving the way for future acceleration to happen. It calls out for it even, naming its energy bars HOOAH! or OO-RAH! These common battle cries (from the army and the navy respectively) *demand* acceleration to take place everywhere, to accelerate everybody. Bodily modification is required as it is only there that the State occurs, that the face of the soldier happens.

Being in a constant state of emergency, the body of the terrorist-soldier (composed in our new earth) has to stay alert for even more than sixty-eight hours. It must always remain alert (fearful), just as it must always stay hungry. Sherman, he who controlled America, can still tell us how to conquer the world: only by intervening through the feeding of all terrorist-soldiers. It is a matter of the most vital importance, and demands the earliest attention of the general entrusted with a campaign. Only thus can one prevent the terrorist-soldier from becoming an active terrorist against us, either directly or indirectly ...

BHUT JOLOKIA ASAR[1]

250g Bhut chili peppers
1/2 tsp crushed fenugreek seeds
3 tbsp yellow crushed mustard seeds
1/2 tsp turmeric powder
1/2 tbsp crushed fennel seeds
1 tbsp salt
1/4 cup lemon juice
½ cup mustard oil
1 sterilized glass jar

Wipe the chilies with damp clean cloth and let them dry completely;
Cut the chilies into 1 cm small pieces;
Mix all the spices and salt together;
Mix with the chilies;
Transfer into a clean and dry airtight glass container;
Add freshly squeezed lemon juice and oil;
Cover with the lid tightly;
Shake the bottle vigorously;
Keep in the sun, covered by a netted lid, for 7-8 days.

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[1] Recipe from 'AssamFoodie's Blog', at http://assamfoodie.wordpress.com/some-like-it-hot/. Last accessed on April 10, 2011. Note: The word 'asar' is a cognate of the Bengali word 'aachar' and the Hindi-Devnagiri word 'achar', which means 'pickle'. We will have occasion to review the implications of the word 'pickle', beyond its mere culinary sense, below.

Vague Weaponizations or, the Chemistry of Para-Tactical Engagements[2]

Manabrata Guha

> *There are laws of warfare, and it often happens that fidelity to an oath given to an enemy must be kept...[A] pirate [however] is not included in the number of lawful enemies, but is a common enemy of all. With him there ought not to be any pledged word, nor any oath mutually binding.*
>
> MARCUS TULLIUS CICERO, DE OFFICIIS (ON DUTIES)[3]

> *The legacy of the Copernican Revolution – that is the revolution by and according to the open universe – is comprised of three components: The speculative drive of 'an extreme line of thought', the revolutionary vocation of 'disturbing the peace of this world in still another way' and the true-to-the-universe logic of delivering all expressions of isolation and discreteness 'remorselessly into the open'.*
>
> REZA NEGARESTANI, GLOBE OF REVOLUTION[4]

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[2] This essay could not have been written without the encouragement, assistance, intervention and keen insight of Reza Negarestani. Thanks are also due to Robin Mackay for proposing the subject of the essay, and for inviting me to explore what, to me, are some rather frighteningly-disorienting lines of thought and experimentation.

[3] Quoted in D. Heller-Roazen, *The Enemy of All: Piracy and the Law of Nations*, (New York: Zone Books, 2009), 16.

[4] R. Negarestani, 'Globe of Revolution: An Afterthought on Geophilosophical Realism', in T. Huber (Ed.), *Realismus Jetzt!*, (Berlin: Merve Verlag, forthcoming 2011). In order of the quotes: S. Freud, *Beyond the Pleasure*

INTRODUCTION

It is commonly believed that actual combat – that is to say, 'the firefight' – is one of the most stressful experiences that one can undergo (a perception that has been somewhat excessively and unnecessarily valorized by the likes of Ernst Junger and others).[5] This is patently false. *What is stressful is the experience – however temporary – of that sliver of spatio-temporality on and within which combat is anticipated.* Thus, for example, in accounts too numerous to list, there are detailed descriptions of how – in the early hours of June 21, 1941 – as the assault formations of the Wehrmacht moved into their jump-off positions along the German-Soviet border on the eve of Operation Barbarossa – an event that Hitler had predicted would arrest the breath and attention of the whole world – even battle-hardened veterans experienced a highly debilitating sense of unease that seemed to emerge from the pits of their stomachs, and which spread – like an uncontrollable contagion – among their comrades-in-arms. For the veterans, while this experience was not unexpected, it was as unsettling as it was for their more inexperienced comrades. The rough and ready solution to this state of

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Principle (London: Norton, 1961), 3; *Introductory Lectures on Psychoanalysis* (New York: Norton, 1977), 353; S. Ferenczi, *Final Contributions to the Problems and Methods of Psychoanalysis* (London: Karnac, 1994), 93.

[5] See, for example, E. Junger, *Storm of Steel,* (London: Penguin Classics, 2004).

affairs was alcohol. As the luminous hands on the faces of their already-synchronized wristwatches steadily crawled towards H-Hour,[6] bottles of brandy and rum made their rounds, passing – regardless of rank – from soldier to soldier who took long and deep swigs from them. The fiery liquid scorched their throats, but it did succeed in arresting – or so it seemed – this continually growing and gnawing sense of unease which manifested itself in the form of irregular heartbeats, cold, clammy and trembling hands, churning stomachs, parched mouths, stammering speech, shiftiness of gaze and, quite often, as a muttered prayer of desperation which appealed to some higher authority – God or Man – to, at best, pull back from the brink of combat and, at the least, to spare the petitioner from that most horrible of injuries – a bullet in the gut.[7] The alcohol was the means by which the individual soldier attempted to fortify his 'unity of being'. It was a means of feeble defence against the terrifying assaults on the somatic integrity of the individual soldier that had already begun hours before the 'guns of June' began their devilish discharges.

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[6] The term 'H-hour' is used to designate the exact hour on which a combat attack or operation is to be initiated, the letter 'H' being derived from the 'hour' operations actually begin. See *Combat Orders* (Fort Leavenworth, Kansas: The General Service Schools Press, 1922).

[7] P. Carell, *Hitler Moves East: 1941-43* (New York: Ballantine Books, 1997).

In the context of Industrial Age wars,[8] protecting and/or guaranteeing the somatic integrity of the individual soldier poses a different level of concern to higher command authorities than it does in the current and emergent times.[9] This is because, among other things, when considered in operational terms, the traditional objective of military strategies of the Industrial Age has always been to degrade (either by destroying them, or by making them irrelevant) the critical centres of gravity of an enemy – in the first instance, command and control nodes – with the foreknowledge that such efforts, if successful, would entail the inevitable disintegration of the enemy's forces, thereby neutralizing its ability to wage war. Prominent examples of such strategies include those of the Soviet-designed 'deep-strike operations',[10] the German operational art of war, known as *Auftragstaktik*[11] and its expanded mechanized version popularly known as *Blitzkrieg*,[12] and most recently, the American strategy of 'rapid (full-spectrum) dominance' popularly known as 'shock and awe'.[13]

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[8] Gen. G. R. Sullivan & Col. J. M. Dubik, *War in the Information Age* (Strategic Studies Institute, U.S. Army War College, Carlise Barracks, PA 17013-5050), 6-9 (PDF version). Available at http://www.strategicstudiesinstitute.army.mil/pdffiles/pub243.pdf. Last accessed on April 01, 2011.

[9] In all fairness, it should be mentioned that the concern with the individual soldier has grown tremendously post the Second World War and, most visibly, post the French and American experience in Indo-China and Vietnam, and the Soviet experience in Afghanistan. Increasingly, 'the body-count' is being directly related to 'morale on the home front'.

[10] Col. (Retd.) D. M. Glantz, *Soviet Military-Operational Art: In Pursuit of Deep Battle* (London: Frank Cass, 1991); R. W Harrison, *The Russian Way of War: Operational Art 1904–1940* (Lawrence, Kan.: University Press of Kansas, 2001); R. Simpkin, *Deep Battle: The Brainchild of Marshal Tukhachevskii* (London: Brassey's Defence, 1987).

[11] D. M. Keithly and S. P. Ferris, 'Auftragstaktik, or Directive Control, in Joint and Combined Operations', *Parameters*, US Army War College Quarterly, Vol. XXIX, No. 3, Autumn 1999.

But, as is being increasingly speculated, we seem to be gradually transcending the battlespace of 'industrialized' warfare. It is being asserted that we are now – responding to new and varied epistemological (and, as I will argue, ontological and pre-ontological) challenges – segueing not simply into what is popularly known as the Age of Information, but also into a state and condition of 'interactive emergency'.[14] Along with this transition, we are also finding ourselves confronting a 'new' adversary who exhibits three general characteristics. In terms of form and structure, the emergent adversary appears amorphous; in terms of tactics, it displays a swarm-like dexterity;[15] and in terms of agency, it is, in Heller-Roazen's words, 'an enemy of all'.[16] Taken together, these characteristics of the emergent adversary, which are inextricably complicit in the creation of a condition of interactive emergency, pose an unprecedented counter-strategic challenge to the established order of things in the international arena. The new enemy does this by renewing its assault on the somatic integrity of the particular – the human-citizen, the soldier, the war machine, the State etc. – along a vector that exposes it to '... a groundless geocosmic continuum built by a nested series of traumas that extend from the very conception of matter, to the formation of the terrestrial field, to the psychic architecture'.[17] Thus, if, as Negarestani asserts in the epigraph to this essay, the legacy of the Copernican Revolution has three components, then this emergent adversary and the condition of interactive emergencies may be considered to be one of the starkest examples of this legacy and, in this sense, presents us with an opportunity to (again) reproblematize war and its conduct.

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[12] Note: German military theorists never actually referred to their operational art of war as 'blitzkrieg'. That was how it was reported in the Allied Press, particularly after the fall of France in 1940. See Frieser & Greenwood, *The Blitzkrieg Legend: The 1940 Campaign in the West* (Annapolis: Naval Institute Press, 2005); See also W. Fanning Jr. 'The Origin of the term "Blitzkrieg": Another View', *Journal of Military History*. Vol. 6, No. 2., April 1997, 283–302. For a competent overview of the German operational art of war, see M. Jonathan, *Combined Arms Warfare in the Twentieth Century* (Lawrence: University Press of Kansas, 2001).

[13] Ullman, Wade et al, *Shock and Awe: Achieving Rapid Dominance*, Institute for National Strategic Studies (Washington, DC: National Defense University, 1996).

[14] See M. Guha, 'Behind the Network Paradise: Speculations on Armed Conflict in an Age of Interactive Emergencies', *The Center for Land Warfare Studies (CLAWS) Journal*, Summer 2011 (New Delhi, India, Forthcoming June 2011).

In December 1979, on the eve of Pakistan's involvement with a US-backed and Saudi-funded subversive war aimed at containing the Soviet Union's increased involvement in Afghanistan, the then Pakistani military dictator Gen. Zia-ul-Haq was reported to have instructed Lt. Gen. Akhtar Abdul Rehman Khan, the Director-General of the Inter-Services Intelligence Directorate (ISI) – Pakistan's premier external intelligence agency – that 'the water in Afghanistan must boil at the right temperature.'[18] Geo-strategically, this made sense: Faced in the east by an economically-stable, militarily-resilient, multi-ethnic, secular, and democratic (and in this sense, hostile) India, distracted in the north by a turbulent Afghanistan where a predatory Soviet Union was on the prowl for a direct access-route to a warm-water front relatively close to the critical Persian Gulf, unable to resist the political pressures of a highly concerned United States of America, Pakistan, understandably, felt the depth of its 'strategic space' fast eroding. Gen. Zia's assessment of this complex politico-strategic situation and his strategy to address it were not limited by the lure of short-term gains. Instead, they were a grounded and realistic approach to participate in – indeed, shape – one of the last dramatic 'great games' of the Cold War. With an eye on a post-Soviet geo-political future, Gen. Zia's strategy to keep 'the water in Afghanistan [boiling]

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[15] See, for example, Arquilla and Ronfeldt, *Swarming and Future of Conflict* (Santa Monica: RAND Corp., 2000).

[16] Heller-Roazen, *The Enemy of All*, 9-16.

[17] Negarestani, 'Globe of Revolution'.

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18. P. Swami, 'Pakistan and Osama: How the West was Conned', *Today Online*, May 04, 2011. Available at http://www.todayonline.com/Commentary/EDC110504-0001310/Pakistan-and-Osama--How-the-West-was-conned. Last accessed on May 04, 2011.

at the right temperature' was designed keeping two objectives in mind. The first and most obvious one involved neutralizing the economic and, more importantly, military superiority of India, while the second was an ambitious – some may even say audacious – gambit to enable Pakistan to play a leading role in what Gen. Zia assumed (or imagined) would be a resurgent Islamic bloc of geo-strategic influence in a post-Soviet world. Whatever may be the merits, demerits and consequences of an application of this strategy, what is of interest to us is the way Gen. Zia phrased his strategic objective. He specifically instructed his ISI chief to raise and maintain the strategic-military condition in Afghanistan at a 'boiling point' level. The culinary reference, seemingly obtuse in this context, is nevertheless revealing. What it suggests is that what are normatively construed as geo-political plans, maps, and objectives are epi-phenomenal particularities that undulate on and along a subterranean logic of plasticity – one that also appears to underwrite the concept of the culinary – that liquefies and fuses the walls, boundaries, barriers, and fortifications of the discrete, the particular and the specific, into gradients of regions, neighbourhoods and locales that constitute an 'open' continuum. This, when pitted against the 'strategic' logic that underwrites the relations between discrete entities (Cicero alludes to this when he speaks of 'the laws of warfare', 'the pledged word', the 'mutually binding oath' that binds States, institutions etc.) presents itself as a highly destabilizing alternative that threatens to unravel the axiomatic basis of its more conventional counterpart. In this sense, this logic of plasticity may be considered to be an aspect of the 'emergent adversary' whose increasing prominence ungrounds the mechanics of the discrete (battlespace) in favour of a visceral chemistry of the continuum – a cosmic culinary exercise – where new gradients (battlespaces) are, in a manner of speaking, cooked up.

In what follows, I will explore how thinking about this emergent adversary, the radically obtuse topology of the battlespace, and the authentically monstrous models of weaponization that it brings in its wake – cast against a cosmic chemo-culinary backdrop – suggests an extreme line of militant thought, and how this line of thought threatens to disturb the peace of this (normatively constructed) world (in yet another way) by launching a corrosive assault against the 'fearful symmetries' of the conceptual architectonic that underwrites the State-designed models of order, security, and war. I will further argue that what is truly radical and extreme about this line of thought is that it assaults not simply the normative models of thought (on and of war, security etc.), but that it also targets, in Fernando Zalamea's words, 'the existence of [even those] 'monstrous' models [that] ... arise with respect to *given* collections of axioms, that can only partially capture the concepts behind the axioms.'[19] I will conclude by highlighting how this kind of – para-tactical – thinking is a *true-to-the-universe logic of delivering all expressions of isolation and discreteness 'remorselessly into the open'*, which has unexpected and unintended consequences on how we think about, among other things, combat and, ultimately, war.

FROM THE STATIST'S COOKBOOK

If amorphous adversaries indeed compel us to operationalize, in the first instance, radically extreme thought-weapons, then it is only fitting that our exploration should begin with an account of a relatively recent, and rather unusual, exercise in weaponization carried out by an arm of the Indian Defence Research and Development Organization (DRDO).[20] It is unusual because, as an exercise, it is – especially coming from the stables of, as Deleuze and Guattari would put it, the State's 'royal sciences' – startlingly counter-strategic. I am, of course, referring to the weaponization of *Bhut Jolokia*, commonly known the world over as the 'ghost chili-pepper'.[21]

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[19] F. Zalamea, *Peirce's Continuum: A Methodological and Mathematical Approach*, available at: http://files.acervopeirceano.webnode.es/200000068-48c2649bc4/Zalamea-Peirces-Continuum.pdf, 5.

[20] While the research and development was done by the Defence Research & Development Establishment (DRDE), Gwalior, India, which is a subordinate laboratory under the DRDO, the production agencies are M/S Premier Explosives Ltd Secunderabad, India and M/S Gulf Oil Corporation Ltd, Hyderabad, India.

This chili-pepper – an interspecies hybrid of *C. chinense* with some *C. frutescens* genes – which grows wild and which is cultivated in some of the north-eastern states of India (Assam, Nagaland, Manipur etc.), and in the Sylhet regions of Bangladesh, appeared in the Guinness Book of World Records, in 2006, as being one of the hottest peppers in the world, measuring over a million Scoville Heat Units (SHUs).[22]

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[21] Note: While I am designating the weaponization of the *Bhut Jolokia* as 'unusual', this is certainly not the first time that such options have been researched. There is, for example, the CIA's now widely-known experiments using LSD and other mind-altering drugs. See 'Project MKULTRA, the CIA's Program of Research into Behavioral Modification. Joint Hearing before the Select Committee on Intelligence and the Subcommittee on Health and Scientific Research of the Committee on Human Resources, United State Senate, Ninety-Fifth Congress, First Session' (US Government Printing Office, August 8, 1977), available at http://www.nytimes.com/packages/pdf/national/13inmate_ProjectMKULTRA.pdf. Also see 'World's hottest chilli to become India's secret weapon against terrorism', *The Telegraph*, UK (http://www.telegraph.co.uk/news/newstopics/howaboutthat/7504418/Worlds-hottest-chilli-to-become-Indias-secret-weapon-against-terrorism.html); 'New non-lethal weapon against terrorism: spicy pepper', *Homeland Security Newswire,* (http://homelandsecuritynewswire.com/new-non-lethal-weapon-against-terrorism-spicy-pepper); While colloquially known as the 'chilli bomb', the Indian defence research laboratory that designed (dare we say, weaponized?) it refers to it as an 'Oleoresin-based grenade'. See http://www.techport.gov.in/TechProvider/DRDO/DRDO_OleoResin.html. All links last accessed on April 10, 2011.

[22] Bhagovati & Changkija, 'Genetic Variability and Traditional Practices in Naga King Chili Landraces of Nagaland' in *Asian Agri-History*, Vol. 13, No. 3, 2009:171-180, 171-2. Note that this fruit also grows in Sri Lanka. It is conjectured that the plant (which, interestingly, is of unknown ancestry) that bears this fruit – among other variants of chili plants – was grown by the Native Americans of the Peru-Bolivian region between 5400-3200 BC. It is claimed that this plant was brought to Asia, Africa and Europe by Columbus, among others.

> The ripe peppers measure 60 to 85 mm (2.4 to 3.3 in) long and 25 to 30 mm (1.0 to 1.2 in) wide with an orange or red color. The unselected strain of *Bhut Jolokia* from India is an extremely variable plant, with a wide range in fruit sizes and amount of fruit production per plant, and offers a huge potential for developing much better strains through selection in the future. *Bhut Jolokia* pods are unique among peppers, with their characteristic shape, and their unusual rough, dented and very thin skin.[23]

There are, apparently, a number of ways to interact with *Bhut Jolokia.* For the most part, it is either consumed raw (despite, or perhaps because of, the extreme effects that it can induce), but in very small quantities – *as a supplement* to the main meal; and/or it is introduced – again, in very small portions – as a part of the ensemble of spices that seem to invariably enmesh and permeate (and that are perhaps even immanent in and to) the Indian sub-continental culinary culture. It is also to be noted that the local folk-medicinal traditions attribute to the *Bhut Jolokia* medicinal properties that are used to address problems relating to (paradoxically!) stomach disorders, asthma, etc.

It is claimed that the *Bhut Jolokia* possesses 'a pleasant and palatable aroma, [but it is also cautioned that] an average-sized fruit is more than sufficient for two meals of the day for a 5-6-membered (*sic*) family.'[24] There are good reasons for this. For a fruit that measures close to a 1.05 million-rating on the Scoville scale (as a comparison, jalapeño peppers are rated at 2500-8000 SHU), directly consuming even a miniscule portion of either the skin or its seed can have highly unsettling effects on the human body. Most commonly, these effects include extreme sensations of burning in the mouth, throat, and stomach. It also causes the human body to sweat excessively and, interestingly, in the context of this essay, the ingestion of the *Bhut Jolokia* (without taking any pre or post ingestion cautionary measures) causes – in the most extreme of cases, albeit temporarily – a partial loss of bodily co-ordination.[25]

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[23] C. L. Barker, 'Hot Pod: World's Hottest', *National Geographic Magazine*, May 2007, 21.

While the *Bhut Jolokia* came into the public eye only after the results of the Scoville tests were submitted to and verified by the Guinness Book of Records, it is necessary to point out that in addition to it being a consumable and a potential source of medicinal benefits, it has always retained a latent potential for weaponization. Thus, long before the Indian defence laboratories began work on formally weaponizing it, the locals of the areas in which the *Bhut Jolokia* plant grows natively used the fruit as a defensive counter-measure against bands of wild and marauding elephants. By smearing a paste made out of the crushed fruit along the boundaries of their villages and fields, the locals created a defensive perimeter that was expected to effectively deter the wild elephants and, possibly, other foraging animals. As the *Bhut Jolokia* plant began to be increasingly researched, a number of interesting facts about it were discovered. Thus, for example, it was found that the plant could be grown in different regions with variations of climatic conditions, which have a direct impact on the degree/intensity of the pungency of the resultant fruits. This indicated the potential for calibrating the intensity of the pungency of the fruit *naturally* (i.e., using no artificial means involving intrusive manipulations at the genetic level etc.).[26] Most importantly, research also indicated that the effects of *Bhut Jolokia*, while certainly painful in the extreme, are not lethal. The symptoms, it is reported, generally subside over time and there have been no publicly available reports of fatalities caused by consuming the fruit.

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[24] Bhagovati and Changkija, 'Genetic Variability and Traditional Practices', 175. One assumes that each of the 5-6 members of this family will consume portions of the pepper with each of their meals.

[25] For those who are interested, you can actually see 'Jamie Kocher, CEO of the Waimea Bay Chili Pepper Company, and www.BambooandTikis.com, eat[ing] the largest and most spiciest part of the Bhut (Naga/Ghost) Jolokia Chili Pepper and this old man almost dies ...' See http://www.youtube.com/watch?v=1tRq8ExAHzk.

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[26] Of course, this does not mean that cross-breeding techniques are not employed to develop stronger (or more variable) strains of the plant and the fruit.

Soon enough, a Briefing Paper – issued by the Indian defence research laboratory in question – described the *Bhut Jolokia* in its weaponized form thus:

> Oleoresin (or, a Chili extract) based grenades are simple to operate, users' (*sic*) friendly and extremely useful for flushing out terrorists from their hideout. These grenades can be thrown by hand to the hide-outs/agitated mob (*sic*) and are easily dispersed as smoke (aerosol) from pyrotechnic mixture ...[27]

The general specifications of the weapon-system were laid out by the Briefing Paper in the following manner:

- Height : 130 mm
- Weight : 390 ± 10 g
- Initiation delay : 1-2 Sec
- Range : 40 ± 10 m
- Coverage area : 2500 m2
- Smoke duration : > 30 s
- Shelf Life : 5 Years[28]

The Briefing Paper then lists the salient features of the weapon-system thus:

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[27] DRDE/DRDO Briefing Paper, 'Oeloresin-based Grenades'. DRDE-DRDO, Gwalior, India, 2009(?).

[28] Ibid.

- Releases smoke from pyrotechnic mixture, causing severe coughing, lacrymation, irritation of eyes & nose and suffocation.
- The body of the grenades, made of plastic, melt immediately after burst, thus difficult to throw them back.[29]

It is also clear from the Briefing Paper that the design-intent underwriting the weaponization of the *Bhut Jolokia* is not thanatologically-driven, that is to say, it is not lethal. On the contrary, it is a non-lethal attempt to radicalize the operational environment within which a target is located. While admittedly, this is only one of a multitude of weaponry and technologies that the State has its disposal, the case of the *Bhut Jolokia* weapon (hereafter, the chili-weapon) is singular because it gives us, among other things, a glimpse of the vector along which the State and its machines of war are preparing to do battle.

Nation-states – organized within the current regime of the international state-system – traditionally maintain their relations (here paraphrasing Cicero) by binding themselves first by norm, and then by international law, to recognize and respect the essential symmetry of the organizing concepts, structures, institutions that they, among other things, share amongst themselves. It is critically important for nation-states to maintain this reciprocity of behaviour – even on the battlefield – because it is this that guarantees the structural integrity of the nation-state system. In light of this, and as we will explore in some detail below, the emergent adversary that the Age of Interactive Emergencies is bringing to the foreground threatens not only the structural integrity of the international state-system, but also poses an existential threat to the nation-state. The near panic of nation-states across the international state-system upon the tragic and startlingly unsettling events that marked September 11, 2001 can be re-contextualized in this light: The post-9/11 actions of the United States of America (supported, in some cases actively, in others passively, by the community of nation-states) are illustrative of the panic-ridden flailing of the arms of a nation-state when confronted by this new and emergent adversary. As the events of the Iraq War of 2003 and of its aftermath and the ongoing operations in the Af-Pak regions show, smashing the organized militaries of those geo-political entities accused of harbouring the emergent adversary – who we may, again echoing Heller-Roazen, refer to as the 'enemy of all' and who the U.S. politico-military establishment refers to as an 'unlawful combatant' – is not enough. The enemy has proven – time and again – to be too elusive for the U.S. led military forces – despite the latter's, at times, terrifying technological asymmetric advantages – to identify, isolate and defeat in detail.[30] Thus it was proved, again, that massed firepower and a sustained 24/7 air campaign was of little use against a virtually ungraspable adversary. This is a problem of immense strategic proportions for the nation-state and may be considered to be an impetus for the design of alternative weapon-systems that directly address the ephemeral nature of the emergent adversary.

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[29] Ibid.

What is interesting about the weaponization of the chili-pepper is what it tells us about how and in what ways the strategizing of combat and the focus of battle is changing. Such instances of weaponization suggest that our traditional (and one might add, historical) experience of combat in terms of violent instances of competition between conflicting interests within a grand-strategic geo-political space, is expanding to include irregularly-emergent violent emergencies that manifest themselves – like a viscerally corrosive and fast-spreading rash – in contexts of spatio-temporal extensions formed by overlapping nests of regions, localities, and micro-localities wherein – despite the best of efforts – the traditional politics of war are, more often than not, relegated to a backstage presence.

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[30] The recent action which resulted in the death of Osama bin-Laden does not contradict this assertion. While the lethal termination of the hitherto elusive figurehead of Al Qaida would most likely push the organization (if one can call it that) to the defensive, such an effect will at best be temporary. It would not diminish the threat that Al Qaida poses. In other words, to kill Osama bin-Laden is one thing, but to neutralize Al Qaida and other similar entities is quite another matter.

In this sense, the chili-weapon may be considered to be an emerging strategic response from the State in the face of the imminent arrival of the emergent adversary.

In keeping with this, and as described in the Briefing Paper, the chili-weapon is slated for use in what the Indian Armed Forces refer to as 'sub-conventional warfare', encompassing counter-terror and counter-insurgency operations. The fundamental idea being that the chili-weapon would be instrumental in flushing out violent agents who seek to embed themselves within nooks and crannies (micro-local nests) of the battlespace that are beyond the reach of the more heavyweight, but essentially blunt, weapons of the State's arsenal. It is interesting to note that while the employment of the chili-weapon requires a nominal degree of accuracy in its delivery, it does not demand the employment of delivery systems that offer precision-engagement capabilities. This is reflective of the gradual recognition that the prospect of facing a conventionally-arrayed adversary, while not impossible, is becoming increasingly remote. Thus, the imperative to use weapon-systems and platforms that can be guided to the precise location of their targets (usually command and control and other similar centres of gravity) – after wading through a whole host of defensive counter-measures – is lesser than before. Instead, going by the implicit design-intent of the chili-weapon, it would appear that the State's military machines have recognized (but perhaps not fully assimilated) that the emergent adversary not only deliberately avoids assembling *en masse*, but also actively resists being rendered discrete enough to be identified and hunted down in detail.[31] Whence the subtle transformation in the State's strategic-military objective, from hunting for discrete nodes of critical importance to the enemy to controlling slices or slivers of spatio-temporal locales where, it is conjectured, the emergent adversary lurks.

Given what we know of the *Bhut Jolokia*, and of the emergent operational context in which its weaponized form is expected to be deployed, it would not be too speculative on our part, therefore, to assume that one of the principal objectives of the designers of the weapon-system would have been to induce (and/or introduce) a territopic (verging on the terrifying) state, or condition, or climate – that is to say, to trigger an extreme psycho-bio-chemical reaction – within the battlespace of immediate interest. The intent being to recreate, at very high levels of magnitude, a sense of unease – a threat to the somatic integrity of the individual, similar to that experienced by the soldiers of the Wehrmacht on the eve of Operation Barbarossa.[32] This threat to the somatic integrity of the Wehrmacht and its constituent units – a threat accentuated by the calibrated use of the chili-weapon – came from ‘within’, that is to say, from the innards of the strategic aggregation of man and machine. It was akin to an intensive thermal eruption – a fireless heat – that subversively assaulted, by progressively softening, the rigid boundaries that define the individual (soldier). This progressive liquefaction of the particular was experienced as the stomach-churning ‘sense of unease’ (also expressed as fear, terror, and pre-combat stress) that spread like a contagion among the soldiers of the Wehrmacht. It could be said that in the above sense, they were being pre-cooked for battle and it was this foreknowledge that prompted their futile attempt to bolster their crumbling defences by consuming fiery liquids. Of course, unknown to them, behind the haze of the alcohol a micro-cosmic culinary exercise was already underway that steadily eroded their individual and collective somatic integrity.

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[31] In this connection, it is interesting to note that it took the U.S. ten years and over US$ 1 Trillion to neutralize Osama bin-Laden. See 'It took US 10 yrs, $1.3tn to kill Osama bin Laden and avenge 9/11', *Times of India*, May 3, 2011, at http://timesofindia.indiatimes.com/world/us/It-took-US-10-yrs-13tn-to-kill-Osama-bin-Laden-and-avenge-9/11/articleshow/8147800.cms. Last accessed on May 03, 2011.

Precisely how this occurs, we will have occasion to revisit at a later point, but along a vector very different from that which underwrites the State's model of weaponization of the chili-pepper. For our present purposes, it is important to note that the relative discreteness of the battlespace (the briefing paper suggests that the 'coverage area' of the weapon is limited to 2500 m^2) allows the State-centric forces to distribute (and calibrate) the oleoresin – the essence of the *Bhut Jolokia* – in a restrained manner within the battlespace. But the paradox (which may well be what the designers of the weapon-system wanted to exploit in the first instance) lies in the fact that while the *introduction* of the weapon-system to a particular battlespace is indeed restrained, in the context of the local battlespace in which a particular engagement takes place, the *effect* of the weapon is virtually uncontrollable. The (ideal) net result expected from such actions is, of course, predictable: the temporary neutralization of the target and the permanent neutralization of its fighting abilities. From this we can infer that the State's instruments who (prepare to) wage war by deploying weapon-systems such as these insist on making (and retaining) an ontological distinction between discrete battlespaces and the larger, global battlespace that the former are nested within. The distinguishing feature of this imperial act of ontological differentiation on the part of the State and its strategic-military instruments is nothing less than the prevention of the 'leakage' of local battlespaces into the global battlespace – which is representative of a logic of strategy that is unable, or unwilling, to think about war and combat across the modal spectrum of the continuum.

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[32] Note that the inducing of this ‘sense of unease’ happens before the exchange of fire between the State’s military forces and the ‘emergent adversary’. In fact, it could be asserted that the use of the *Bhut Jolokia* – to create the psycho-chemical reaction resulting in the sense of extreme discomfort and consequent unease – is preemptive in nature. It is preemptive because it precludes the ability of the ‘emergent adversary’ to respond in any coherent manner against the State’s forces.

From the point of view of the State's strategic-military instruments, and in the specific context of the chili-weapon, this distinction is necessary because the oleoresin – the key element that disturbs the equilibrium of the battlespace – cannot distinguish between friend and foe. In other words, the oleoresin does not – indeed cannot – discriminate between ontologically ordered or prioritized entities when and where the distribution of its effects takes place. Consequently, it makes irrelevant the organizing potential of such privileges within the given battlespace. In this sense, the oleoresin represents, or at the very least affords, a material instantiation of the breakdown of the sanctity of the Law of the Excluded Middle by being complicit in opening the rigidly defined or discrete horizon/battlespace onto the synthetic realm, or what may be referred to as an *intermezzo of possibilia* where 'either/or' rigidities are modally softened.'[33] And, while the

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[33] *Possibilia*: 'Possibles' that may or may not be actual are known as 'possibilia'. There are two primary kinds of possibilia in the specific context of modal logic: (1) Possible objects, such as the son of a young couple that is childless by choice, and (2) Possible worlds, which consist of possible objects that are capable of existing together. Note that the Law/Principle of the Excluded Middle is one of the traditional three laws of thought (along with the laws of identity and contradiction), which holds that 'Every proposition is either true or not true. [$\Box(p \vee \neg p)$]' It should be noted that this is weaker than the law of bivalence (every proposition is true or false), since if there is a third truth value, excluded middle can still hold, though bivalence will fail. (However, bivalence is sometimes treated as a version of excluded middle). See P.T. Geach and W.F. Bednarowski,

State and its strategic-military instruments may not appreciate the implications of the emergence or foregrounding of this *intermezzo*, in purely operational terms it poses a dilemma of almost strategic-existential proportions to them.

In operational terms, traditionally, the State's military instruments prefer to maintain distinct (albeit, at times, and in the context of manoeuvre warfare doctrines, mobile or flexible) 'frontlines' (thus distinguishing between 'friend' and 'enemy' etc.) during a combative engagement. This allows them to establish a baseline from which they can embark on their imperial forays.[34] Given this, the blurring (or, becoming-'vague') of 'the forward edge of the battle area' and the consequent fuzziness of the battle-lines proves inimical to the strategic-military interests of the State and its military instruments, because it denies them the finitude of a comprehensible and reproducible battlespace within which a regime of 'total information awareness' and 'global strike capabilities' can be established.[35]

'The Law of Excluded Middle' (Symposium), *Proceedings of the Aristotelian Society*, Supplementary Volume (1956). It should be further noted that the law of the Excluded Middle is violated when the fusion of the 'either ... or' manifestations of rigidity and discreteness with modalities or possibilities of the continuum takes place, which results in the synthetic blurring of all boundaries and exact identities.

[34] Deleuze and Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. B. Massumi (London: Continuum, 2003), 424-7.

[35] Norman Friedman, in his shockingly short-sighted exegetical exercise on Network-centric Warfare, refers to this as 'the picture'. See N. Friedman, *Network-Centric Warfare: How Navies Learnt to Fight Smarter through Three*

The emergence of this *intermezzo* – wherein the Law of the Excluded Middle stands in positive danger of being subverted and made irrelevant by the synthetic modality of the continuum – undermines the imperial propensities of the State and its strategic-military instruments. But the danger far exceeds the threat to the State's imperial posture. Indeed, in the context of the *intermezzo* or the synthetic realm of the continuum, where defined hierarchies of order and organization find themselves being leavened and liquefied, the traditional (realist-oriented) units of analysis of the international order of things – comprising Man, the (geo-territorial basis of the) State and War – find little traction; and in this sense, the *intermezzo* poses a direct threat to the very integrity of the architectonic that serves as a conceptual endo-skeleton that actualizes the possibility of structures like the State and the international state system.[36]

Taking into account these operational and existential caveats, the State and its instruments appear to acknowledge (as we have alluded to earlier) that the emergent adversary – given its three principal characteristics – has to be addressed globally within discrete battlespaces, and it is believed that this can be achieved by increasingly employing weapons like

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World Wars (Annapolis: Naval Institute Press, 2009).

[36] The reference to 'traditional realism' and to 'Man, the State, and War' is to Kenneth Waltz's seminal *Man, the State, and War: A Theoretical Analysis* (New York: Columbia University Press, 2001).

the chili-weapon.[37] To render the emergent adversary impotent (albeit for a discrete amount of time), the State's machines of war opt to (re)organize the global battlespace into discrete sections or sub-battlespaces that retain, for the most part, the salient features of what the State considers to be the global battlespace. Following this rather crude apportioning of the global battlespace, the State's military instruments then initialize combat operations that seek to individually overwhelm each of the discrete sub-battlespaces by using a weapon-system that aims to radically disturb the consistency and equilibrium of the target-battlespace by psycho-bio-chemical means, with the not-unexpected ulterior objective of extracting the emergent adversary from the terrain within which it operates. The logic of operability that underwrites this model of war(fare) may be represented as in Figure 1.

The implicit assumption underlying this *concept* of operations is that the space of battle is considered to be comprehensively hostile, dictating that operations within this space of battle are, or should be, unrestrained. It should be appreciated that while this may be considered to be the *concept* of operations involving such weapon-systems, in operational terms the

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[37] This is superficially similar to the argument that David Kilcullen makes in his *The Accidental Guerilla: Fighting Small Wars in the Midst of a Big One* (Oxford: Oxford University Press, 2009). Though it should be noted that Kilcullen does not openly suggest or insinuate the use of psycho-bio-chemical means to fight 'small wars' or even 'small-unit actions'.

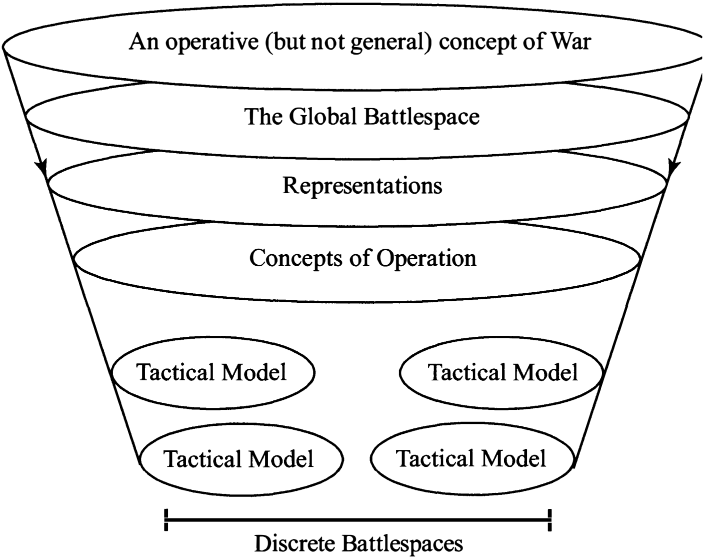
An operative (but not general) concept of War
The Global Battlespace
Representations
Concepts of Operation
Tactical Model
Tactical Model
Tactical Model
Tactical Model
Discrete Battlespaces

Figure 1. Discrete Global Battlespace

State's combat operations involving weapon-systems like these – for the reasons mentioned above – almost always must exhibit a high level of restraint. Further, aside from the existential imperatives that inhibit the State's use of this unconventional weapon-system, there is also its insistence on understanding the potency (and the potential) of the chili-weapon in the context of the offensive manoeuvres that hark back to models of warfare appropriate for the Industrial Age. Despite the rather subversive possibilities and potentials that the chili-weapon offers – which we shall explore shortly – the objective of the State's military machines remains wedded to the principle of launching a decapitating strike against an adversary. The use of the chili-weapon in the hands of the State and its military machines serves precisely this end by threatening to disorient, literally, the mind (i.e., the central nervous system) of the adversary by compelling it to deal with highly destabilizing – albeit localized and transient – conditions triggered by an overload of oleoresin. In the process, however, this admittedly extremist design-intent (especially when considered from the perspective of the State and its military instruments) clouds the truly monstrous potential of the *Bhut Jolokia* as a weapon.

In light of this, it cannot be denied that, to all intents and purposes, the chili-weapon is, by design, a concept-weapon that aims to disturb the normalcy of the world (i.e., the battlespace) occupied by a target by compelling the latter – in transforming the operative conditions within the world considered as a sub-set of a 'global' world – to transition through various traumatic phases leading up to, but not past, a thanatologically-terminal condition, with the final consequence of being extracted from the substrate on and within which it thrives.[38] Considered operationally, it is indeed a highly unusual way for the State and its instruments to seek to engage with, but not necessarily deter, the emergent adversary. By designing and operationalizing the chili-weapon, the State, thus, is not saying to the emergent adversary: 'If you attempt to do *x*, then I will employ the chili-weapon against you'. That would be a statement of deterrence. Instead, the State is saying, 'I will pre-empt your threat-generative capabilities by interdicting the functioning of your neuro-cognitive mechanisms, thereby instantiating a counter-strategic operation that will target your somatic integrity'. Considered in this way, the significance of the strategic shift effected by the State – leaving aside its commitment to a concept of operations from a past age of warfare – is considerable and is reflected in its willingness to adopt what may be best described as a psycho-bio-chemical counter-tactic to create temporary conditions of extreme unease veering close to 'terror'.[39]

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[38] Note: Here 'trauma' is meant – given the State-centric context – simply as an experience of an event or situation that causes great distress and disruption. Contrast this with what Negarestani refers to as trauma. Negarestani proposes that '... trauma should be understood not as what

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is experienced but as a form of cut made by the real or the absolute in its own unified order; a cut that brings about the possibility of a localized horizon and a singular but interconnected 'point of view'. In short trauma as cut reinscribes the flow of the universal continuum or global continuity within the discontinuous or discrete horizon'. See Negarestani, 'Globe of Revolution'. The State does not recognize this Negarestanian notion of trauma. It cannot afford to. Instead it limits its recognition (and this is reflected in the design-intent of its more unusual models of weaponizations – as in the case of the *Bhut Jolokia*) of trauma to an experience (which it can calibrate within a given and necessarily finite space).

[39] Of course, the State ignores the implications of this, which becomes obvious when cast in the Negarestanian notion of 'trauma'.

Against this backdrop, it could be said that when compared to the meta-strategic and strategic-operational models of Industrial Age Warfare, the emerging model of warfare that the State is beginning to craft appears to hold true to Zalamea's assertion about those '"monstrous models" [that] ... arise with respect to *given* collections of axioms [but] which are never really able to fully capture the concepts behind the axioms'. In other words, though the chili-weapon represents an unusual attempt – particularly given its design-intent and material characteristics – by State-centric forces to engage with emergent battle conditions, the operational *concept* of operations involving the use of such weapon-systems remains true to the axiomatic principles around which the State and its machines of war have traditionally organized themselves and have waged war. But this does not detract from the other-worldly, post-lethal monstrosity of the model of weaponization that the chili-weapon, albeit abstractly, invokes. In what follows, we will explore such a model of weaponization. The monstrosity of the model is evidenced by the foregrounding of the full modal (understood in a chemo-cosmic sense) spectrum of the continuum, which, interestingly, underwrites an understanding of culinary processes as a visceral interactivity involving the synthetic realm of the continuum in which the discrete, the specific, the particular (for example, the ingredients of a culinary exercise) reinscribes the generic continuum, resulting in the blurring of the boundaries of the particular into 'the open'.

VAGUE WEAPONIZATIONS

To all intents and purposes, the weaponization of the *Bhut Jolokia* by the State and its instruments is a patently counter-strategic act, which is why it is fascinating. But, as we have seen, the State's fealty to models of warfare that were designed in and for the Industrial Age precludes its ability, if not to fully comprehend the immense potential of the weapon-system, then at least to exploit it. Alternatively, as has been suggested above, it could also be the case that the State is perhaps actually able to recognize not only the weapon-system's potential, but also the threat-potential that it presents to the State. In other words, it could be the case that the State recognizes the not necessarily terrifying, but certainly territopic[40] effect that the chili-weapon could have on its *own* prospects. This could explain, we ventured to suggest, why the State handles the chili-weapon with restraint. In this section we will turn our attention to a more extreme model of weaponization – free from the structural imperatives that preclude its full optimization by the State and its instruments – that we suggest underwrites the design-intent of what we have come to know as the chili-weapon.

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[40] Insofar as the axioms of the State (discrete battlespaces, well-defined entities and modal rigidities demarcated by 'either ... or ...') are vitiated by fusion and chemical reactions with synthetic modalities of the global battlespace or the continuum.

To set the tone and the pace of the discussion to follow, and to highlight what appears to be an insidiously subversive and extreme line of militant thought, one should consult the recipe, printed facing the opening page of this article, for *Bhut Jolokia Asar*, one of the more interesting instances of how *Bhut Jolokia* is employed within the culture of traditional Assamese cuisine.

An 'asar' (in Assamese) or 'achar' is a condiment, that is to say, it is a 'pickle'.[41] It is an external entity – generally consumed in small quantities – that while retaining its independence, accompanies the main course of a meal, providing, optimally, a camouflaged edge to the latter. In the context of Indian culinary traditions, a pickle is an aggregate of a number of individual ingredients (generally, fruits and vegetables, but also occasionally meats/seafoods, and the 'usual spices') usually based within an oil/lemon juice/brine suspension. This mixture is allowed to 'mature', that is to say, to self-catalyze or cook itself, resulting in the apparent blending of the sharp edges of the individual or discrete ingredients (including the *Bhut Jolokia* in the above recipe) into a continuum of culinary tastes and sensations.[42] This self-cooking of the pickle renders the potencies and flavours of the individual elements of an ‘achar’ into a state and condition of suspended animation. In this state, an overlapping of their individual or particular fields of tastes and sensations occurs, resulting in the establishment of a more generalized field of culinary sensations which, while retaining muted shades and softened edges of the independent potencies of the ingredients, is synthetically different from each of them. In other words, it could be said that the discrete becomes vague in the context of the continuum by losing its rigidities, which arise from the law of the excluded middle, thus fusing with other *possibilia* or chemical modalities provided by the generic base of the continuum. In this way, the continuum infiltrates the discrete (*qua* the axiomatic) through the vague, which is an emergent state or condition where a chemically-driven softening of boundaries takes place resulting in the sharing and overlapping of the resultant locales (diffused states and conditions enveloping) of the discrete which, in turn, foregrounds a cosmologically-expansive continuum.

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[41] It is important not to confuse the 'Indian' pickle with the gherkin/cucumber-based pickles that are commonly found in the West.

As appetizing (or not) as this recipe may appear to be, in the context of this essay, it serves as an extremist model of weaponization that not only wrecks the collection of axioms that underlie the design-intent and subsequent weaponization of the State's version of the chili-weapon, but also consumes the very concepts that underwrite its alleged axiomatic premise. What is extreme about this model of weaponization is that it compels – through a chemistry of dissolution – the renegotiation of the traditional transactional and exchange-centric economy of relations that are said to characterize the local/global and the particular/generic.

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[42] Note: Even the act of ‘setting the mixture in the sun’ has a twist. If the pickle is made only of vegetables, the ‘sun’ refers to the weaker ‘winter sun’. If other ingredients are used such as meats/marine products and only certain kinds of vegetables/fruits, the ‘sun’ refers to the ‘summer sun’.

Note the sequence in which the pickle is 'cooked' i.e., softens into a generic base and fuses with synthetic modalities of the continuum or *possibilia* associated with neighbouring elements or ingredients in the suspension. The process begins with the creation of a (dry) mixture involving the aggregation of the spices and the *Bhut Jolokia*. At this stage, it is presumed that while there is already an economy of relations at play between the ingredients (established as the essential oils of the individual [dry] ingredients are brought into close proximity with each other) it is not seamless; rather, it is discrete. In other words, the spices and the pepper – while establishing relationships with each other – continue to retain their individual identities. In this sense, it could be said that the Law of the Excluded Middle and the Principle of Contradiction – at least in so far as they respectively pertain to the emergent mixture and its individual ingredients

– remain undisturbed. The ingredients are (individually) what they are and cannot (yet) be anything other than what they are. As such, they are not yet part of a global ensemble where they *can* be *both* what they are AND something that they are not at the same time. But – and this is important to note – they do retain their potential to associate with one another in other, more intimate, ways which – as we shall see – involve the dismantling of the restrictions posed by the Law of the Excluded Middle (on the level of the generic mixture or the continuum) and the Principle of Contradiction (on the level of discrete or individual ingredients). This happens during the second stage of the pickle-making process.

The second stage begins with the suspension being added and the resultant mixture being exposed to the sun. At this point a qualitative change takes place in the discrete relations that have thus far been established between the constituents of the dry mixture. The introduction of the suspension, by generating heat, radicalizes the nature of the transactional relationship that hitherto marked the dry mixture. What occurs is the release – by purely chemical means – of the potential-motility of the spices, the pepper, and the suspension thereby breaking down the discrete singularities that aggregate to form the essence of the dry-mixture.[43]

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[43] By 'the release of the potential-motility' of the ingredients, I simply mean to suggest that the particularities of each of the ingredients open up – as we shall see – to 'the open' or the full chemical and modal spectrum

The suspension, in this sense, plays a critical role not simply by contributing its own potential-motility to the dry-mixture, but also by serving as a partial trigger for a catalytic reaction or synthesis that leads to the emergence of the pickle. Partial because – though we will not address the issue in any detail here – the role of the solar-energetic inputs in the context of the pickling process should not be underestimated.[44] Thus, with the introduction of the suspension to the mixture of the spices and the peppers, the resultant, in many ways augmented, mixture now becomes something other than merely an aggregation of its individual constituents. It is at this point that the Law of the Excluded Middle begins to lose its relevance. The actualization of the potential-motility of the spices, the pepper, and the suspension involves nothing less than an assault on their particularities (individual tastes and sensations) that make up the dry-mixture and the suspension. It is important to recognize that this assault is more of an insurrection than an invasion by an external agency. Regardless, facing such an *intensive* assault, these particularities (of taste and

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of the continuum. In other words, the activation of the potential-motility does not imply a disintegration or a fragmentation. Nor does it imply the heterogenization of a homogenous particularity. Indeed, as we will see, one of the paradoxical consequences of the 'opening up' of the particular is the establishment of a meta-homogeneity that is intimately connected to what here we are referring to as 'the open' and which we will later refer to as the 'universal continuum'.

[44] It could be said that the economic relations that stem from the solar-energetic inputs are consumed by the *Asar*.

sensation) are compelled to become complicit in the production (or, more accurately, synthesis) of a generic field (of culinary taste and sensation) in which they (the individual spice, pepper and suspension) remain in a state of suspended animation or modal kineticism.

Now, Fernando Zalamea, in his analysis of Peirce's *continuum,* has the following to say:

> Peirce's *continuum* is formed by superposed 'real' environments and neighbourhoods – modes of fusion and connection of the *possibilia*. On that *continuum* 'ideal' points are marked – cuts and discontinuities of the actual – only to construct contrasting scales and to facilitate the 'calculus' ... Indeed, the actual, the given, the present, the instant, are no more than *ideal limits*: limits of possibility neighbourhoods which contain those actuality marks, those points impossible to be drawn, those fleeting presents, those impalpable instants.[45]

In our context, therefore, it could be said that the generic field (what we have previously referred to as an *intermezzo*) on which the culinary chemistry of the *Bhut Jolokia Asar* takes place, and that is revealed as the individual ingredients of the recipe catalyze, is akin to Pierce's *continuum.* Following Zalamea's exegesis, it foregrounds itself as the particularities of the tastes and sensations of the ingredients of the pickle fuse with one another. This fusion – which, as we have noted above, is the agitation of the potential-motility of the individual ingredients including the suspension – involves the erosion of the particularities and exact identities (here understood in the Zalamean sense of 'ideal points') of the individual constituents, and their synthesis into a field of culinary sensations that, while not bereft of the traces (which are 'impossible to be drawn, those fleeting presents, those impalpable instants')[46] of the individual essences of the ingredients, also produces (typically) a new culinary experience that is *locally* vague. Characterized by modal complexity and blurry boundaries which can only be approached through synthetic neighbourhoods and infinitesimal extension to the outside, vagueness is the *local* projection of the general within the particular field or the discrete ingredient.

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[45] Zalamea, *Peirce's Continuum*, 23.

The operative premise underlying this breaking down and fusion of particularities and the production of a vague (but also particular) experience is that the continuum is 'the open'; it is the universal exteriority that allows, in the first instance, for the possibility for the nesting and overlapping of fields of particularities or specificities ('ideal points') on and within itself. The mandatory cautionary note here is to recognize that this universal exteriority is not, and should not be considered as, an ontological space – that is to say, as being the raw material for the formation of concepts; rather, if anything, it is pre-ontological. It is the originary fundament upon which ontology is possible. Its complicity in the production of the ontological field is satisfied by its mere presence. In this sense, it could be said that the continuum or 'the open' is the universally contingent condition of possibility where the particular/specific/discrete are instantiated as a scattering of 'cuts' and 'discontinuities'. The particular/the specific/the discrete are, in this sense, these 'cuts' and 'discontinuities' which mark the emergent of the actual from the possible and the contingent. Given this, it could further be said that the breakdown of the individual boundaries of each discrete ingredient or softening of rigidities of each particularity inevitably brings to the foreground the generic continuum, albeit in local and particular terms. In other words, the erosion of the particularities exposes – through neighbourhoods and infinitesimal gradients – the localized or monadic worlds of the particularities to the continuum or 'the open'. At this point, two questions demand our attention: (1) How does the breakdown of the particular take place?; and, in a related sense, (2) when the particular or discrete entity actualizes itself on and within the universal exteriority, does this process of actualization result in the total and complete exclusion of the exterior from the monadic world of the discrete?

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[46] Thus, for example, how does one identify and articulate what the 'ideal' taste of the individual spices or the chili-pepper might be?

As a first step we should recognize that the particular/specific/discrete is an apparent coagulation of the continuum within a localized region or space, given that the possibility of this occurring is always in the context of the continuum or 'the open'. It is an instance where the radical openness of the continuum meta-stabilizes (or, 'cooks in and within itself') to chemically and modally create a field of consistency. But it should be noted that this particularized field of consistency is not distinct from 'the open' or radical exteriority. Rather, it is the transient isolation, localization, and regionalization of 'the open' within particular or discrete spatio-temporally bound horizons, that detracts from the ability 'to capture all the richness of a *general* concept ([that is to say, of] the generic, modal and indeterminate)'.[47] Note that when Zalamea refers to the 'general concept (generic, indeterminate)', he is gesturing toward what we have referred to as 'the open' – both within and outside the context of the particular. In this sense, 'the open' persists – within the monadic world of the discrete or the particular – not as itself in its originary sense, that is to say, as 'the open'; but instead, as the 'vague' (i.e., indistinct). As an aside, note also that here the Law of the Excluded Middle and the Principle of Contradiction stand violated.

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[47] Zalamea, *Peirce's Continuum,* 4.

‘The open’ in the context of the particular is both ‘the open’ or generic (in its own context) and ‘the vague’ (in the context of the particular). In other words, it (the continuum/‘the open’) is simply irreducible to *either* … *or* … possibilities indicated by the Law of the Excluded Middle. And, continuing in the same vein, the particular is both ‘particular’ (again, in its own context) *and* ‘vague’ (in the context of ‘the open’). Thus, for example, a particular element, signified by an actual or discontinuous mark – such as a chili or a citizen – can be both a chili and not a chili or a civilian and a non-civilian at the same time. Here the vagueness of the pickle (both chili and not chili) and the vague adversary (both a citizen and non-citizen) violates the Principle of Contradiction. It should also be noted that this presence of ‘the open’ (in its necessarily ‘vague’ form) within the discrete world of the particular is also a latent source of extreme instability for the monadic world in which it lurks. Why is this lurking presence a source of radical and extreme instability? Because its presence at the local level brings about the violation of the Law of the Excluded Middle and the Principle of Contradiction; which, in turn, brings into play new modes of fusion, osmosis, and transversality across the full spectrum of the continuum, modes that are inimical to the structural integrity and form of the particular, the discrete and the individual.

Against this backdrop, it would not be too much of a stretch to suggest that what we have thus far been referring to as the breakdown, softening or the dismantling of particularities is nothing less than the radicalization of the 'vague' within the particular, which we now know is a signature of the continuum within that which is discrete. Thus, when the question is posed as to whether the institution of the particular or the discrete excludes 'the open', we are compelled to respond in the negative. The discrete and the particular is always infiltrated by 'the open' in the guise of the 'vague'. And, how does this infiltration take place? It is certainly not established by the instituting of a transaction-based economy of relations. It is also not simply a question of suggesting the addition of 'the open' to the locale of the particular. Rather, the mode of infiltration of 'the open' into a discrete world is in the form of a cleavage, or a cut – a trauma – that slices – neither inwards, nor outwards – the particular. The cut is not a simple splitting or division of the particular into further discrete particularities. Rather, it is, as Hermann Weyl suggested, 'a natural way to take into account the nature of a continuum which, following Anaxagoras, defies 'chopping off its parts from one another, as it were, with a hatchet'.[48] In this light, this slicing or cutting is nothing less than the exposure of the horizon of interiority of the particular to 'the open'/the continuum. In our specific context, we propose that this is a principal contributory cause to the blurring of battlelines, and to the generation of a climate of modal and chemical conditions that obfuscates the local battlespace, with extreme spillover effects into what the State and its military instruments consider as being the global battlespace.

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[48] H. Weyl, 'The Ghost of Modality' in *Philosophical Essays in the Memory of Edmund Husserl* (Cambridge, MA: Harvard University Press, 1940), 294.

Considered in this way, *the chili-weapon, which may be considered to be akin to the Bhut Jolokia pickle, is, in the first instance, indicative of a model of weaponization that involves the catalysis of individual potencies into, on, and as 'the vague', which is chemically linked to the continuum.* Now, in normative terms, a weapon-system's effectiveness is generally assessed in terms of the potential effects that its kinetic capabilities can deliver. These are usually measured in terms of the number of rounds that can be fired in a discrete amount of time; the 'weight' of the firepower that the weapon-system discharges; the mobility of the weapon-system; and its ability to complement other weapon-systems that may be fielded to create the global ensemble of weapons deployed on the battlefield. It is also important to note that the functionality of a weapon-system, usually, remains discrete. Further, weapon-systems (and this includes the thermonuclear option) are constructed as aggregate capabilities that combine their features to produce a cumulative effect. It is important to pay attention to the fact that each component of the weapon-system retains its individual features, capabilities and characteristics, although they are also instrumental in the forming of ensembles of weapon-systems.[49] Ensembles of such weapon-systems have a singular objective: termination of individual (that is to say, particular and discrete) instances of threats. This is done by attempting to interdict the critical command and control nodes of the perceived threat. In this connection, it is worth pointing out that while such weapon-ensembles may appear to overwhelm a specific battlespace with area-suppressing firepower, the base object remains wedded to the principle of neutralizing discrete points of resistance. In this sense, the desired effects resulting from the employment of such ensembles of weapon-systems are very local and punctual. Only by a process of arithmetic aggregation are we able to contextualize these local effects in 'strategic' terms. And, in this context, it is also worth pointing out that most conventional weapon-systems are essentially defensive in nature despite the normative bias towards classifying ensembles of weapon-systems as being 'offensive' or 'defensive'.

In contrast to this, the extreme model of weaponization that underwrites the chili-weapon is in a class of its own. Like the *Bhut Jolokia Asar* – in which the chili-pepper is an active co-constituent – the chili-weapon is less an aggregation of disruptive sensory triggers targeted towards an adversary, and more a catalysis-engineer that exposes particular and discrete entities to a sensorial continuum. What is singular about this is that, contra the normative understanding and design-intent of conventional weapon-systems, the model of weaponization represented by the chili-weapon does not target particular and discrete entities. Rather, it aims to (re)introduce the continuum (or 'the open') not simply within the space occupied by such entities, but also within the entities themselves, by facilitating a radical reflexivity between the continuum and these entities which are in fact local manifestations of the continuum itself, and could therefore not exclude the open. As we have noted above, this weaponization occurs not by means of an invasive cut, in a bid to render the localized particular/region even more discrete (which is what the State attempts), but by exposing the particular (here, the adversary) to the generic in ways that destabilize the former, thus blunting its local instances and intensities. The sensorial disorientation that follows the employment of the chili-weapon – characterized in the Briefing Paper in terms of 'severe coughing, lacrymation, irritation of eyes and nose and suffocation' – could be said to be one example of the extreme physical perturbations that afflict the particular/discrete when it is introduced to an existential dilemma that follows its exposure to the continuum, which involves the collapse of the Principle of Contradiction.

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[49] This allows for quick repairs to be made under battle conditions. Essentially, being an ensemble of multiple parts, the modular nature of the weapon-system allows for the quick replacement of the less-than-optimal functioning part.

Our brief review of the chili-weapon – given the details provided by the Briefing Paper – suggests that much of what is excessive in its underlying model of weaponization is obscured by the structural and existential imperatives of the State and of its military instruments. The State's employment of this weapon does not maximize this latent potential that the chili-weapon represents. Instead, as we have seen, the State's design-intent is organized around the ability to deliver a devastating attack on the central nervous system of the 'unlawful combatants' within a battlespace, in a bid to incapacitate them. This is understandable because the State's primary objective is to extract these 'unlawful combatants' from the battlespace without disturbing the latter's essential normalcy. In the process, however, there occurs an obfuscation of the truly insidious character of the model of weaponization that is at play. Additionally, we have seen how the fealty of the State's military machines to what is fast becoming an outmoded model of warfare limits how this ostensibly radical and extreme weapon-system can be used. While it is true that unrestrained use of this weapon-system within the discrete confines of local battlespaces succeeds in overwhelming the space of battle, it does so, however, through an objective re-ordering and assimilation of the local battlespace within a much larger global (and in that sense, discrete and restricted) battlespace in which the State and its instruments can freely use their precision-strike and global-strike capabilities. In this context, it is important to note that our reference to the global battlespace as conceived (indeed constructed) by the State and its military machines does not refer to the generic battlespace or to an understanding of the continuum as a 'globally' generic battlespace. In the State's version of what it refers to as 'the global battlespace', there is no room – at least under ideal conditions – for any kind of ambiguity or vagueness. 'To be generic' within the State's version of the global battlespace, is 'to be categorical'. The 'generic' in the State's global battlespace serves as a place-holder or a category within which particularities can be organized or left in suspended animation pending their eventual (re) organization. In this sense, the 'generic' is, for the State, a specific category. Given this, it will be appreciated – as is also evident from the design intent of the chili-weapon – that the use of such exotic (and, in some senses, extreme) weapon-systems is targeted towards the category of what I refer to as 'specific generalities' which, in the context of our current focus of interest, can be isolated only within localized battlespaces. The State's use of this weapon-system thus has very little to do with anything other than interdicting –

as we have previously stated – the ability of the adversary (within the context of the local battlespace) to establish and operationalize an effective command and control system. What this suggests is that the State and its military instruments – despite having at their disposal a weapon-system of truly radical proportions – insist on reverting to the operational doctrines of combat of the Industrial Age.

PARA-TACTICS OF COMBAT

Somewhere in the remoter areas of Naugaon, Assam, sheltering from the hot tropical sun, a family of four sat down to have their midday meal, consisting of boiled rice and green vegetables. Working from dawn till noon, the family had slaved at their small paddy plot – the output of which would prove critical for their chances to avoid starvation during the coming year. The children – both under fifteen years of age – had worked too. The family's meal which, by any standard, was at best modest and at worst meagre, gave little culinary pleasure save that which accompanies any meal when one is wracked by intense hunger. Whatever small variation is applied to this basic fare would be, as always, provided by a couple of fresh onions and a condiment – the Bhut Jolokia Asar. As the wife ladled out the food – reserving the smallest portions for herself and her very young daughter – the husband reached for the earthen jar containing the Bhut Jolokia Asar. From then on – as the meal progressed – the

Bhut Jolokia Asar would play a supplementary, but critical, role in re-determining not only how the modest meal consisting of rice and vegetables tasted, but also the effects it would have on the consumer. The inclusion of the Asar introduces a radical element into the meal. If the meal is considered as being a particular battlespace, the Asar serves as an engine of catalysis (a model of tacticity) that exposes – by supplementary means and under camouflage – the radical open-ness of the continuum, not simply within the meal, but also within the consumer.

In the previous section, it was suggested that the catalysis that manifests itself in and as the *Asar* is an instance of the emergence of the vague within the horizon of interiority of the individual ingredients of the pickle, including the suspension. This, we further suggested, is indicative of an extreme model of weaponization which, contra its traditional counterparts, including the State's efforts to weaponize the *Bhut Jolokia* as a chili-weapon, does not break down a target – a particular and discrete entity – into smaller discrete entities in a bid to overwhelm them individually. Instead, as we have seen, the radical monstrosity of the model of weaponization underwriting the chili-weapon – a model we derived from the *Bhut Jolokia Asar* – evidences itself in the way in which it compels the target – a particularity, discreteness, specificity – to expose its interiority to what we have referred to as the continuum or 'the open'. And while we have already pointed out that this exposure takes the form of a 'cut' or a 'slice', it is worth reiterating that this 'cutting' or 'slicing' does not involve any external agency. Rather, it is an exposure of 'the open' which always-already lurks within that which is particular, specific and discrete. In what follows, we will now employ the model of weaponization afforded by the *Bhut Jolokia Asar* to explicate a vector of para-tactical militancy that synthesizes the traditionally discrete relations between 'tactics', modes of tacticity, and objects of tactical interest and relevance, not to annihilate points of defence or resistance (which are 'objects' of tactical interest and relevance), but to make such points complicit in their own rendition into 'the open'.

Sandor Ferenczi, in his *Final Contributions to the Problems and Methods of Psycho-Analysis*, notes:

> [A] traumatic force catches up and, as it were, shakes the ego down from the high tree or the tower. This is described as a frightening whirlwind, ending in the complete dissolution of connexions and a terrible vertigo, until finally the ability, or even the attempt, to resist the force is given up as hopeless, and the function of self-preservation declares itself bankrupt. This final result may be described or represented as being partially dead. In one case such 'being dead' was represented ... as maximal pulverization, leading

> to finally complete de-materialization. The dematerialized ... component has the tendency to drag the not yet dead parts to itself into non-existence ...[50]

Our objective in quoting Ferenczi in this context is to gesture to the vector along which our proposed model of para-tactical militancy will foreground itself. The generic objective of this model of tactical militancy (which, as we will see, must necessarily be executed at the level of the infinitesimal)[51] is similar to what Ferenczi refers to as conveying 'the hopelessness of resistance', which is effected by the dissolution of the intensive 'connexions' of a target-entity that lend to the latter a consistency that underwrites its discreteness. But to derive such a model of tacticity, which is operative at the infinitesimal level, will require us to reconsider matters relating to, in the first instance, the continuum ('the open').

Fernando Zalamea, following the work of Charles Sanders Peirce and Giuseppe Veronese, provides us with a systematic study and account of the continuum, or 'the open', that allows us to investigate the implications of the latter for synthesis, the axiomatic and the discrete (or the specific/particular) and to understand the continuum as a means of bridging between mathematics, chemistry, cosmological processes and, in our specific context, war and its conduct. The continuum is, according to Zalamea, 'an 'absolutely general' concept which, in principle, 'does not have to be completely objectified in just a formal context'. In other words, 'every general concept is, in reference to its individuals, strictly a *continuum* ... Thus, the *continuum*, as a lean, 'free' concept in the realm of the general and the possible, cannot be bounded by a determinate collection ...'[52] Beginning from this premise, it is then possible to reconstruct a general concept of war (both as a condition or state of affairs AND as the intensive reflexivity that such states or conditions necessarily involve) in the manner suggested in Figure 2.

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[50] Sandor Ferenczi, *Final Contributions,* 222-3.

[51] An 'infinitesimal may be regarded as a continuum "viewed in the small".' J. L. Bell, 'Infinitesimals and the Continuum', *The Mathematical Intelligencer*, Vol. 17, #2 (New York: Springer-Verlag, 1995), 55.

Figure 2 represents Zalamea's description of the 'double sigma' (the continuum), which has three universal or global properties, each with its own implications – plasticity (what we previously referred to as the logic of plasticity), inextensibility and supermultitudeness. It is necessary to recognize that the intricate interweaving of these three universal properties create their local counterparts – generic relationality, the logic of vagueness, neighbourhood and *possibilia*. In this sense, as Zalamea asserts, 'the *double sigma* underlines some fundamental threads between global and local aspects of [the] continuum.'[53] From the above, it will

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[52] Zalamea, *Peirce's Continuum*, 7 (italics in original).

[53] Ibid, 8-9. Italics in original.

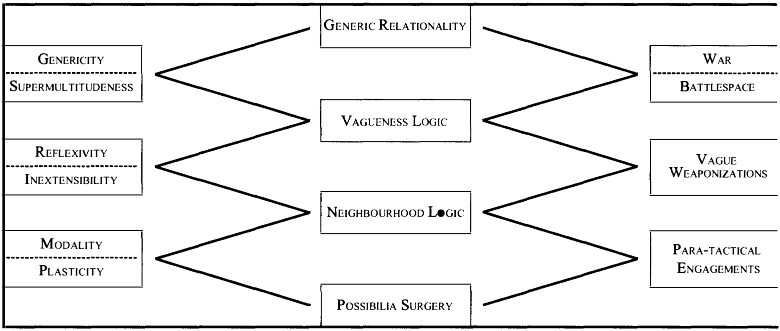
GENERICITY
SUPERMULTITUDENESS
REFLEXIVITY
INEXTENSIBILITY
MODALITY
PLASTICITY
GENERIC RELATIONALITY
VAGUENESS LOGIC
NEIGHBOURHOOD LOGIC
POSSIBILIA SURGERY
WAR
BATTLESPACE
VAGUE WEAPONIZATIONS
PARA-TACTICAL ENGAGEMENTS

Figure 2. Weaponizing the Double Sigma

be evident that what we had previously referred to as the State's perception of the 'global battlespace', which is derived from a non-generic, that is to say, a specific concept of war, and which is progressively filtered through increasingly discrete modes of representations, fails to address or account for the unbounded genericity of the continuum – which we can under the present circumstances provisionally label as the general concept of war – and the supermultitudeness of the battlespace that such a generic concept of war invokes. Perhaps a fruitful way to explicate this would be to refer to the continuum as being a *self-churning* that erodes the discreteness of particularities. It is important to note that this erosion of particularities only strips away from them their 'particularizing attachments, determinative, existential or actual',[54] which results in the particular progressively losing its consistency. Another way of putting it would be to say that the release of the particular from its particularity does not obliterate the particular; rather, it 'frees' the particular from that which axiomatically or modally particularizes it in the first instance, thus diluting its discontinuous or rigid modality into the synthetic modality of the continuum, and thereby loosening the particular into the open continuum.

Now, it is tempting to envision this as the act of an external and operative agency, or to some corrosive nature of the continuum. However, to sustain this argument would involve invoking an originary distinction between the continuum and the particular. The counter-strategic perspective that we wish to highlight here is that *no such external agency or force brings about the de-particularization of the particular*. Instead, it is a consequence of the operative reflexivity of the continuum within the particular and, in this sense, the distinction between the local/particular/discrete and the continuum is always local and transient.[55] From this we can infer that this reflexivity that is characteristic of the continuum does not diminish – it is at play both in and as the continuum, and remains at play within the particular wherein the continuum lurks, like what Ferenczi would refer to as 'an alien (trans)implant'. In the context of the supplementing of the modest meal of the Assamese farmer and his family with the *Bhut Jolokia Asar*, we can therefore suggest, given that we have presumed the *Asar* to be a model of radical weaponization which involves the continuum, that its supplementary role in the midday meal described above serves to function as the traumatic force that Ferenczi refers to. It is a vector along which the universal continuum mobilizes itself (by being true to itself) not simply within the particular meal, but also within the individual that consumes it – directly or otherwise. It is not the case that the *Asar* impinges on the meal; rather, it chemically transforms the particularity of the meal to accommodate the inassimilable open-ness of the continuum. To the extent that the *Asar* mixes with the meal (remember that the *Asar* involves a liquid suspension), being itself organized around a kernel of depthless openness (this being contributed by the chemistry of the oleoresin), it agitates the latent presence of the continuum within the meal. And, further, by the act of ingesting this meal – supplemented by the *Asar* – the individual also interiorizes the continuum. In this way, the continuum asserts its presence within what is discrete and particular. This has effects both on the particular and on the continuum – though in the latter case it is less a matter of 'effect' and more an expression of its peculiar open-ness.[56]

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[54] Ibid, 10

[55] 'The reflexive' is 'defined as something any part of which however small itself has parts of the same kind' (C.S. Peirce). It preserves the germ of the continuum under any condition and no matter what kind of cut or discontinuity it undergoes.

In the context of the particular, the self-churning of the continuum is – as we have previously alluded to – an originary reflexivity, which cleaves (intensively) the particular, thereby introducing a gradient relationality within the particular. This is achieved not by the particular being disintegrated into further discrete elements, but by the unfolding of infinitesimal or non-punctual and continuous segments. In the context of the particular, the presence of infinitesimal or non-punctual and continuous segments results in the establishment of the vague, where the Principle of Contradiction stands violated. This 'opening' of the particular results in the latter's progressively dissolving/loosening to create neighbourhoods to accommodate vagueness, which overlap with other such unfoldings or openings of particularities. Since the vague is identified, in part, in terms of unfolded boundaries and modal softness, it can effectively react and meld with other entities across the continuum insofar as its boundaries can be shared by other entities and its modality can fuse with the contingency of the outside. The vague, therefore, opens the exact and particular to the free osmotic flow of the continuum between the global and the local. Alternatively, it could also be said that this opening of the particular establishes a continuity of the continuum within discrete locales and regions (extensions/expansions/stretchings of the particular). It will be appreciated that in our analysis of the *Bhut Jolokia Asar* (as opposed, significantly, to our analysis of the chili-weapon as fabricated and employed by the State and its instruments) we saw how the sharp edges of the individual ingredients of the *Asar* catalyzed, resulting in the emergence of a continuity of tastes and sensations which we related to the local presence of the continuum in the form of 'the vague'. From the point of view of the continuum, this process does not involve the latter's being unfaithful to its own *nature*; instead, it involves a 'transformation of modality' that is reflected in the degeneration (the operation of intensive reflexivity) of the particular into the vague, and thence into and as the continuum. It is this transformation of modality that Ferenczi refers to as 'the traumatic force', which can be regarded as an instance of a cosmo-chemical process that involves a modal change that, in turn, entails a visceral encounter with the full spectrum of the continuum.

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[56] Ferenczi describes the evolution of the human being in terms of 'alien transplants' according to which the human is a polyvalent horizon of nested chemistries and a series of alien transplants of the continuum: 'It is possible that we harbour in our organism inorganic, vegetative, herbivorous and carnivorous tendencies like chemical valences.' See Ferenzci, *Final Contributions*, 227-30.

Such a model of para-tactical engagement – unlike traditional concepts of (strategic-military) operations – works to institute a radical Logic of Relations (that governs relations between particulars, individuals, specificities) by invoking a pure synthesis of location and direction. This synthesis wrecks the traditional distinction between tactical models, objects of tactical interest, and local-level tactical objectives by fusing them on and along the exteriorized/interiorized continuum. No tactical agency drives this process. Nor is the presence of tactical objects of interest – points of resistance or defence – considered a deterrent to this model of engagement. At every turn, such a model of tactical engagement generates what we have referred to as an *intermezzo*, 'understood as a synthetical range where whatever is possible should be able to glue – which has to be a general place (*logos*), extremely flexible, plastic, homogeneous, without irregularities …'.[57] Herein discrete points (networked or not – of defence and resistance) are introduced to an interiorized abysmal chasm that collapses them from within, thereby conveying what Ferenczi refers to as 'the hopelessness of resistance'. But then again, we need to remain mindful of the fact that such a state of affairs undermines our efforts to label this mode of tacticity as a 'model'; it would perhaps be more fitting to refer to this modality as being an exhibition of a 'pure tacticity' that runs immanent to events, individuals, particulars and other such instances of ontologically-privileged discreteness.

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[57] Zalamea, *Peirce's Continuum,* 15. Parenthesis and italics in original.

CONCLUSION

We began our exploratory exercise by considering an unusual model of weaponization – in the form of the chili-weapon – conducted by the State. While such a model of weaponization, we noted, is radical in the sense that it points to an ongoing reassessment of the space of war and battle (considered normatively), it fails to sufficiently interrogate the axioms that lend it a logical and operational consistency. The fealty to these axioms, we noted, is a contributory cause that camouflages the sheer monstrosity that lurks behind such models of weaponization.

Our interest in the State's weaponization of the *Bhut Jolokia* lay in the latent potential of the chili-pepper (co-constituted by the oleoresin), which rates so high on the Scoville scale, to materially disturb the somatic integrity of those against which it is deployed. When this aspect of the *Bhut Jolokia* is taken into account we then confront what constitutes the radical alterity of this model of weaponization – its propensity to foreground the continuum. The cookery involved in the *Asar* – as we have described it – thus represents, micro-cosmically, the action that takes place on and along the continuum as the unbound chemical spectrum of modalities, global-local syntheses and universal contingency. In this sense, the self-cooking of the continuum (represented by the 'maturing process' of the

Asar) becomes the generative condition which allows not only for the possibility of points of resistance, but also, paradoxically, for the tactical counter-measures that strip away from such points their particulars. The climate of operations, while remaining local is thus infused by the continuum in the form of 'the vague', which we confront in the emergent battlespaces in the form of the 'vague civilian' ('the enemy of all') who exhibits the pure tacticity of hypercamouflage.[58]

It is at this point that our attempt at a 'vague weaponization' differs from the model of weaponization that the State actualizes with the chili-weapon. Whereas the latter attempts to create – by psycho-bio-chemical means – conditions of temporary disorientation within discrete slices of spatio-temporality, which is roughly analogous to the institution of 'the vague', its efforts are also geared toward the containment of such effects. As we have seen, this is because, in the 'global battlespace' constructed by the State and its strategic-military instruments, the presence of 'the vague' is inimical to the objective of asserting 'full spectrum dominance' and of developing and retaining 'global strike capabilities'. Indeed, it could be asserted that what we have thus far referred to as the emergent adversary is 'the vague' (which, as we know, is the local and synthetic presence of the continuum). Conversely, in our model of vague weaponization, the objective is not to limit 'the vague' but to *negatively generate* the particular by exposing it to the vague. In other words, the local object of the model of 'vague weaponization' is to proliferate *possibilia*, thereby establishing an intermediary logic of plasticity between the particular and the continuum or 'the open', between the axiomatic and the contingent.

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[58] On 'hypercamouflage', see R. Negarestani, 'The Militarization of Peace: Absence of Terror or Terror of Absence?', **Collapse** I, 53-91.

Further, as we discovered, the extremeness that spectrally haunts such models of weaponizations is not terminally lethal. This is another point of similarity between the State's model of weaponization of the *Bhut Jolokia* and our radical model of weaponization. The apparent overlap lies in the fact that, superficially, both models do not consider the annihilation of the target as being an absolute and necessary end. The difference, of course, lies in the fact that the State's models attempt to preserve the particularity of those elements that pose a threat to it within a discrete battlespace, while our more radical model, on the other hand, does something more excessive: It seeks to dissolve spatio-temporal instances and events by exposing them to the logic of the continuum to the point of no return. This dissolution is akin to an 'ubiquitous osmotic process' – 'a *natural* way, the "transit" of modalities, the "fusion" of individualities, the 'overlapping' of neighbourhoods',[59] which may be represented as in Figure 3 (overleaf).

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[59] Zalamea, *Peirce's Continuum*, 17.

In this way, the vector along which such weaponizations and the para-tactical engagements that they bring in their wake is '[c]orrespondingly, [representative of] a line of thought [that is] set to irreparably deepen the geophilosophical synthesis from the a priori *terra verita* rooted in the somatic integrity of the earth, the state and the human-citizen to the ever-self-renegotiating verity of geocosmic continuum, and thus should be identified as immanently territopic.'[60]

In closing, let us return to the 'state of unease' that the soldiers of the Wehrmacht experienced on the eve of Operation Barbarossa. Even before the 'guns of June' rang out in anger, though rooted within dugouts and trenches cut into the earth, the somatic integrity of the individual soldiers (and, by extension, of the war-machine of which they were constitutive units) was already under threat. As they drank their spirits to bolster their confidence (which Ferenczi would no doubt identify as 'the ego'), they could not have been unaware that, burrowed as they were into the damp but comforting confines of their earthly defences, at some level, they had already transited into that territopic *intermezzo* where what confronted them were what Pierce refers to as the supermultitudinousness of *possibilia*[61] – 'without beginning, middle, or end'.

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[60] Negarestani, *Globe of Revolution*, 2.

[61] C. S. Peirce, 'Multitude and Continuity' [c.1897; NE 3.86-87], quoted in Zalamea, *Peirce's Continuum,* 12.

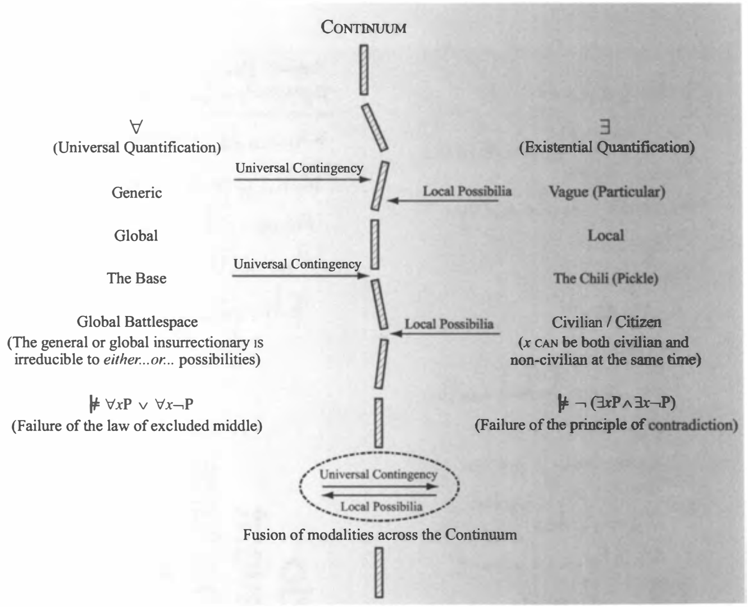

CONTINUUM
∀
(Universal Quantification)
∃
(Existential Quantification)
Universal Contingency
Generic
Local Possibilia
Vague (Particular)
Global
Local
Universal Contingency
The Base
The Chili (Pickle)
Global Battlespace
(The general or global insurrectionary IS irreducible to either...or... possibilities)
Local Possibilia
Civilian / Citizen
(x CAN be both civilian and non-civilian at the same time)
$\not\models \forall x P \vee \forall x \neg P$
(Failure of the law of excluded middle)
$\not\models \neg(\exists x P \wedge \exists x \neg P)$
(Failure of the principle of contradiction)
Universal Contingency
Local Possibilia
Fusion of modalities across the Continuum

Figure 3. Continuum and the Osmotic Circulation of Modalities

Thus, their muted prayer to some higher authority – Man or God – to step back from the brink of war was always-already too late. They were – as we are (given that despite its collective manifestation, the 'we' is individualistic, discrete, particular, and specific) – already at war. They were, as we are, always-already committed to being co-constituents of a cosmic culinary exercise that serves 'the open'.

Museum

ingredients ← WATER

Agar Agar
Dextrose Triptone Agar
Glycerol
Sperm oil
Salt NaCl
Sugar
Pet concentrated milk
V8
cranberry juice
corn oil
PET Chocolate flavored Yoo-Hoo
Chicken extract

Hardware

Gold leaf
local vines
galvanized pans
screw hooks
thumb tacks
Black Magic plastic
steel

Con Edison clean energy

~~Some~~ Known Strains
~~Typical Growths~~

Mucors racemosus
Rhizopus apophysis
Aspergillus niger
Penicillium notatum
Streptomyces griseus.

Things to do
to help prevent
a power shortage
this summer.

FOOD and the City

Interview with Carol Goodden

In 1971 Gordon Matta-Clark and Carol Goodden founded FOOD. *Part restaurant, part art project, and offering employment to artists,* FOOD *provided a space for social, architectural and culinary experimentation and a meeting place for the artistic community.*

The development of the FOOD *project can be seen in the context of Matta-Clark's earlier work, in which there seem to be several levels to the link between architecture and cooking: At points the artist seems to have understood cities and urbanisation as a kind of metabolisation or digestion process (the movement from centre to periphery, gentrification, transformation of neighbourhoods). But we should also consider Matta-Clark's long-standing interest in alchemy: Throughout autumn and winter 1969, 'alchemical' apparatuses were bubbling away in his New York loft, works such as* Photo-Fry *employed processes of transformation that were explicitly 'culinary', and the remainder of a series of works in which agar was used to grow various substances were exhibited in the 1970 show* Museum. *At the time Matta-Clark*

All Images: Succession de Gordon Matta-Clark en dépôt au Centre Canadien d'Architecture, Montréal / Estate of Gordon Matta-Clark on deposit at the Canadian Centre for Architecture, Montréal.

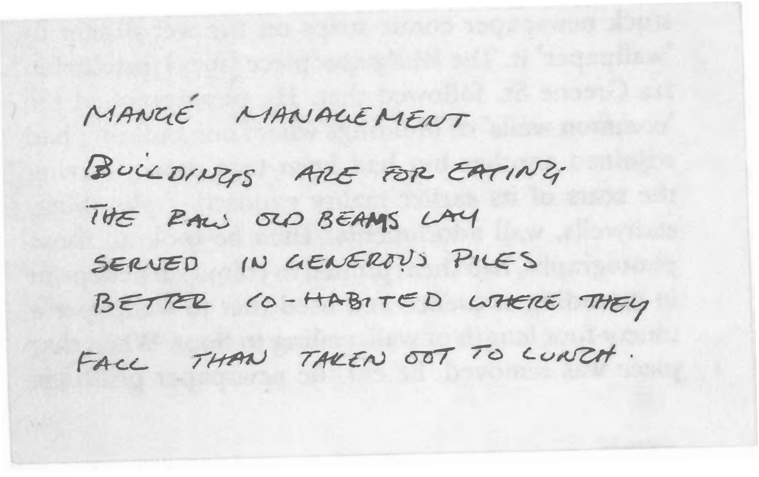
related this work to 'those traditions that have always dealt with the preparation and transformation of materials'. This raises the question of how this concern manifests itself in his more well-known architectural and spatial work. Might we also understand the cutting pieces (which developed during the construction of FOOD) as belonging to an alchemical or culinary order? Several of Matta-Clark's notes attest to such a parallel between the (an)architectural and the culinary. Cutting breaches the living-cells (cells for living in) of apartments, to allow a circulation between what is below and what is above – visually, architecturally, and in terms of the habitation of the space – in the same way that the process of heating/cooking breaks down cells and transforms matter. A later work Days End [1975], *conceived as 'a pie-like slice', sought to 'extend the building … below as much as above, like an alchemical motif where there is that definite dichotomy – on balance – between the above and below … Think about shelter as a form of being, which it is …'. Here a building is between earth and air, and the alchemical liberation of earth into air links architectural practice to the sublime transformations of cooking.*

Collapse *spoke to Carol Goodden about FOOD, about Matta-Clark's relation to the city, and the extent to which alchemical or culinary practices infuse his work. The accompanying images, notes drawn from the Gordon Matta-Clark Archive at the Canadian Centre for Architecture, Montréal, capture something of the artist's mercurial imagination.*

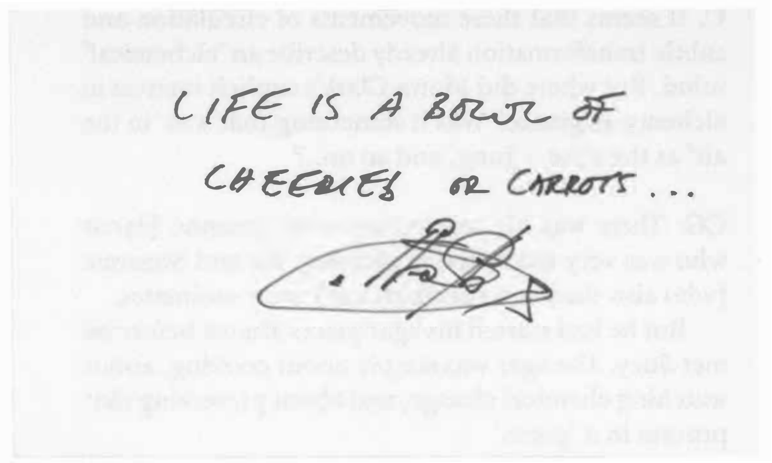
Collapse: What was Matta-Clark's relation to New York City – to being in New York – how did the city become a 'fuel' for his creativity and pose new questions to him?

Carol Goodden: Gordon was raised in NYC, after his early years in Chile. I believe the energy of the city was ingrained within him. He saw it as something ever-changing and wished to 'save' the decrepit, the wasted, the useless – transform it into something visually appealing or useful. In this effort he would collect trash from under the Brooklyn Bridge (one of his favourite places) and combine his artifacts into a 'piece.' He made a 'sandwich' of collected things, closed them up in wire, plastered the wire so that his oblong box looked like an over-large suitcase, and stuck newspaper comic strips on the wet plaster to 'wallpaper' it. The *Wallspaper* piece [1973] installed in 112 Greene St. followed that. He photographed the 'common walls' of buildings where one building had adjoined another but had been torn down, leaving the scars of its earlier reality exposed – plumbing, stairwells, wall adornments. Then he took all those photographs, had them printed in colour on newsprint in cascading sequence and used that to wallpaper a ninety-foot length of wall, ceiling to floor. When that piece was removed, he cut the newspaper printings into booklet-sized swatches, bound them, and gave the booklets away.

This constant migration in his mind, the evolution of everything, fuelled his interest in saving pieces of abandoned buildings, or buildings threatened with demolition. Thus he cut one building in half, transforming it; he cut pieces out of floors of buildings; he cut holes and slices through buildings, watching how the light changed and *tromp l'oeil* effects were produced; he decapitated a building in Italy and followed the light trails across the walls with cuts; he cut a corkscrew swatch through the old Beauborg, and so on. Gordon's mind was extremely complex. He never saw or thought about anything singly. For instance in this note – 'Mangé management': it's a play on words,



MANGÉ MANAGEMENT
BUILDINGS ARE FOR EATING:
THE RAW OLD BEAMS LAY
SERVED IN GENEROUS PILES
BETTER CO-HABITED WHERE THEY
FALL THAN TAKEN OUT TO LUNCH.



LIFE IS A BOWL OF CHEERIES OR CARROTS . . .

using the whole thought: *Mangé* could have become *ménage*, or *ménage a trois*, but he apparently was in FOOD when he wrote this, or thinking of FOOD. This constant combining of sights and thoughts, from one subject to another, was replete in his speech as well, making it quite impossible to understand what he was talking about. Many times one sentence or reference would appear in a speech today and a week later another reference to that subject but within an entirely different context, so that one could begin to see that his mind worked in a circular pattern and could almost only be followed by living constantly with him. 'Life is a bowl of cherries or carrots…' The first is simply a trite phrase and then it is combined with what he daily saw at FOOD.

C: It seems that these movements of circulation and subtle transformation already describe an 'alchemical' mind. But where did Matta-Clark's explicit interest in alchemy originate? Was it something that was 'in the air' at the time – Jung, and so on..?

CG: There was his connection with Suzanne Harris who was very interested in alchemy. He and Suzanne (who also died at a youngish age) were soulmates.

But he had started his agar pieces almost before he met Suzy. The agar was simply about cooking, about watching chemical change, and about preserving that process in a 'piece.'

I can possibly, psychologically speaking, project that some of Gordon's internal mentations might have been caused by the car accident he had while in college at Cornell doing his architectural studies. He 'passed out' and in the process crashed the car which killed one of the occupants in the car. Needless to say he felt horrible about this and carried it as one of two major guilt burdens. He was diagnosed with Addison's disease (adrenal gland deficiency) and was put on heavy cortizones (which is what eventually killed him). But I have to wonder if he was not thinking about the alchemy in his own body, why and how things worked, what would happen if he ate this or that, be it recognizable food or food processed through the chemicals that he used to make his agar pieces. He loved watching the change from something recognizable into something new, such as his fried photographs.

The alchemical experiments in Gordon's Chinatown loft (just before I met him) were flat trays in which he sprinkled agar and then tossed various found objects – anything; metal, wood, half-eaten sandwich, dead leaves. He was very interested in watching the mouldy substance grow and change every day, every week. It started out with adding water but then he would let these large sheets dry out, stop growing. The pieces were shown at the Holly Solomon Gallery – in their trays, I believe; they were too fragile to just lay or hang by themselves.

C: When they were exhibited, do you think they were, for him, just the 'dead' remainder of the actual work (the growth itself) – like the photographs of the architectural works – records of something that no longer existed?

CG: No, I believe he saw the agar pieces as transformed. They were just as alive to him as the actual process of the growth of the agar. Just as the cuts were 'the piece' before a building was demolished. The photographs were documentation, true, but he would collage them into a piece of their own.

So the idea of throwing objects into a space and watching it transform, as in the agar pieces, developed into throwing objects into a contained space and then, as I described, binding them up, first with wire lath, then plaster, then papering the plaster with found newspapers (comic pages for colour).

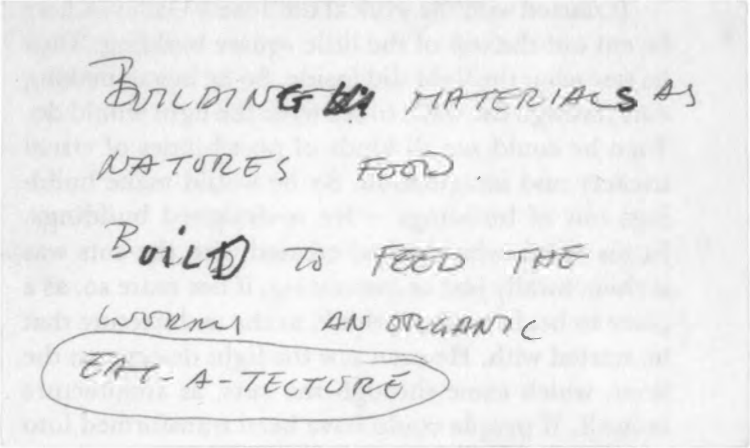
The wire-plaster sandwiches that Gordon made under the Brooklyn bridge were the impetus for cutting the 'sandwich' out of the wall during the FOOD construction, and that started the whole idea of cutting through layers of floors, walls, windows, stairs.

Then the cuts became an intellectual idea of *trompe l'oeil*: When you looked at some of the cuts, it was hard to know which cut was on which wall, which was a stream of light. Especially in photographs, it was visually confusing. There was the element of revealing, in letting the light through. Or the element of what one could see through the cut, such as in the circular cuts. But the linear cuts, especially the one in the decapitated house in Italy, seemed to me very much a trick of the eye. And Gordon loved that complexity, that it was not clear. Even in the Pier Piece [*Day's End*], one wasn't sure, in stepping across the cut through the pier floor, whether the rest of the building was attached or not. Would you float off? Was the huge half-moon cut in the side of the tin way up high a real sky? A painting? Was the half moon on the floor the moon or the light through the cut? One's imagination could go quite fantastic.

It started with the work at the Toselli Gallery where he cut out the top of the little square building. Then he saw what the light did inside. So he began making cuts through the walls to see what the light would do. Then he could see all kinds of possibilities of visual trickery and imagination. So he would make buildings out of buildings – He re-designed buildings. In his mind, what he had created with the cuts was architecturally just as interesting, if not more so, as a place to be, live, squat, think, as the architecture that he started with. He even saw the light designs on the floor, which came through the cuts, as architecture in itself. If people could have been transformed into ethereal light images, they could have lived in the 'light' rooms created.

I think the Pier Piece truly was about cooking shapes – a piece of pie, and the hole in the centre of the pie, which tied into the transfer and re-creation of how light entered, to form new architectural shapes. Then he used the water as a reflector, both by seeing the river through the holes and by cutting through the deck of the pier to access the strip of water below. Who knows what the beginnings of all these thoughts were ... watching his mother cook upside-down cake? Watching mixtures thicken? He did not verbalize any of this.

C: Would you agree that there is a link between this breaching of the 'cells' of a building, and allowing the



BUILDING MATERIALS AS
NATURES FOOD.
BUILD TO FEED THE
WORMS AN ORGANIC
EAT-A-TECTURE

elements to invade and mix inside, and the interest in cooking – that both came from this abiding interest in change and alteration, the relation between changing something material, and the spiritual effect that this has (whether letting sunlight into a building, or adding heat to a postcard...)?

CG: Yes, exactly.

C: So that cutting, removing (subtraction), would be done in order to set in motion or in flow a visceral communication (architectural 'digestion') – to reveal strata, all the way down to a substratum of continually-in-motion circulating matter, the constant terrestrial cookery of waste and regeneration. A kind of cutting of spyholes into what lies beneath 'permanent' structure. In a 1976 interview Matta-Clark says, enigmatically: 'A cut is very analytical. It's the probe, the essential probe, the scaffold of sharp-eyed inspectors'.

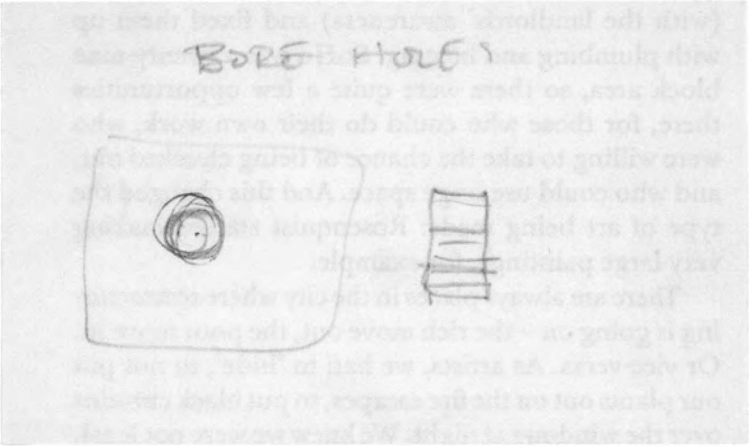
We can see this aspect of uncovering the building as a corporeal machine with inlets and outlets [1971's *Pipes*], and a limited lifespan, to be decomposed and digested, either by ruin, or to be transformed and reincorporated by the metabolism of urbanisation itself. In taking over the building and making FOOD, I guess you were partaking in that very process yourselves – preparing FOOD for the city ... Could you say a little more about the process of renovation/restructuring of the space that became FOOD, and the moment when Matta-Clark first started making the cuts and realizing that this was something significant?

CG: It actually started with the loft that we had been forced to leave. I had built a sauna, a shower, and a toilet compartment out of three public toilet areas in an old loft. We were unjustly forced out when the landlord changed. Gordon was angry and thought he would take a part of what I had built, which he loved, with him. So he made a horizontal slice through the walls of the sauna/shower. That fuelled the slicing of pieces out of FOOD.

In its former life FOOD was a Spanish-American coffee shop, *Comidas Criollas*, that served early morning workers in the light manufacturing district and closed after lunch. It was on the corner of Prince and Wooster, well-located. It had windows all around which delighted both of us. We took the old *Comidas Criollas*, gutted it, poured new floors, laid tiles, put the kitchen out with the people so they could watch us cook, which was my idea. Then we were able to pick up the building adjacent to the north, so Gordon began cutting through that wall to join the two spaces. He designed the sandwich-making area and cut a horizontal 'window' through that wall, of about the same size as the sauna cut. The particular textures of wallpaper or wall finishings, different on both sides, was what intrigued him. That was what fuelled his searching through the Brooklyn buildings looking at the floor surface and the ceiling surface and realizing that if he cut through the floor, his sandwich would be decorated differently on each of its sides.

C: There is a very direct sense in which the 'broken' state of New York at the time immediately enabled Matta-Clark, and others with vision, to access these derelict spaces which could be experimented with in various ways.

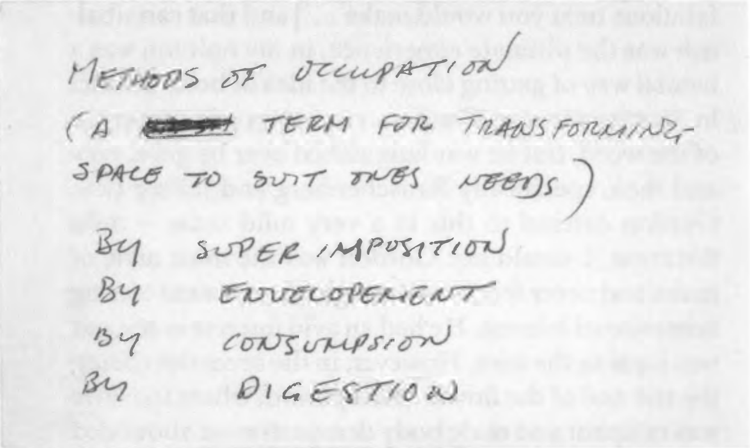
But perhaps the parallel is stronger: that the condition of the city was an open invitation to cut through,



to see differently, to recombine what was there to create new possibilities. Can you tell us something about how it was to be in New York at this time? One wonders how far we are really able to understand, today, how 'open' a city could have been – we are used to urban spaces being far more controlled, everything being clearly owned, and there being little opportunity to use and experiment.

CG: SoHo, in particular, was in great flux. It had come out of an era of light manufacturing which was no longer economically feasible in multi-story buildings. Businesses were moving to New Jersey. This left vacant buildings. Artists snuck into these buildings (with the landlords' awareness) and fixed them up with plumbing and heating. SoHo was a twenty-nine block area, so there were quite a few opportunities there, for those who could do their own work, who were willing to take the chance of being chucked out, and who could use huge space. And this changed the type of art being made: Rosenquist started making very large paintings, for example.

There are always places in the city where restructuring is going on – the rich move out, the poor move in. Or vice-versa. As artists, we had to 'hide', to not put our plants out on the fire escapes, to put black curtains over the windows at night. We knew we were not legal. The Broome Street Expressway was scheduled to come through from New Jersey to Brooklyn, wiping out all those buildings, so our time was limited. But Julie Judd single-handedly fought the city and convinced them that SoHo was now an art centre and important to New York. So the Expressway was cancelled and suddenly we (artists) were 'legal.' Prices of the buildings, which the artists had fixed up into glorious, original places, skyrocketed. The buildings were clearly owned, in SoHo, all over, but they were 'in rem' – meaning they couldn't pay their taxes and were therefore in danger of being repossessed by the city. This is why the owners let artists live and work there, so that they could be receiving some kind of rent, illegal or not.



METHODS OF OCCUPATION
(A ~~[illegible]~~ TERM FOR TRANSFORMING-
SPACE TO SUIT ONES NEEDS)
BY SUPER IMPOSITION
BY ENVELOPEMENT
BY CONSUMPSION
BY DIGESTION

C: Yves-Alain Bois has said that Matta-Clark's critical project was to understand the status of architecture as 'waste-in-waiting' – emphasising a perspective of ephemeral process on architecture and building. Matta-Clark himself also speaks at one point, in 1971, of a 'primeval cannibal chaos', the 'alien subjugated life' that might break out and destroy civilisation. There are other mentions of cannibalism, leading us to wonder about its significance.

CG: The 'waste-in-waiting' idea is exactly how Gordon saw every dilapidation. As to cannibalism, Gordon's written conversation with Lee Jaffe, suggesting that he donate his body to FOOD ['just imagine what a fabulous treat you would make …'] and that cannibalism was the ultimate experience, in my opinion was a mental way of getting close to the idea of body contact in an extreme way. Gordon was not gay in any sense of the word, but he was languished over by gays, now and then, specifically Rauschenberg and Jeffrey Lew. Gordon catered to this in a very mild sense – mild flirtation, I would say. Gordon was the most male of males and never followed through on any latent teasing homosexual interest. He had an avid interest in sex and was loyal to the core. However, in the seventies (being the tail-end of the flower-child period, where free love was rampant and nude body demonstration abounded – and, in my belief, any artistic soul is interested in all bodies, regardless of gender), thoughts of body contact with same sex were not prohibited in thought. In dance, particularly Steve Paxton's contact dances, there was a lot of body contact between all males and females, disregarding all ancient prohibitions.

C: But this notion of the consumption of the body is also symbolically about ephemerality and process: the 'primeval cannibal chaos', or the repressed, continuous nature of reality, is itself 'homosexual', it is a homogeneity that continually decomposes and conjoins with itself …

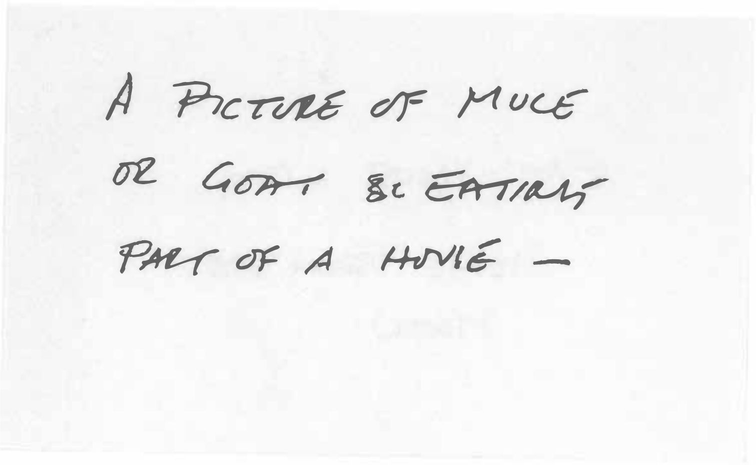
CG: I agree. Many of Gordon's ideas were plays on words and meanings, rather than actuality. It was rather difficult to understand Gordon in conversation, frequently, as he spoke in circles – his mind was racing faster than he could verbalize and so he would pick up a portion of this idea and speak it, while that idea fed into the next idea and he would pick up a portion of that idea. So that as these circles of ideas spiralled through his brain, the listener was getting only bits of each circle of verbalizations. But if one listened long enough, all the circles would finally interconnect and one's own brain could sort through and make sense of the connections ... rather like the experience of speed reading.

C: In the early medieval philosophy of property and ownership, a dispute arose over whether Franciscan monks betrayed their renunciation of property by eating food provided by the order: the question being whether, and at what point, ingestion implies ownership. We know that the question of ownership is at stake in *Fake Estates* ...

CG: Yes, I do think the legal aspect of ownership, and the questions that ultimately arise from it, was a part of the fascination. I remember his excitement about finding out that these survey errors existed and that he could 'have' them.

C: ... But using food in creative practice can also be a way to highlight not only process or transformation, but also the *consumption* of artwork, and its *incorporation*. With FOOD, was there an agenda of making and living art that, in being geared toward consumption (ie being food, and therefore consumable) ironically couldn't be commercially consumed? In the sense that one could maintain an artistic practice that was continually lived, consumed and incorporated in a social context, and was not accessible to the art market, at the time beginning to commercially burgeon?

CG: Yes, I think that must have been so, though subliminally. After all, Gordon did try to sell his art piece, FOOD, to Castelli, and Castelli actually did take a look. What I remember of the seventies was a move towards Conceptualism. One artist had his opening piece at the Whitney and it was a block of ice covered by dry maple leaves. Every day the block melted a little more, making a different pattern of water as it melted. Its own shape also changed with the melting, and the placement of the leaves changed. It was not exactly a piece that one could 'buy', but nonetheless, very interesting. This makes me think of dance ... especially Trisha Brown. Her pieces, her choreography, was a lot about intellectual thought. She was very sculptural, very spatial, in her pieces.

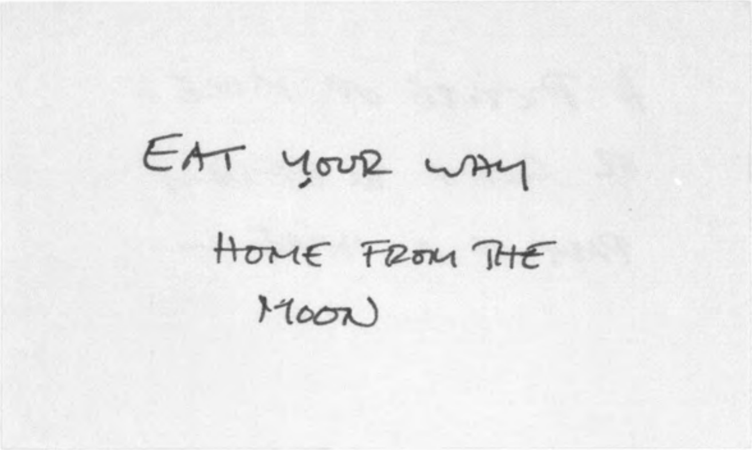


A PICTURE OF MULE
OR GOAT & EATING
PART OF A MOVIE –

Her form of sculpture could not be bought either. It could only be (excitedly) thought about.

C: What was cooked at FOOD?

CG: Lunches and dinners. Soups, sandwiches, salads, stews for lunches, and anything from Cajun cooking to Castillian cooking to vegetarian, Japanese, French – whatever any of us felt like – for dinners. We usually had about three choices for a dinner plate. We baked our own bread and had a dessert chef – Joanne Akalitis of the Mabou Mines theatre group was one. Robert Prado, of the Philip Glass Ensemble, a saxophonist, was our main lunch chef. One day we got in a bunch



EAT YOUR WAY
HOME FROM THE
MOON

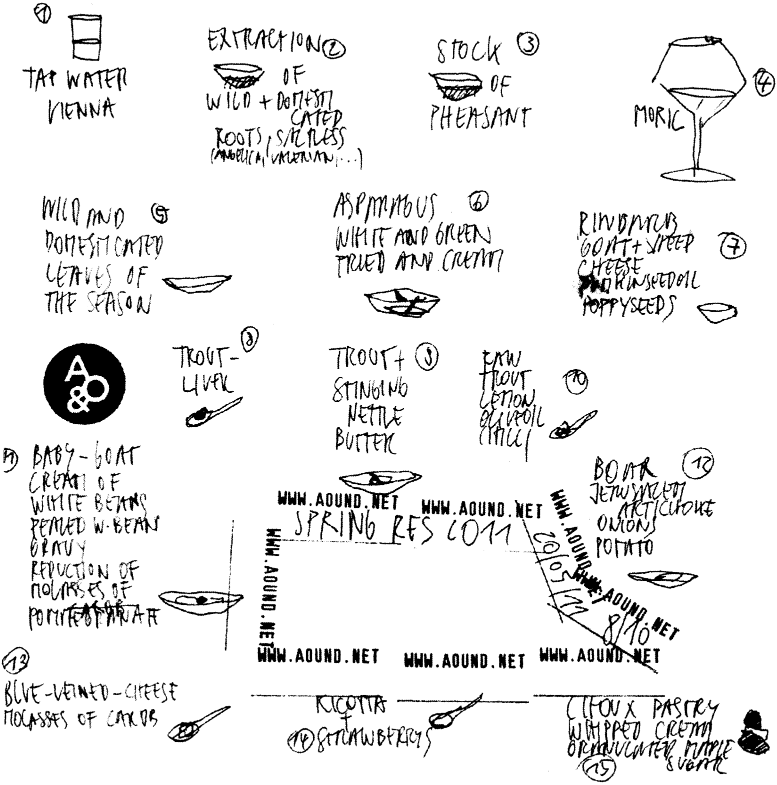
of soft-shelled crabs from Maryland. We covered the ash tables with newspapers and dumped the cooked crabs onto each table. If Robert could see that people didn't quite know how to attack their crabs, he would sit down with them, sporting a giant white chef's hat, and show them how to crack and suck on their crabs. As a cook in real life, Gordon was very experimental. At FOOD we served halved, hard-boiled eggs, with yolks removed and broth in the cavity, into which we squirted, via syringe, a few *live* brine shrimp. This was Gordon's idea. We also served quail egg salads – he loved the pickled quail eggs. The 'famous' Bone Dinner, served at FOOD, was Gordon's idea.

C: In what spirit was the Bone Dinner served – could you describe something of the preparations, the atmosphere, how people responded? Who was 'invited'?

CG: Everyone was invited – It was a public restaurant, so whoever came, came. The Bone Dinner was part of the Guest Chef programme. They were held on Sundays. Gordon was the Guest Chef for the Bone Dinner. He wanted to serve a 'sculptural' meal. We went early morning to the meat market and loaded the pickup truck with huge leg bones and joints which had been sawed into manageable sizes. We also picked up frogs legs and chicken drumsticks. We bought unsweetened gelatin (ground bone) and made an aspic salad. We got oxtail bones from another meat market and made oxtail soup. The main plate was the array of different sized bones. The big bones, cut into rings, were stuffed with wild rice, wild mushrooms and more ... After the dinner, the plates were taken back to the musician, Richard Peck, who scrubbed the bones up and handed them to Hisachika Takahashi, a sculptor/painter/jeweller. Hisachika drilled holes through the bones and they were strung on a hemp rope as a necklace so that the customer could wear his dinner home. People loved it. We had very little anti-reaction. There were some who wondered what on earth we were doing, but by now, people who came to Guest Chef days were pretty accustomed to whatever surprise we were about to serve up.

C: Ultimately, what kind of enterprise was FOOD? – a restaurant, a piece of living art, a support network for the artists who could work there, a place to hang out – which of these aspects came first, and how much planning and conceptualizing was involved, or was it just another adventure ...?

CG: Certainly it was another adventure, but I wouldn't say 'just' another adventure ... To me FOOD was a restaurant, a social place, a place to serve fun food to friends, and hopefully pay for itself – but I did have a main social interest which was to provide financial support for the artists. To Gordon it was an art piece – a grinding, revolving, changing, regurgitating, consuming thing, like his agar pieces. People came in thin and went out fat. People came in poor and earned enough to continue to make their art. Food came in as slabs of meat and fish and became roasts, stuffed stomachs, stews. Flour barrels became bread. The germs of ideas of choreography began over lunches. A pick-up full of bones became a tasty dinner became a necklace around the neck.



① TAP WATER VIENNA

EXTRACTION ② OF WILD + DOMESTICATED ROOTS, [illegible] (ANGELICA, VALERIAN, ...)

STOCK ③ OF PHEASANT

④ MORIC

WILD AND ⑤ DOMESTICATED LEAVES OF THE SEASON

ASPARAGUS ⑥ WHITE AND GREEN FRIED AND CREAM

RHUBARB ⑦ GOAT + SHEEP CHEESE LINSEEDOIL POPPYSEEDS

TROUT- ⑧ LIVER

TROUT + ⑨ STINGING NETTLE BUTTER

RAW TROUT ⑩ LEMON OLIVEOIL CHILLI

⑪ BABY-GOAT CREAM OF WHITE BEANS PEARLED W-BEAN GRAVY REDUCTION OF MOLASSES OF CAROB POMEGRANATE

BOAR ⑫ JERUSALEM ARTICHOKE ONIONS POTATO

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⑬ BLUE-VEINED-CHEESE MOLASSES OF CAROB

RICOTTA + ⑭ STRAWBERRYS

CHOUX PASTRY WHIPPED CREAM GRANULATED MAPLE SUGAR ⑮

Where's the Edge of the Pot?

Interview with AO&

Since 2008, Vienna-based 'semi-nomadic organization' AO& have developed and refined a unique practice which sees them bringing their knowledge of produce and culinary skills to bear in extensive tours of the landscape and intensive occupations of buildings which become spaces for the serving of their strikingly minimalist, concentrated multi-course meals. **Collapse** *met the members of AO& (Philipp Furtenbach, Philipp Riccabona, Thomas A. Wisser, Rainer Fehlinger) during their Fall 2011 residency, in a derelict shopfront on the Lower East Side of New York, billed as '240 hours nonstop ambulatory on ground aggregation, accommodation, eating and drinking plants and animals of the season, aliments of disclosed NY origin, multiple differentiated courses'.*

AO&'s policy of personally sourcing every one of their ingredients contributes to an intimate familiarity with every aspect of their meals' preparation. If in effect their work entails a rigorous insistence on the full inhabitation of the problem of food in contemporary society, it certainly goes beyond the moralism of the various environmentalist food lobbies. As they describe, their 'perverse' practice of cookery extends our understanding of 'food preparation' beyond the confines of the kitchen, exposing social, ecological and architectural dimensions of the culinary.

Collapse: You are about to open for the first night of your residency here in New York. But you haven't just arrived. How has the preparation process worked in this case – did you have an idea of the ingredients you want, or do you just go out and see what is available?

AO&: We arrived twelve days ago and had to prepare the location as well – clearing the space, putting the cooking equipment together, the dining table, the lighting, etc. All we brought from Austria was salt and wine, so we also had to source all other ingredients during that time.

We do have an idea of what we are looking for, in general categories – you need animals, produce, grain, fats and oils, and so on. To create a twelve-course menu, it takes a certain variety of ingredients. We were looking for farms online and talked to people, found out about farmers' markets in Manhattan, checked out their products and then drove around to visit the farms.

C: If you're arriving with a set of requirements, does that mean the menu itself doesn't respond to the site?

AO&: We don't ever work with ingredient lists or anything like that; we go to a place and search for fields of ingredients, so to speak, and then work with whatever we manage to put together. So the menu does respond to the site, because you have to work with what the people here produce. If there are no lemons to be found, you have to use vinegar or the juice of unripe fruits ...

C: So, you find produce and follow the commercial chain back to the producer?

AO&: Yes, in this case, that's what we did. Once you start somewhere, you get recommendations as well, and we also found this rooftop farm, for example. So you could say it starts as a collection of places, of sites. You go there and you actually take a look at the land, and at the farm, and you talk to the proprietors, and it becomes very clear whether this is someone you want to work with, or not.

C: Does it happen often that you decide not?

AO&: It can happen, sometimes you follow a wrong lead; but seldom. Now we've got a good sense for it.

C: New York is not the first place one would think to look for people growing food. So, what sort of things did you find in your travels?

AO&: The average product is pretty bad, but as with anywhere else, there are some extraordinary ingredients to be found. In our research we discovered there is quite a culture of inner-city farming, and we had to include this. We found a one and a half acre rooftop farm on top of an industrial building in Queens, they grow there all summer; this is our most local producer.

The special ingredients like oil, vinegar, sugar, were quite hard to find in New York, especially since the production of vinegar seems to be tightly restricted. You need a special license, you're not allowed to make vinegar, because all fermentation processes are strictly regulated in New York State. And it was only after days of research that I found one producer of apple cider vinegar ...

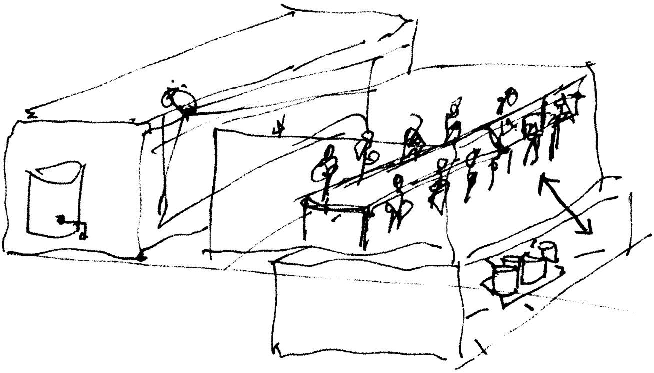
So, ultimately, with these goods, we end up in a situation in the kitchen where, in the best scenario, with every ingredient you use, you've immediately got images of the place where it came from.

C: So your experience in the kitchen is changed a lot by that sourcing process.

AO&: Yes. It is a kind of luxury to have this maximum transparency: knowing the people personally, knowing what they are like, knowing the products, and what they put into the products.

C: But you aim for the same close relation to the space you're cooking in too. How important is the site to your work, and how much work was necessary on this space in New York?

AO&: That goes hand in hand, yes. Cooking isn't our exclusive focus; it's more of a tool for us, a powerful instrument to gather people together. A lot of our work is about creating temporary settings, working with different sites, to enable unconventional forms of communication. We often turn a place that at first sight may not look very hospitable into something that is. In this case, in New York, it was a lot of work from the moment we arrived up until now, to change this place from what it was to what it is now. We have created areas for cooking and dining that are highlighted, very clean and well-maintained. When we first walked into this space, you couldn't really imagine having any kind of social communication situation here with food involved. We had to clean everything out,



brush everything, hose everything down; we brought the kitchen equipment together bit by bit; and then brought in the theatrical lighting, to establish a situation for eating. To make it somewhere where people, even if they first think 'what is this place?', eventually feel comfortable and get to talk to each other because they feel at ease in it, they don't feel the urge to leave.

This meticulous preparation plays a significant role in a lot of projects we do. It's the kind of work you probably wouldn't normally want to do; but by doing this, spending days on our knees scrubbing, in cleaning a space we also conquer the site. That's really important for us, in order to get the confidence as to how we can act after that in here.

C: To make the space into your own environment …

AO&: Yes, we justify our presence through the effort we put into this work; also, it's a kind of devotion or humility, doing something that normally would be done faster and cheaper, using machines or cheap labour.

C: So that work of preparing the building becomes a part of the food preparation?

AO&: Totally, yes. You could even include this in the set of orthodox rules according to which our ingredients are brought together. If you touch every single corner of the place and prepare everything, you put a lot of hard work into the place, and you feel more at home because you know every part of it.

Like our project in the mountains [*Leben und Sterben in den Bergen*, 2008], where we dug a massive hole and created a whole environment in there. It's the same thing with the space and with the food – standing in the kitchen while you prepare things, it's just different to cook with things where you associate every single ingredient with a certain person or place or story. You could ask, where's the edge of the pot? – the whole space and context is important. Also in terms of taste, I think eating the same things in different situations changes the experience. And to have these rules is also a limitation. It makes it more interesting for us if we don't just come here and go to a shop and buy

anonymous products to cook with. In following our rules, we really try to establish a connection to the landscape here, to the culture, to the environment.

C: So part of the work is to do with creating a convivial situation around food, and that involves co-ordinating yourselves with all the materials – from the building to the ingredients. But where does the rigorous nature of the culinary practice originate? And are the rules very rigid, or do they change for different projects?

AO&: As far as the ingredients are concerned, it has been the same in every project for the last five years: We only use products where we know the source, where we have a personal relationship – meaning that one of us has been at the site where the product comes from. There are some exceptions – for instance, if we know someone really well and we trust him or her, and they come with something they brought, let's say, from Madagascar, and they spent some time with the farmer at the farmer's site, and took a photo of themselves, and tell us a story about this, we also discuss whether we can use it. So sometimes we take these decisions, and sometimes the story isn't good enough! We have to feel *related* to it.

In this case, as we discussed, we went to markets, we did online research, we found rooftop farms; these are places we have been to ourselves. We always try for as many of us as possible to go visit the places; but in this case, for pragmatic reasons – we didn't have that much time: twelve days preparation, twelve days for the show – Rainer did a lot of the travelling while we were preparing the space itself. We put together a tour from what we had seen at Union Square market and similar places, of things we thought were well-produced and interesting for our cooking. Rainer went to upstate New York and New Jersey, and actually visited the places we thought were relevant or interesting to us. And he established the connection to the farmers, and then showed us the pictures, told us the stories related to that.

In Austria we have a very elaborate network already of people who make all kinds of extraordinary things – they have very small fishponds, for example, or breed old strains of produce, and have those very distinctive things in their market stands. But here we had to build it up from scratch, just like the whole setting we've constructed.

C: You have already said that you don't use recipes as such. But there is a certain style of cooking, and certain procedures you use, that seem to involve a distillation and concentration of flavours; and the sequence of the menu here in New York seemed to be very systematic. How would you describe that aspect of what you do – what is aimed at in the experience of the meal?

AO&: Since we can't rely on a constant supply of ingredients, and we don't know beforehand what our stock will look like, we never work with recipes. But there are certain techniques we use a lot, often involving long-running processes such as concentrations, reductions or fermentations. And since we have a strong relation to our products, we try to highlight their quality through a certain minimalism and dramaturgy.

It's also related to the way of thinking I [Philipp F.] learnt fifteen years ago from studying architecture. I was really interested in urbanism and urban structures, how they try to work; and I also developed an interest in working with sites, and the relationships which are important: social, historical, infrastructural, or, say, psychogeographical – I learnt to consider all those different aspects at the same time, which is still important for me. This is a way of thinking you can also use to think about creating a menu or a dish: You have different textures, different tastes, different colours, different meanings and associations of each ingredient – like a tag-cloud, you might say. And that's what happens in discussions that we have before we start with the preparation, or while we prepare. So you have this context around each ingredient, which has certain qualities, and around that, and in combination with more ingredients, you create one dish. And then there's also a context around this single plate, in relation to what came before, and what will come afterwards.

WASSER
① WIEN

NATUR KALT
KULTUR WARM
WURZEN ②

③
MORIC
GR. VELTL.
2005
u FEILERWAFT

KAROTTE
KAROTTE ④
KAROTTE
HEIDELBEER.
KRESSE

TOPICREME ⑤
ROTKRAUT
WEISSKRAUT
MOHN

BLUTORANGE

W. BOHNEN
AUS
MINUTENBROT
BENIN HONIG
OLIVENÖL ⑥
SCHW.
KÜMM.

⑦ CEVICHE

LINSEN
FISCHFOND
WEISSWEIN
KOHLRABI
FORELLE
UNKRAUT V. PEPI

⑧

GERSTENSUPPE
WINTERPFEFFER-
WESTAFRIKA
PALMÖL GERSTE
BUTTER CHILI
WILDSCHWF.
RIPPERL
ERDNÜSSE
MELUNA

⑨

WILDSCHWEIN
⑩ JÄGER: GÜNTHER
WINDISCH
JUS
NUDELN

RIEBL ⑪
BRAMATA
APFELMUS
BLAUSCHIMMEL

BRANDTEIG
[illegible]
KROKANT
ZITRONENHONIG
⑫

⑬

BLUTWURZ
FINANZIER VON
KONRAD
BURTSCHER

VIENNA
WINTER
RESIDENCY
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WIEN 1060

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The sequence of courses is directly related to each event's dramaturgy. There is a formal logic, an arc. We usually start with an empty table, and at first, no drinks will be served. The first course of a prologue of liquids would be a glass of tap water, followed by a saltless, basic root vegetable broth and some more intense stocks. Then the diners get the first glass of wine, as a course on its own, and the food will subsequently become more solid, travelling through plants and animals of the season.

C: If the necessity to feel 'related' to each ingredient can be interpreted as some kind of ethical intervention or idea of how our relationship to food 'should' be, isn't it one that's idealistic, in the sense that no urban population could sustain these kinds of direct relationships? Do you see it as a model in that way?

AO&: No, not at all; it's a perversion, a luxury. We started to work like this in order to define a new kind of luxury. It's not political, it's not the same as slow food, the organic movement, and so on. It wouldn't make sense to propagate this in other societies that are not like ours, you know. You can interpret it as a political thing – a lot of people do – but it didn't originate like that. Food and its quality is very standardized nowadays, even in gourmet restaurants.

C: Like an 'international style' of cookery.

AO&: They mostly buy the same stuff from their own suppliers, they have these big refrigerated trucks that come with peaches from France, foie gras ... from one high-ranking restaurant to the next, they deliver to all of them. Whereas you could say that even if what we do is very elaborate, with multi-course menus, and with a certain technique applied to it, most of the people on this planet don't even have the choice to say, on purpose, "I'm only going to use ingredients where I know where they come from" – because they don't know anything else. This is how most people on the planet cook, out of necessity. To do what we're doing on purpose is a phenomenon of wealth, of being disconnected. This is why we call it a perversion, and we are well aware of that. The only thing that justifies our method is the society we use it in. It wouldn't make sense to take this to a so-called third world country, because this is just what they do: they cook very simply, most of the time using very good products, better ones than we have.

We often try to strip away everything manicured or unnecessary and present the ingredients as they are because this is already very valuable, especially if you assemble them in the way we do; and we try to have excellent stock from small producers.

C: It is certainly noticeable that in each dish one can taste every ingredient. Last night, you presented New York tap water as the first course, and in the very delicately-flavoured soup for the second course one could still taste the water as one of the ingredients.

AO&: It is interesting for us to start from the water and build up really slowly; you become much more sensitive about textures and tastes by starting like this. And what we also like about this is that it irritates people. They think they're going to get a nice menu, and then all they get at first is tap water. Maybe they think it's funny; then they get this subtle, saltless soup and some of them are getting worried – what is this that we're gonna be eating tonight?! And sometimes when we have a series of nights, and people pay, you have a situation where people are thinking, OK, they start with water, no bread on the table, and they start to get angry. After a few courses, you can see how they feel more and more at ease and happy.

C: Going back to Philipp's architectural background, one could say that in your projects the importance of food is in the way it acts as an architectural element, in that it affects the circulation of people and communication. And that this menu sequence is a kind of carefully constrained demonstration of the power of food to affect the social situation.

AO&: We are interested in this question of sites and the communication which takes place on a site or in a village or in a part of the city; and to make an intervention in that situation. And the food plays some role because it makes people stay in one place at the same time. You can make them feel comfortable, and they open up because they lose their barriers. That's why we use food. Food serves as a vehicle to reassure people, to enhance communication. And in regard to my [Philipp F.] architecture and urbanism background, I consider this to be the same thing, it's a kind of soft urbanism, rather than the normal declaration, "I have decided how we can develop this part of the city, and here is the master plan". You can feel the power of food to act in this communicational way very strongly if you work like this.

In the project *Studies on Hospitality* [Aug-Sept 2010], we travelled through a valley in the Austrian mountains with handwagons for thirty-five days: We bought four handwagons, two for equipment and food (of course, local foods; mostly donations from private gardens) and the others for our personal belongings and what we need to stay overnight, so that we could stay anywhere. So we started this journey, not knowing where we would sleep; we went to every village, to several houses and tried to convince people to spontaneously let us change their homes into semi-public spaces, to convert them into a guesthouse, you could say. We saw ourselves as some kind of task force, ringing doorbells and trying to figure out social relationships – who is important, who is well-connected, who is lonely... Then we invited people over to the temporary host's place, and they were allowed to invite some neighbours as well. We walked all the way with our handwagons and visited every single village there. It took five weeks, that was the minimum time period it made sense to do it in. And it was really successful in every village.

What helped with this, again, was this element of humility or submissive behaviour: in this case, in the pushing of the handwagons. If you'd have done this by car, pulled up and said, "Hi, we're here, in the back of

our car we have all we need to cook for you", it wouldn't be half as successful. Arriving with the handwagons has this submissive aspect again: When we started the project, we looked at ourselves and said, "Hey, you guys look so stupid with those handwagons ..." – it really felt strange. Beautifully styled, with nothing but waterproof black bags, on purpose. Our appearance was really strict, only grey and black, the wagons were black – the aesthetics are really important here, to ensure it's open to more people. We were aware of the strange and, at first sight, maybe even intimidating impression we made, that's why we wanted to make sure that everything looked 'proper'.

So, we went to people's houses and convinced them, sometimes within ten or fifteen minutes. We entered their houses; and within hours they had four guys in their kitchen, pulling open every drawer and starting to prepare food. It's very intimate; there's a lot of trust involved, if you let someone in your kitchen – this is probably the most intimate place you can work in a private home. During the period of this journey we cooked dinners in twelve private homes and fed about five hundred people, with all ingredients foraged locally. For one weekend, we reopened an old hotel/restaurant that had been closed for almost thirty years, and another time we served deer stew at the local gas station ...

Incidentally, we got funding from regional development because we declared it as 'performative regional development'. And they like our approach, because what usually happens in 'regional development' is that there's a pot of money, it's given to the communities, and they do some project directed from a desk. We don't just come up with a concept, we apply our methods and try to really get deep into the social situation.

C: From the many elements you describe that create that ability to enter into a new situation, it sounds like you were putting yourself at their mercy, rather than arriving and saying 'we've got something to offer you' – this submissive position is very different from the idea that you are there to benefit 'the people' with art practice; perhaps a counter to the notion that art can provide a social glue to bring people back together. Often in regional development projects it's a question of people airdropping art onto a community.

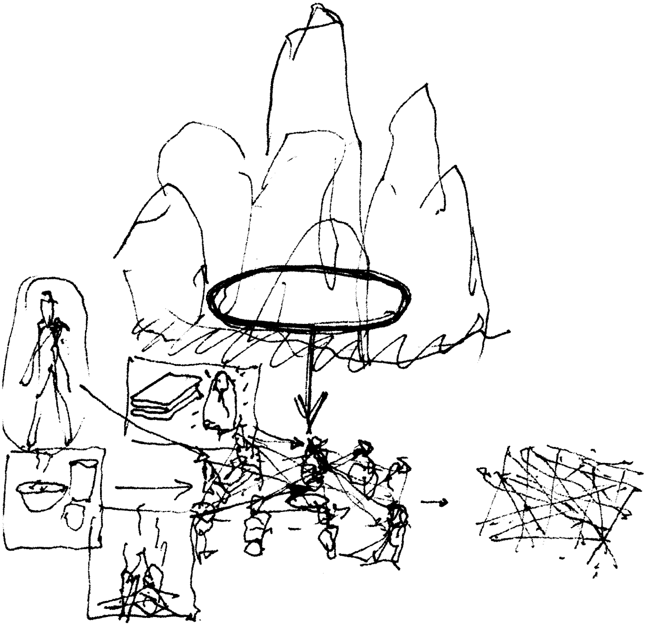
AO&: And in fact of bringing *artists* together – it's self-referential art world stuff.

Another project in the same valley two years before involved digging a hole by hand, one hundred and sixty cubic metres. It took us ten days. So, farmers would come and say to us, "I can come with the machine and do it for you in a day". And we said, you know, that then the whole place would look messed-up. And also again, because people are still kind of conservative in the mountains, we knew that otherwise these people were going to think that we were just some freaks from far away – which we are, basically! But by doing that, by being there digging with our hands, old people were walking by, saying "what are they doing?" And then people started to talk in the village, you know: "It's nice to see young people work so hard!" So they had respect for what we were doing, and that really opened up a relationship.

C: And why were you digging this hole?

AO&: Digging the hole was part of the preparations for *Leben und Sterben in den Bergen* ('Life and Death in the Mountains') [Aug – Sept 08], one of our biggest and most important works. We spent nine weeks in a remote alpine area (*Großes Walsertal*), and the first half was dedicated to creating the site for the actual project to happen. We dug that hole in a circle of trees, filled it up with gravel from the bottom of the valley to have an even surface, installed an 800 kg oven and an additional smaller one for cooking, built a huge tent to make the site rainproof; we had solar panels for lighting and a sound system, we spent all day and night there.

The actual project involved all kinds of meetings and events, from avant-garde electronic concerts and



DJs to lectures on terminal care and legal issues, or pagan burial rites in the alpine area, the first grand public council of the valley, etc.

C: Thinking about it in an art context, a lot of recent work with food and conviviality has tended to recuperate for a gallery setting (albeit 'relational') something that, with Matta-Clark's FOOD in the seventies,[1] was a genuine experiment, along the lines you have been describing – food and the ritual of eating as a social agent. It seems like you are inhabiting the social space in a far more interesting way, a way that can't necessarily be recaptured into the 'contemporary art' system.

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[1] See C. Goodden, 'FOOD and the City', present volume.

AO&: The art field is interesting for us primarily as a way to be able to work on a larger scale, more internationally, and to be able to finance the work as well. Also it's a kind of cover you need for legal reasons, because if you work in this cooking context, you always have to make sure that everything is declared properly, and that you have all the legal issues cleared. And what we do here is not legal at all – we work with propane indoors, we serve alcohol, we don't have a license for anything, we aren't even officially allowed to work in this place ...

Since we only ever work in a project-oriented way, it would be very difficult to get all the permissions for every single project, you would wait for weeks and weeks. And if people ask what we are doing, if they ask me what my profession is, to say 'artist' is the easiest thing. Of course it's perceived as art by certain people, what we're doing.

C: But you're not concerned about locating yourself in that context?

AO&: It comes in handy sometimes, but this was never the main point of interest. Our group basically started with a restaurant in Vienna, *Saint Charles Alimentary*, that was working in collaboration with a pharmacy, and was trying to think the concepts of medicine and nutrition more holistically. But we have never really tried to put a label on what we do. There are different ways to navigate through situations – with some people it's helpful to present yourself as a chef who is running a gourmet kitchen; with other people it might be helpful to say you're doing a sociological project; and with some people you just say you're an artist. In fact, I think the work speaks for itself, and you can decide what you want to call what we do.

During the early years it was more difficult to make out what we're doing; but as the body of work is growing, it's easier to get a sense of what our interests are.

C: So Saint Charles was the first time you worked together in a food-related context?

AO&: After this schooling in architecture, I [Philipp F.] went to Berlin and worked in a restaurant, because I needed a job for two days a week to pay the bills, and I was interested in cooking. I started as a dishwasher in a really good restaurant. So that was the beginning of taking the cookery thing more seriously. And then I got a chance to work full-time as a sous-chef, so I did that for two years. During this time, the chef [Claudio Andreatta] was a really good master for me. And one day he told me I could choose what I wanted to do, a project within this restaurant. Now this was at the time that I was just about to start working with meat. So I said that before I start to work with meat, I want to kill an animal myself. I made this short film *God is a Rabbit*, it was about a rabbit dying and being eaten, diametrically filmed, just with orthogonal views.

When I came back to Vienna and happened to find a big loft apartment to live, I opened a temporary, illegal restaurant. The brother of an old friend of mine [Philipp R.] came to help me and got really interested. So together we were investigating new things. I didn't want to work with this gourmet stuff anymore. We started to choose living animals, for the next two months, to be ready to be cooked; and we started to look at each vegetable, thinking that there must be a wild form of it; we started to buy books and read up about this. For the first two years, both of us spent four months a year outdoors, just learning about all these things. And also, for instance, there was a project where we chose a new-born pig; people could buy shares of this pig, and they got sent bulletins every month about how the pig was growing up, and so they built up this personal relationship and learnt what it means to eat meat that you know.

C: So you were already concerned with fully inhabiting the question of where food comes from?

AO&: Yes, but it was also this ritualistic viewpoint, in a very neutral sense – just to be aware of every procedure that is going on, to really question every procedure.

And then these pharmacy guys found us, and they asked us if we could develop a concept of bringing back nature to pharmacy. This concept included a restaurant which became really successful, and we had a lot of press, even international. Knowing that we were now going public with our work, that was the crucial point where we said, if we're going to do something public, there has to be some specific characteristic about it, so that's how it started.

The restaurant was a very small, narrow place seating no more than fourteen people. And even then, our work had this performative side to it; we didn't have a menu or anything, people couldn't just order food, we took care of them. It was a place where all kinds of people would walk in and out all day, and the 'backstage' area was bigger, and maybe even more important, than the actual dining area ... We played old Sun Ra tapes all the time, and concerts took place. It was an open kitchen, and on weekends, we prepared about a dozen courses; that was when we started to cook in a more precise and differentiated way.

C: What are the background of the others in the group, and how did they become involved?

AO&: [Thomas W.] I have studied linguistics and philosophy – my masters' thesis is about theories of metaphor. I'm a musician and writer, I released some records, and I also work as a DJ. My work with Philipp and Philipp started in 2007.

[Philipp R.] I have many different interests, I worked as a carpenter, I had a strong connection with farming, and worked in Vienna as a salesman for farmers as well. Before I started to work with Philipp I studied medicine for two years. But at that time I didn't want to go a classical way, I wanted to start with something totally independent for myself. Right from the beginning I was sure all my disparate interests found a good playground in this work.

[Rainer F.] Concluding Studies in Music and Media technology, I joined the group in 2010 after several years of involvement, assisting in various projects. Apart from AO& I live and work in Linz and Vienna as a recording artist. I also hold a truck licence, so I'm the driver of our hearse.

C: Where did the hearse come from?

AO&: The hearse is a private donation from a friend, a Mercedes 709, 4.6 metric tons, dark grey colour.

We had it refurbished in the Czech Republic. It was not a ceremonial vehicle – it used to hold up to ten coffins and was built for big cities and catastrophes. We are running it in association with SOS, the State of Sabotage.[2]

C: You visited several Alpine resorts in the hearse [*Feed the Rich*, February 2010] to serve soup to the people there – you called this an 'non-oppositional contribution to the so-called critique of capitalism'.

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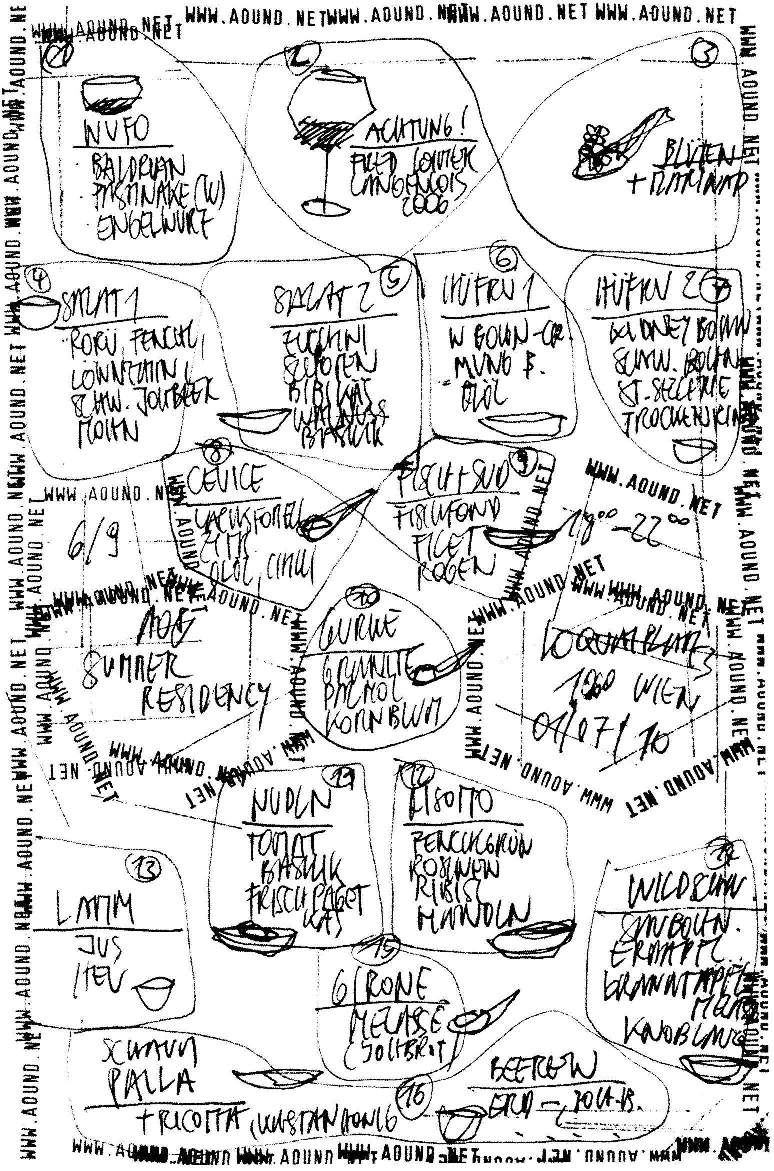
[2] See http://www.sabotage.at.



① NUFO
- BALDRIAN
- PASTINAKE (W)
- ENGELWURZ

② ACHTUNG!
FRED LOIMER
LANGENLOIS
2006

③ BLÜTEN
+ [illegible]

④ SALAT 1
- ROHE FENCHEL
- LÖWENZAHN
- SCHW. JOHBEER
- MOHN

⑤ SALAT 2
- ZUCCHINI
- SCHOTEN
- BIBISKÄS
- WALNUSS & BASILIK

⑥ HÜLSN 1
- W. BOHN-CR.
- MUNG B.
- ÖL

⑦ HÜLSN 2
- KIDNEY BOHN
- SCHW. BOHN
- ST. SELLERIE
- TROCKENKIRSCH

⑧ CEVICE
- LACHSFORELL
- ZITR.
- ÖL, CHILI

⑨ FISCHSUD
- FISCHFOND
- FILET
- ROGEN

⑩ GURKE
- GRANITE
- PASTIS
- KORNBLUM

⑪ NUDLN
- TOMAT
- BASILIK
- FRISCH PAGET KÄS

⑫ RISOTTO
- FENCHLGRÜN
- ROSINEN
- RIBISL
- MANDLN

⑬ LAMM
- JUS
- HEU

⑭ WILDSCHW.
- SAUBOHN.
- ERDÄPFL
- GRANATÄPFL
- MEER
- KNOBLAUCH

⑮ GIRONE
- MELASSE
- (JOLLBROT)

⑯ SCHAUM PALLA
+ RICOTTA (WÜSTENHONIG)

BEETROW
[illegible] – 2014-15.

6/9

AOS
SUMMER RESIDENCY

19⁰⁰–22⁰⁰

LOQUAIPLATZ 3
1060 WIEN
01/07/10

AO&: Criticism of our economic system is mostly oppositional and short-sighted at the same time. We are aware of our social background and its benefits and wanted to reverse the idea of charity, as an embracing gesture and to raise questions.

C: Is it possible that the group could evolve practices completely outside the culinary context?

AO&: We have already been working without any food or cooking involved – our walks, the hearse tours *Visitation* and *Memento Mori*... – and we see food as a tool, serving many other purposes than just nutrition.

C: If not food is therefore not the main concern, what would be the central characteristic of the group?

AO&: We are interested in creating situations and experimenting with settings that strengthen communicational processes.

C: Experimenting with the in-between social spaces that enable other processes to carry on, as when people 'do lunch', for instance?

AO&: Right, and we found out that food is a powerful instrument to do so. It's a fundamental necessity to eat, and it makes people spend time with each other – a unifying experience that is life-supporting, but also

involves trust. Anything you ingest could be poisonous or even deadly.

C: Where did the name AO& come from?

AO&: In the Austrian countryside they had these tiny grocery stores called A&O, it's an old grocery chain in Austria. One day we found an abandoned old A&O. They had just started to renovate this building and pulled down the sign. So we took the sign and just swapped the letters.

The direct meaning would be 'from the beginning to the end, and beyond that'. Another interpretation is this: The topic of death often plays a certain role in our projects – the first big project was called *Leben und Sterben in den Bergen*; then with John [Gerrard] we did *Brot und Tod* ('Bread and Death') [Nov 2008] – in a shut-down bread factory in Vienna.

No matter what belief or religion one has, it doesn't matter – as an atheistic, intellectual or a religious person, death plays a role for everyone, a smallest common

denominator, you could say. And if you're interested in living systems, it's important also to deal with that.

C: This New York residency is taking place concurrently with the exhibition of John Gerrard's new work *Cuban School* at Simon Preston Gallery. How did you meet John Gerrard?

AO&: We met John in 2008 – he discovered our work in this little restaurant we had and saw some relation to his art. He came to us, asked us a lot of questions and told us about his work. We started to collaborate and became friends, we also came to realize some of our projects through people we met via John. In his Vienna art and production space he built an open kitchen according to our needs for us to create portraits of every season of the year in a series of multi-course dinners ...

There's a thematic connection between our approach and John's works, like his *Grow Finish Unit* or the oil derricks[3] – it's about greater correlations of civilization, and maybe its impending end.

C: This also seems to be one theme of *Memento Mori Tour* [June 2010], where you visited 'places of execution'.

AO&: The *Memento Mori* tour was a portrait of a certain area in Eastern Austria and parts of the Czech Republic, with a focus on sites related to matters of life and death, such as the nuclear power plant Temelín, the oldest existing Neanderthal caves, a military training ground, and the historical place of execution you mentioned. We also visited the grounds of a seed bank, and many other places. All those places create certain associations; we foraged stinging nettles at every site to brew liquid manure as a symbolic summary. In the end, we threw it away.

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[3] See J, Gerrard and M. A. Morris, 'Corn Bomb', present volume.

Photographs:p268,YasminaHaddad;p271,MarcLins;p272,Rainer Fehlinger; p281,Philipp Furtenbach; p291, Markus Gohm
Sketches: Philipp Furtenbach for AO&.

KOMBUCHA

Kombucha is a fermented tea made with a symbiotic culture of bacteria and yeast sometimes referred to as a SCOBY (acronym of the above description) or a mushroom.

You will need a SCOBY. Ask someone who brews for a 'baby' SCOBY or fish one out of a store bought bottle. (Every bottle of kombucha brewed creates a new SCOBY within it – a small mushroom-like disc that is the by-product of the larger batch of kombucha and the surroundings of it being bottled.)

Next brew about two gallons of tea – I prefer a green tea – add sugar 'to taste' (you need some sugar for the fermentation to occur), let cool, and pour into a large glass container.

Then float a SCOBY in it for about two weeks (cover with a towel so the mixture can breathe while protecting it from fruit flies).

After two weeks you have a fermented tea and a baby SCOBY in addition to the mother you originally floated.

Separate the baby from the mother and set the SCOBYs aside to use again.

Now you bottle your tea in air tight jars, I use old wine bottles with air tight stoppers.

Then let bottles sit in a dry airy cool place for two more weeks.

Refrigerate and drink when cool.

What you have is a carbonated tea that is full of 'good', pro-biotic bacteria similar to yogurt.

The secret to success is finding the right spot as the SCOBY collects and grows not only from the bacteria of the tea but also from its/your surrounding environment, feeding back into an ecosystem in a micro-form of permaculture.

Object Oriented Cookery

John Cochran

Graham Harman's claim that praxis distorts 'ontology' as much as theory does,[1] is an insight that has long been missing in cookery praxis and theory. Ontology, for Harman, refers to a description of the basic structural features shared by all entities.[2] Cookery, for our purposes, will be considered to refer to all forms of cooking, including what happens in our home kitchens. Many times cookery praxis is something we take part in by consuming the practice of professionals. But whether we cook or not, from the gathering of ingredients to the eating of meals to the metabolic emergence of nutrients in our bodies, the feedback systems used to engage in complex analyses of factors in human life such as hunger, nutrition and environment are likely to be lost in the immediate experience of food or the larger narratives in which food participates. More often than not, the praxis of cookery distorts its 'being' to the extent that the pause required to consider why, how, when, where and what we eat, and how we participate by proxy in cookery, is non-existent. So that we may, indeed must, ask the question: In what sort of open or closed system does cookery praxis take place?

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[1] G. Harman, 'Intentional Objects for Non-Humans', PDF, at http://www.europhilosophie.eu/recherche/IMG/pdf/intentional-objects.pdf, 4.

[2] 'Henceforth, let "ontology" refer to a description of the basic structural features shared by all objects, and let "metaphysics" signify the discussion of the fundamental traits of specific types of entities.' G. Harman, 'On Vicarious Causation', COLLAPSE II, 171-205: 204.

Developed through his use of Heidegger's tool analysis and Husserl's intentionality (extrapolated in his essay 'Vicarious Causation'), Harman's 'Object Oriented Ontology' [OOO] claims that the refusal to recognize non-human objects and interactions reduces all human praxis to anthropocentric proclivities that fail to acknowledge other entities besides the human. I want to consider this claim through Levi Bryant's reading of OOO, considering whether contemporary cookery praxis can join with OOO in advancing the critique of what Quentin Meillasoux has called 'Correlationism', defined as 'the idea according to which we only ever have access to the correlation between thinking and being, and never to either term considered apart from the other'.[3] What sort of extra-correlational beings are required for cookery praxis in general? And how might an ontological commitment to objects inform cookery praxis? Given such a commitment, cookery would have not only to acknowledge a real outside of human experience, but also a real outside the immediate and actual human sensations of eating. What is important is that, in considering a food as an 'object' independent of humans, an analysis becomes possible in which we get a picture of how it behaves in collectives of human and non-human actants.

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[3] Q. Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. R. Brassier (London/NY: Continuum, 2008), 5.

As blasphemous as this may sound to a 'foodie' – someone who 'has to know what they like, why they like it, recognize why some foods are better than others and want to have good tasting food all or certainly most of the time'[4] – cookery requires a concept of food in which food is not only an object 'for us' – whether inflated into higher ideals or considered in terms of immediate sense perceptions – but also an object *in itself* with capacities and tendencies undiscovered.

Cookery, by the very nature of its processes, must allow for a concept of food that recognizes at the very least object-to-object interaction. That is to say that food has capacities in excess of human intention and interaction, and we must recognize that food has encounters outside of its relation to humans.

However, this is not to reduce food to a merely empirical status, or to claim an absolutely independent objectivity for it; for cookery also ought to avoid superficial technical approaches that reduce food to primordial units of an underlying actuality upon which cookery can only operate. Although science can certainly provide many productive analyses of what food can do, there is more to food than is revealed by science.

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[4] N. Weston, 'Foodie: What is That, Anyway?', at http://www.slashfood.com/2006/02/10/what-is-a-foodie-anyway/-ixzz0p4mnMsLZ.

OBJECTS AND OMELETTES

In 'Philosophical Ontology,' Roy Bhaskar asks, 'What must our world be like for science to be possible?'[5] To which Levi Bryant has added: *what must our world be like for science and our daily practices to be possible?*[6] Cookery, the object of our analysis here, is just such a 'daily practice'.

From the fact that actual science experiments are conducted under intentionally closed conditions, Bhaskar concludes that the world in which science is possible must be open. In other words, because the world is an open system, scientists must work to close systems in order to conduct experiments. Bhaskar's insight is that objects, and therefore events, are 'out of phase' in an open system; science works hard to close that system. In order to experiment, science spends most of its time eliminating chance, putting objects into 'phase' or into place, in order to experiment. The objects of science are transitive. Bryant extends this analysis to our daily practices, concluding that intransitive objects have 'powers that operate without producing a particular effect'.[7] Objects have a real endo-relational structure, a 'phase space' that exceeds actualism, that is more than the local (transitive) manifestation of an object. In other words, 'we do not know what an object can do'.

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[5] R. Bhaskar, *A Realist Theory of Science* (London: Verso, 2008), 36.

[6] L. Bryant, 'Roy Bhaskar: Transcendental Realism and the Transitive and the Intransitive', at http://larvalsubjects.wordpress.com/2009/02/02/roy-bhaskar-transcendental-realism-and-the-transitive-and-the-intransitive/.

I would like to propose a parallel between Chefs and Philosophers; it consists in examining what sort of ontological commitments lead to what sorts of praxis. To rephrase Bryant and Bhaskar's question: *What must our world be like in order for cookery to be possible?* If we address cookery as a question of 'philosophical ontology', then this question also involves looking at how the praxis of cookery distorts the image of this world.

Any amateur cook who has attempted to make an omelette is aware not only of the many things that can go wrong – that is to say, how hard one must work to close a system in order to make the egg not stick, brown, or dry out – but also of the powerful *distortion* that accompanies the exciting prospect of 'the perfect omelette' – a distortion that consists in the reduction of the egg to the mere ontological possibility or potentiality of its' 'being' 'the perfect omelette'. The professional, on the other hand, can make sixty omelettes in an hour, two at a time, and does so by eliminating *chance* as much as possible.

The professional therefore operates the ultimate ontological distortion, the most complete closing of the system. Professional objects have as their credo 'give (sell) a man a fish, and he can eat for a day', rather than 'teach a man to fish, and he can eat for a lifetime'. The 'professional' distortion masks where food comes from, how it arrives at the table and what potential it has with regard to other entities, disavows chance and shapes ontology into a series of targets that must be hit in order to maintain the normative goals of the field in which the professional participates. A flat ontology might act as a corrective to this distorted field, which has a certain affinity with the primacy of economics and markets – it is important to note that the objects produced in this way by the professional are designed to eliminate the amateur and produce instead a consumer. A realist, flat ontology where 'all things equally exist, yet they do not exist equally', offers cookery the means to assert that food operates in an open system. A flat ontology for cookery would be capable of resisting the prism through which cookery praxis re-presents the world, while at the same time maintaining an awareness of the necessity of cookery – and of its concomitant distortions – for humans.

Harman and Bryant affirm that 'objects are always in excess of their relations'.[7] Two points follow from this thesis: Firstly, qualities are not something an object possesses or is, but rather something an object does.

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[7] L. Bryant, 'The Mug Blues', at http://larvalsubjects.wordpress.com/2010/04/30/the-mug-blues/.

Secondly, to know an object is not to possess the skill of recalling a set of essential qualities or properties belonging to an object, but rather to know the powers or capacities of an object.

As we shall see, in the absence of this ontological commitment to open systems and a nonhuman real, food emerges either – in an empirical realist approach – as mere substance and the event of sensations, *or* – in a transcendental idealist approach – as food (solely) for thought. Either way, in an anti-realist gesture, food is reduced to the traditional dyad substance/idea. To see examples of both approaches in action, it will be instructive to examine two popular movements or contemporary practices of cookery in which debates surrounding cuisine take place: Molecular Gastronomy (MG) and Slow Food (SF). It will be seen how both demonstrate a normative lack of ontological commitment, and pose barriers to an object-oriented cookery.

MOLECULAR GASTRONOMY

In Spain in 2010, what some have called 'the world's greatest restaurant' shut its doors due to financial losses. El Bulli, with the development and expansion of *haute cuisine* as its charge, plans to reopen as a culinary academy in 2014. Since 1987, El Bulli had developed the 'science' and technologies of food production and presentation, and pushed dining to the edge, by exploring how all senses (sight, sound, texture, smell as well as taste) can be engaged while eating. El Bulli was thus at the forefront of what has been labelled 'Molecular Gastronomy'. Although El Bulli's chef Ferran Adrià resists the tag, MG has become a convenient way of referring to technologically-advanced practice that resists the traditional myths of cookery while employing texture, sounds, smells and visuals to create an 'extreme dining experience'. Adrià's self-identification as 'deconstructivist', along with French Chef Thierry Marx's claim of practicing 'techno-Emotional' cookery, prompts us to question what sort of ontological commitments are present in the practices of these two chefs in particular and in the movement of MG more generally. Mostly concerned with shocking diners by presenting unusual or unexpected sensual encounters, MG, like most human praxis that refuses to engage with the problematic of a real beyond human mediation, more often than not finds only and exactly what it seeks.

That this movement represents or identifies itself as a *science of the senses* is made clear by a recent report entitled *Molecular Gastronomy: A New Emerging Scientific Discipline*. The report, mostly celebratory of MG as a scientific discipline, dedicates its first section to a study of the senses:

> Before we begin to look in any detail at the chemistry of food production and preparation, we should take in a brief overview of the way in which we actually sense the food we eat. Questions such as what makes us enjoy (or not) any particular food and what it is that makes one meal better than another are of course largely subjective. Nonetheless, we all share the same, largely chemical based, set of senses with which to interpret the taste, aroma, flavor, and texture of the food. In this section we will explore these senses and note how they detect the various food molecules before, during, and even after we have consumed them.[8]

Much like ancient Epicureans, Molecular Gastronomists' ontological commitments are to the *senses* as heralds of truth. Much like ancient Epicureans, they regard objects as reducible to primordial units such as atoms or molecules. And much like contemporary Epicureans (but unlike ancient Epicureans) this approach implicates pleasure as immediate, unbound and limitless. Ultimately, in MG, food – the ultimate non-human actant intertwined within human collectives – is 'undermined' and seen only as a means to immediate aesthetic experience. Despite its ostensibly radical and scientific credentials, in MG food is not considered in itself, but only as a means to the end of human pleasure or (more rarely) sustenance.

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[8] P. Barham, L.H. Skibsted, W.L.P. Bredie, M.B. Frøst, P. Møller, J. Risbo, P. Snitkjær, L.M. Mortensen, 'Molecular Gastronomy: A New Emerging Scientific Discipline', *Chemical Reviews* 110 (4), 2010: 2313-65, at http://pubs.acs.org/doi/abs/10.1021/cr900105w.

In some ways Molecular Gastronomic praxis is no different to most other culinary praxes: Through the study of time, temperatures, chemical reactions, and cooking materials, food is prepared for consumption. However, by carrying out this practice in radically closed environments, these (mostly European) chefs tend to finish up producing 'advanced' versions of practices first developed by industrial food scientists in the United States. The supposedly 'artisanal' MG as contemporary haute cuisine, and industrial food science as the basis for fast food, have at least three things in common: 1) the methods and techniques practiced; 2) distinctive ingredients such as additives, traditionally rejected by haute cuisine; and 3) actual fast or junk food products such as Fishermen's Friends, Altoids, Corn Nuts and Pop Rocks, that float between the two practices – produced by industrial food science, traditionally sold as junk food, and now used as an ingredient by MG.

Haute cuisine's genesis is usually traced baked to François Pierre La Varenne and his codifying of French cuisine. His book *Le Cuisinier François* was written in the Middle Ages and marks the transition of French cookery into the modern age. One of the revolutionary aspects of La Varenne's approach was the abandonment of heavy exotic spices in favour of regional herbs and local vegetables.[9] La Varenne's concepts of freshness and of food's ability to stand on its own without much adulteration still stand today in much of haute cuisine. However, if one were to conclude that a defining characteristic of haute cuisine consists in its logical extrapolation of a region's food, then MG can only be seen as a logical extrapolation of industrial science practiced as globalized food. And in employing the products and methods of food science, MG seeks to manifest the most exciting immediate 'experience' possible.

If they were to take into account a mind-independent and human-independent reality, Molecular Gastronomists would have to consider food to be more than aesthetic experience *for us*. A Molecular Gastronomist could gather organic ingredients, ingredients chosen with concern not only for ecosystems humans participate in and affect but also for food-to-food interactions. This hypothetical chef could consider not only an object's effect on systems but also that of its absence from systems. She could then tinker with objects, allowing for manifestations independent of intentions, acknowledging that an 'object does', allowing epistemology to flow from an open ontology that admits that *we do not know what an object can do.*

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[9] See V. Leschinzer & A. Dakin, 'Theorizing Cuisine from Medieval to Modern Times ', present volume.

Techniques she could consider are fermentation and developing probiotics, which stand in contrast to the highly closed practice of MG. Kombucha, the ancient art of brewing fermented tea, is a process of using imperceptible bacteria that is specific to its brewing facility. All kombucha is different and is celebrated because it picks up bacteria from the environment where it is brewed, independent of human manipulation – resulting in healthful 'good' bacteria. Such experiments are taking place for many reasons other than the tantalising of human senses: alternative sources of protein, ecology, ethics and probiotics.

Foods will either invite you to eat them, or not, for many reasons, of which human sensation is *only one*. Therefore if cookery involves an object-oriented understanding of food, it cannot be limited to a study of immediate sensations involved in dining. Food entices through basic Darwinian concepts: adaptation, abundance, repetition and proximity. But it thereby sets itself up to become ensnared in social convention and markets that develop certain habits and play into other human machinations. If MG does approach a form of realism, object-to-object interaction and flat ontology, it squanders its insights by making aesthetic immediacy the only goal – a problem rooted in a lack of interrogation of ontological commitments, which leaves it open to being easily co-opted by neoliberal capitalism. Tantalizing the senses above all leaves MG open to the charge of contributing to a spectatorship culture: What is the role of the practitioner or artist here? Is the goal to create food as a magician-genius-professional in order to 'blow people away', or is the goal to create an engagement with food that empowers others to enter the kitchen, whether professional or not? MG's approach values professional closure at the expense of opening up food to the amateur – a high price to pay.

Here it is important to keep in mind the totemic hero of MG: Roald Dahl's Willie Wonka. Wonka's approach is best exemplified in his interaction with Violet Beauregard. The chapter entitled *Good-by Violet* begins with Wonka exclaiming:

> When I start selling this gum in shops it will change *everything*! It will be the end of all kitchens and all cooking! There will be no more marketing to do! No more buying of meat and groceries! There'll be no knifes and forks at mealtimes! No plates! No washing up! No garbage! No mess! Just a little strip of Wonka's Magic Chewing Gum and that's all you'll need at breakfast, lunch and supper! This piece of gum I just made happens to be tomato soup, roast beef and blueberry pie, but you can have almost anything you want.

Of course Violet Beauregard – a child and a world-record gum-chewer – cannot resist, and reaches out and snatches a piece. After chewing the gum she balloons up to twice her size and shows every sign of turning into a blueberry. Here we see in no uncertain terms what 'food' can 'do'. However, Dahl's Willie Wonka is as much a social scientist as a food scientist. His goal goes beyond sensation; it is to 'change *everything*' not by revolutionizing, but by *eliminating home amateur culinary praxis.* Through Wonka, Dahl explores immediate gratification even in the face of an abject poverty where humans are reduced to bare necessity. Candy is but a means for Willie Wonka in his quest for total market domination – as can be seen in his obsession with secrecy, his exploitation of Oompa-Loompahs, and his creation of a fake rival in Old Fickelgruber.

But what in Dahl's tale is a dramatization of the dark side of desire, avarice and human society, set in dark economic times resembling early twentieth-century capitalism, has been misconstrued by MG as offering a joyful playground for mad scientists, obsessed with their own 'genius' and unaware or unwilling to admit that they are manipulating more than just the senses. The aforementioned self-descriptions of Ferran Adrià as 'Deconstructivist' and Thierry Marx as 'Techno-Emotional', are rather apt: deconstruction considers above all the text (the meal), and 'Techno-Emotional' describes a seamless stimulation by the author of his passive eater, by means of secondary qualities or ‘bundles of sensations’.

If we fail to acknowledge that *we do not know what an object can do,* and approach and figure sensation as an end point for cookery, the latter becomes a radically closed system that terminates upon human swallowing. We neglect the fact that food is a non-human actant involved in human and non-human collectives. Food as an object continues to translate you, and you continue to translate food, even after swallowing; appearance and taste are only a subset of a food’s manifestation. For example, someone who has a thyroid problem has to regulate his or her metabolism. Through trial and error and the introducing of minimal foods at certain times, such a person is able to monitor the effects of certain foods on their bodies during certain parts of the day. This person would also have to monitor the food-to-food interaction within their bodies. In modulating such a diet we must consider food as a non-human actant necessary in order for a whole (person) to act. The elegant balance of, for example, grapes and salmon has to be considered in terms of the food-to-food interactions it might set off. All the while a person’s aesthetic proclivities cannot be ignored. Such a condition perfectly illustrates how praxis distorts, for it is only when we need to externally regulate our metabolism that we recognize how much goes into the elegant system of processing food for humans. Considering food as a non-human actant not only offers us a path to avoid reducing cookery to primordial units, thus destroying a proper object analysis; it also avoids treating food solely in terms of immediate sensations, ideological struggles or marketing schemes. OOO rejects universal approaches that homogenize the needs of individuals and hierarchize humans above all others.

Where MG understands the proper being of an object to be manifested in a phenomenal actualization, object-oriented cookery would see the proper being of an object as consisting in its virtual endo-relational structure, which only ever expresses a part of its powers in any manifestation or actualization. An apple should never be reduced to 'sweet' or 'red' – that would be only an apple *for us*. An apple *apples* even after it enters into a set of exo-relations through which objects translate each other.

These ontological commitments are important for cookery for two reasons: 1) They are necessary in order to recognize unintended consequences and therefore to allow for a constant openness and a resistance to monolithic approaches; 2) They establish an awareness of praxis – which is to say that entering into exo-relations with objects as attractors, although maybe constant, necessarily sets up a disposition to interaction as 'wonder'. The disposition of wonder being: we are never totally sure of what an object can do, as when it becomes entangled with other objects, it only presents certain expressions owing to its exo-qualities. Without the constant disposition of wonder we fall into the trap of the professional – an instrumental being in the service of nothing but markets, delivering all creative breakthroughs into the hands of neoliberalism and encouraging a spectator mentality on the receiving side – the professional chef creating the professional eater. The point is not just that we should be open to unexpected things in cookery, but that if our disposition of wonder, a form of affirmation, is restricted by a concentration on the human senses, then an arcane, highly laboratorial practice such as MG will create nothing more than interesting meals for professional spectators. MG begins with material forces (chemical reactions ...) but ultimately turns those forces, the 'primordial units' of its cuisine, into nothing more than sensation, without considering social material consequences. Disciplines that base their practice on aesthetic outcomes only further alienate food from its source, process and eater. MG engineers consent to alienate.

An apple manifesting in a pie is only expressing certain powers as it enters into a set of exo-relations. Once the apple has been translated into pie, a new object is present, with apple as a part of its whole. But the pie as an endo-relational structure can express itself in a myriad of ways: It can become a doorstop, fall off the windowsill and feed animals, be used in a comic gag to hit someone in the face, entice someone off a diet, move through a human providing nourishment … The apple present in that pie as a part still has an endo-relational structure and further powers of manifestation – for example, providing fibre or vitamin C to humans, being processed through fermentation, or housing ants. MG presents us with a prime example of an actualism that refuses the sort of open system that could accommodate these powers, and aligns the objective-subjective distinction with that of primary and secondary qualities.

All chefs must consider which objects they wish to exclude and which to include; and this (along with the use of cling film) is how we know cookery praxis as closed. However, in another sense, chefs have an opportunity to experiment with open-ended processes. A recent example of object-oriented cookery is a five-course Mexican feast concocted to bring the wonders of edible insects to New York.[10] Serving larvae and live insects, Phil Ross created one dish of squirming wax moth larvae. Popping a live bug in one's mouth, if taken seriously, would have to open a diner's eyes to a multitude of alternative sources of protein. Ross's invitation to experience live food explicitly acknowledges that we do not know exactly what an object will do – for this chef in some sense has no control over what these bugs will do. A bug bugs.

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[10] http://www.nytimes.com/2010/09/22/dining/22bug.html.

MG's ontological commitments are to an *actualism* informed by *relationism*. That is to say, MG, even with all its chemical reactions and experimenting with food, by taking human sense as its end goal is ultimately a praxis that takes the basic structural feature of entities to be expressed in immediate events *for us* (actualism). Global relations inform this event (relationism): MG is a logical extrapolation of globalized cuisine praxis (fast food, junk food) or food science praxis located in globalized corporate food companies. A praxis that is then interjected into haute cuisine and returned to globalized cuisine with enhanced credentials.

SLOW FOOD

On the other hand, the 'basic structural feature of all entities', as far as Slow Food is concerned, is determined by a *relationism* informed by *actualism*. SF can be seen as a logical extrapolation of Chef José Andrés' words: 'McDonald's as genius of organization, development, and marketing.'[11] That is to say, paradoxically, that the ideology that McDonald's promotes is the same as Slow Food's: *food is more than cooking and eating*. An ideology interjected into localities, singular villages, towns, food markets and bazaars and then returned to globalized cuisine circuits with cogent arguments for food to be seen as more than a material substance involving real makings and doings. SF's denial of foods as individual objects and actants that move through human and non-human collectives leaves issues of nutrition, local organization and development aside in order to promote counter-progressive causes such as the preservation of what SF's (mostly European and White American) leadership perceive as valued traditions of cookery and food production. SF's inability to recognize different speeds, to see that many places in the world don't suffer the same affects and effects as 'fast' paced technologically-advanced cultures, puts into question SF's very framing of the solutions and problems. As Louise Fresco states:

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[11] http://living.glam.com/articles/latest_stories/exclusive_interview_with_chef_jose_andres/.

> Now it is not surprising that with this massification and large-scale production, there is a counter-movement that emerged – very much also here in California. The counter-movement says, Let's go back to this, Let's go back to traditional farming. Let's go back to small-scale, to farmers' markets, small bakeries and all that. Wonderful. Don't we all agree? I certainly agree. I would love to go back to Tuscany to this kind of traditional setting, gastronomy, good food. *But this is a fallacy. And the fallacy comes from idealizing a past that we have forgotten about.* If we do this, if

> we want to stay with traditional small-scale farming we are going, actually, to relegate these poor farmers and their husbands – among whom I have lived for many years, working without electricity and water, to try to improve their food production – to relegate them to poverty. What they want are implements to increase their production – something to fertilize the soil, something to protect their crop and to bring it to a market. We cannot just think that small-scale is the solution to the world food problem. It's a luxury solution for us who can afford it, if you want to afford it. In fact we do not want this poor woman to work the land like this. If we say just small-scale production, as is the tendency here, to go back to local food means that a poor man like Hans Rosling cannot even eat oranges anymore because in Scandinavia we don't have oranges. So local food production is out. But also we do not want to relegate to poverty in the rural areas. And we do not want to relegate the urban poor to starvation. So we must find other solutions.[12]

SF has taken on as its goal the task of preserving ingredients and food production methods from collectives, populations and communities that may be disappearing from cookery praxis due to global economic pressures. For example, posted on a calendar of events on Slow Foods San Francisco's website was this announcement for the film *Mr. Bene goes to Italy*:

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[12] http://www.ted.com/talks/louise_fresco_on_feeding_the_whole_world.html.

> One of SF founder Carlo Petrini's favorite films was screened at the Delancey Street Theater on April 4th. Benedito Batista da Silva, 60 years old, is considered a reference when it comes to manioc flour production in the Brazilian Para State, deep within the Amazon. This documentary shows his trip from Braganca to Turin and back home. The encounter of different cultures, of small-scale farmers from all over the world and the enchantment of coming into contact with European culture blends with the profound affective bond Mr. Bene forges with his Italian host family. The film is about breaking barriers, whether cultural, economical or even physical, in this amazing *anthropological* adventure whose premise is that hope still exists for small Brazilian farmers.[13]

A small village in Brazil produces manioc flour deep in the Amazon. In order for the art of manioc flour production not to be lost and the practice maintained for centuries to come, SF invites artisans to a world conference where chefs and other small farmers interact on a global stage to figure out how to preserve 'best practices' – authentic practices. Professional chefs are put into contact with a product that may be useful to them, thereby opening up a global market for what was once food for a single village and was in danger of becoming ‘lost’.

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[13] http://www.slowfoodsanfrancisco.com/cgi-bin/slowfood/sf_events.html?evcode=00023;id=TYTwX5Zx (emphasis mine).

Obviously SF elevates food to a representation of human experience, a symbol of human cultural uniqueness. Where MG can be criticized for reducing food too much, SF can be faulted for attributing *too much* to food. Where MG reduces food simultaneously to primordial units and bundles of qualities, SF elevates foods to a status beyond autonomous entities, refusing a flat ontology.

For SF not only are objects, such as food, reduced to relations; human collectives as autonomous objects are identified and ignored in order to develop seamless global patterns and connections of ‘*more than cooking and eating*’. SF’s ontological commitments or lack thereof raise questions of how to recognize actual collectives and cultural distinctions. Globalized cuisine’s quest to discover the food products of underprivileged or developmentally marginalized peoples of ‘cultural value’ and open them up to new markets, emulates the emerging markets approach promulgated by World Bank neoliberalism and the ‘Washington Consensus’. The goal of such structural and developmental reforms is to reduce objects to relations in order to place these products and collectives within a globalized food system. For SF, value lies not so much in financial economics (although that plays a large part) as in an economy of authenticity and in the ability of specific objects to seamlessly move into other economies. Contemporary inclinations, technological innovations or caloric intake, are not considered in deciding how useful the preservation of a certain product could be within a specific collective. In other words, what a food does is not as important as how it is perceived by Western diners.

What is clear is that SF's ontological commitments are deceptive. On the one hand, SF presents an outdated mode of anthropology in which foods are idealized and cultural artifacts are preserved for the sake of preservation. On the other hand, it heralds the possibility of a radically connected network of relations where an emerging market approach can take hold. On one hand, SF values a food on the basis of its origin, taking into account its participation in collectives, but only on its own selective terms. On the other hand, SF posits a background of potential relations in which we should view food, and that frame does not allow a *food* or a *collective* autonomy, does not allow for food as a non-human actant with an endo-relational structure. A food's potential outside of human intention, outside of a perceived market, is what is at stake for an object-oriented approach. SF mobilizes food in an idolized or idealized fashion. Authentic culture and roots supersede all other concerns, in order to introduce relation-fetishism as ingress for leftists to neoliberalism.

An object-oriented analysis of what food *does* would be useful for a political global food movement such as Slow Food. Such an approach could demonstrate how food organizes human and non-human chains; how food translates us and other objects individually and collectively in ways that resist reified generalities. In SF's case, *relationism* (in this case, the notion that 'food is the sum of its relations') informed by *actualism* (authentic immediate collectives to be subsumed) ultimately amounts to little more than a human-thought-being correlation. A correlation that neo-liberalism depends on, given that it is the 'seamlessly global' nature of the market that allows SF to *believe* that shopping at Whole Foods and eating at fine dining establishments are radical political acts.

Ultimately, either SF is redundant (because the people practicing SF do not need instructions – specific cultures in specific locations are and have been practicing SF production and preparation for a long time); or SF is dogmatic in its approach as well as its practice because it charges itself with the measurement of authentic virtue without allowing that metric to be determined in an open system that critically addresses the food it proposes to 'save'. The breaking down of cultural, economical or even physical barriers by a neoliberalism dissimulated by outmoded 'anthropology' or self-righteous 'conservation' is yet another form of praxis being trapped within a correlation of being and thought. Without ontological commitments to a 'real' independent of humans, SF is simply subsumed into economics.

FLAT COOKERY

In view of what has been said above, MG might be seen as object-oriented in its first stage, in that it acknowledges food as an object. Experimentation, albeit ultimately geared towards the senses, does foreground *what an object can do*. And SF's object-oriented inclinations lie in its recognizing of collectives, towns and regions and even farmers as objects in Bryant's sense. What MG does well is break us out of the traditional myths that have dominated cookery praxis – myths such as the searing of meat in order to encapsulate juices are debunked in favour of some progressive praxis. What SF does well is to observe the wider implications of a fast-paced technologically-advanced approach, identifying problems such as monoculture and the shortcomings of industrially-produced food.

If we return to Harman's claim that praxis distorts, we notice that OOO at the level of praxis offers nothing new. In other words, OOO is not offering a *new* distortion, only a levelling of ontological distortion. What is revealed in this levelling are intricate webs in which *no* thing (language, power, ideology, religion, food or knowledge) dominates or provides the exclusive conditions of possibility. This is not a form of materialism, but rather a realism that allows the independence or autonomy of non-material objects – any 'thing' that makes a difference.

At the level of object-oriented praxis and epistemology, Bryant is clear:

> I think it is the hypothesis that objects *act* or are encountered in their doing. In other words, *knowing*, not passively *mirroring*, knowledge is a product of *doing* and is a discovery of *doings*. We know things, we discover them, through their *acts*, and if we wish to discover the powers of objects we have to *act* on these objects to see what they do in these conditions. It is through provoking objects to discover what properties flash forth that we discover their powers … to find out what objects are capable of doing.[14]

Therefore, cookery becomes an elegant configuration of entities in a feed-forward-feed-back clumsily-woven web of objects interacting on equal footing. If we do not know what a specific food can do, and this food is interacting with all sorts of other objects at a specific instant, then even in a radically closed environment, cookery becomes a lot like surfing. It consists of a series of tiny adjustments, prompted by anticipations and responses from an openness to utterances from all human and non-human actants entangled. Of course, in order to prevent short circuits, a chef must allow herself to be translated by other objects. In feeling her way through, aesthetics forms a *new* epistemology where the abundance of local manifestations forms a meal. Keeping in mind that the entanglement that constitutes this meal does not begin or end with this specific event of eating – objects stretch out through other objects. Anticipating objects' behaviours and responding to both expected and unexpected acts, even the most experienced chef benefits by adopting the disposition of an amateur home cook. A disposition which is simply a commitment to objects being out of phase.

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[14] L. Bryant, 'Object-Oriented Empiricism', at http://larvalsubjects.wordpress.com/2010/03/26/object-oriented-empiricism/.

Other than money and love, the conventional distinction between professional cookery and amateur home cookery is primarily one of epistemology and praxis. Epistemology, because the professional possesses extreme forms of the type of 'knowledge' that contributes toward an instrumental distortion of being. Knowledge built on error, keeping cookery on track. Praxis, because the professional possesses a skillset that dictates a specific set of actions. The professional's mode is one of eliminating chance, restricting the 'phase space' of objects. It is clear that there is a financial interest in maintaining this distinction between professional and home amateur – as seen in the fact that 'home amateur' status is coveted by a local bistro offering *homemade* bread in the attempt to sell us something back that has been all but eliminated from actual homes; but equally in the disparaging distinction made by chain restaurants encouraging us to 'eat out' because 'we deserve a break' from the chores of cookery. On one hand amateur cookery is praised as a delicious enticement only available at local restaurants, on the other hand disparaged as a mere menial task to be avoided. The uncritical adulation of Willie Wonka, whose genius leads him to wish to do away with amateur home cookery, illustrates this drive of professional cookery to dominate and destroy home amateur cookery.

Flat Cookery praxis levels the distinction between professional and home amateur. Flat Cookery's ontological commitments to objects and a real outside of the correlation between thinking and being are evident in 1) the entwining of epistemology and praxis, allowing food the ability to speak back or objects to act; and 2) the amateur's indirect disposition, allowing for a wandering off the exclusive tracks of thinking and being as they pertain to cookery. Which is to say that the inclination of an object-oriented approach to cookery is that of a particular know-how that flows from acting – from doing. Flat Cookery operates out of the acts of feeding people. Acts that have been passed down from generation to generation on one hand and yet refuse the myths, nostalgia and romance that accompany professional disciplines. The professional invents objects with minimal phase space in order to dominate amateur home cooking – objects such as frozen dinners and washed mesclun mix that pacify the non-professional. But the amateur is free of the restraints of 'knowledge and skill' to experience the 'phase space' of objects. This is not to say an amateur is ignorant, that he lacks knowledge. No, the amateur acts out of affirmation. Here affirmation is instinct, experience and the acknowledgement of webs of objects that act autonomously and in aggregate. The professional, on the other hand, not only operates in alienation but also alienates. The professional motivated by the representation, the symbolism and the distortion of markets dismisses the amateur's clumsily-woven affirmation. The amateur is an object in this ontology. An object *does* feed one's family or *does* socialize with others or *does* regulate one's metabolism or *does* counteract one's diabetes or *does* volunteer at a soup kitchen or *does* enjoy a fine repast. Of course the question of *what an object does* motivates the amateur, for as a tree trees and an apple apples, the amateur amateurs, and in doing so avoids the excesses of distortion. Object Oriented Cookery amounts to a commitment to autonomous entities, but also to an openness to food as an actant independent of human intention.

To Roast Eggs.

Make a puncture in the large end of the egg, then pour water over it, and cover it in hot ashes in front of the fire, from whence you may easily take it when done.

Mary Mason, *The Young Housewife's Counsellor and Friend: Containing Directions in Every Department of Housekeeping, including the Duties of Wife an Mother* (NY: Protestant Episcopal Church Book Society), 1875.

Reason in the Roasting of Eggs

Richard Wrangham

In the eighteenth century egg-roasting was a sufficiently puzzling activity that it inspired a familiar saying, 'There is reason in the roasting of eggs'. The aphorism was intended to justify the most arcane of pursuits, but actually the reason for roasting eggs has been unknown until recently. There is indeed a good nutritional explanation for this now-vanished culinary tradition, as there is for cooking any other food: cooked food gives us more energy than we would get by eating the same food raw. Furthermore, our consumption of cooked food makes possible not just our high energy budgets, but also the extreme size of our brains. Accordingly the notion of 'reason in the roasting of eggs' includes a second meaning beyond the assertion of mere utility. It encapsulates my claim that the evolution of human mental powers has depended on our ancestors' food being cooked.

No such thought was in Edmund Burke's mind in 1773 when a dinner party conversation prompted him to reflect on the significance of cooking. He was responding to the idea that human beings can be defined as the species that cooks. James Boswell, diarist and amanuensis of lexicographer Samuel Johnson, made the proposal and recorded the conversation.

Boswell began by rejecting previous definitions of humanity. "An ancient philosopher said," he declared, "[that] Man was 'a two-legged animal without feathers,' upon which his rival Sage had a Cock plucked bare, and set him down in the school before all the disciples, as a 'Philosophick Man.' Dr. Franklin said, Man was 'a tool-making animal,' which is very well; for no animal makes a thing, by means of which he can make another thing. But this applies to very few of the [human] species."

He continued with his own proposal. "My definition of Man is, a 'Cooking Animal'. The beasts have memory, judgement, and all the faculties and passions of our mind, in a certain degree; but no beast is a cook. ... Man alone can dress a good dish; and every man whatever is more or less a cook, in seasoning what he himself eats." Burke approved Boswell's idea. "Your definition is quite good," he said, "and I now see the full force of the common proverb, 'There is reason in the roasting of eggs.'"

Burke may have thought he saw the full force of the proverb, but what he meant when he quoted it can only have been the idea that humans cook for a reason. As to what the reason was, Burke surely did not know; because until the last two decades no one had systematically investigated why we cook. Conventional wisdom acknowledged that cooking could remove poisons, kill bacteria and enormously improve the taste and texture of an evening meal, but there was no consensus as to whether cooking was necessary or what its most important function was. As late as the 1960s, when the anthropologist Claude Lévi-Strauss proposed that people cook merely to symbolize their distinction from animals, no one is recorded as objecting to his stated assumption that cooking was an arbitrary choice. To Lévi-Strauss and most anthropologists, humans were no different from other animals, equally capable of a successful lifestyle whether or not our food was cooked.

Fortunately 'raw-foodism' has become popular recently, and this habit of restricting diet to raw foods has created new opportunities for investigation. Results are consistent: On the one hand, people can eat 100% of their food raw and be healthy enough for an active life. Indeed, many raw-foodists keep to their diets because they feel very good on them. Yet unlike non-humans, human raw-foodists are so relatively short of energy that not only do they lose weight on average, but their bodily functions are also liable to be impaired. In the only research on the reproductive performance of women, conducted by a survey of several hundred Germans, the average woman on a 100% raw diet had too few spare calories to be able to menstruate. The study indicated that, whether or not their diets included meat, and even when eating domesticated foods taken from the global food resource (and therefore free of a seasonal drop in food quality), women could not reproduce effectively when eating raw. Domesticated foods are much more effective sources of energy than wild foods, and our ancestors expended much more energy as hunter-gatherers than raw-foodists do in urban environments. So while a raw diet of domesticated foods can sustain people in the West today, a long-term raw diet of wild foods, of the type that our ancestors ate before 10,000 years ago, would be impossible. In short, although humans are animals, we are different from other animals. Without domesticated foods and an urban lifestyle, we need cooked food.[1]

A close look at our intestinal systems shows one of the reasons. Our intestines are small compared to those of other primates. An excellent advantage of guts being small is that they cost less to run than the more elaborate digestive structures of our raw-food-eating ancestors. However, a species can afford for their guts to be small only if they can predictably obtain a diet that is easily digested. In the case of human ancestors, cooked food explains our diminutive digestive adaptations, from our small mouth and teeth to our absent caecum and greatly reduced colon. We can get away with the reduced size of these structures because cooked food is easier to digest than raw food. Thus, in line with other comparisons between cooked and raw foods, a baked potato takes a shorter time to digest than a raw potato. It demands less muscular churning, acid secretion, enzyme production and other biological investment. Furthermore, a baked potato also provides us with more of its digestible energy than a raw potato.

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[1] See R. Wrangham, *Catching Fire: How Cooking Made Us Human* (NY: Basic Books, 2009).

The fact that cooked food provides more energy than raw food is the main reason our lineage can afford to forego efficient digestion of raw food. The fundamental logic for the extra energy is that cooking involves heat. Because hotter molecules move faster, their structure changes. They tend to open up in ways that allow component chains to be more easily attacked by enzymes. Starches gelatinize, changing a previously semi-crystalline structure into a solution of glucose-rich strings. Proteins denature, exposing otherwise hidden threads of amino-acids. Fats melt, releasing lipids from inert solidity. Animal species do not need special adaptations to take advantage of these benefits from cooking. Most animals prefer cooked food, and they fare so well on a cooked diet that many of our pets now have an obesity problem. But human ancestors were the only species that made the breakthrough to preparing cooked food on a daily basis, which allowed them to follow the unique path of becoming committed to eating it. The skill of cooking thus gave us more calories per gram of food, not to mention a wider range of foods that we could exploit. The enhanced energy we obtain by using external fuel to improve our food is one of the main reasons why we are now the dominant species on earth.

Life is in many ways a search for energy, so a species that achieves a new level of energy acquisition faces expanded biological opportunities. Perhaps none was more important than the chance to invest in the brain.

Human brains have two very odd features. They are relatively enormous, and they have been increasing in size rather steadily for a long time (more than two million years). Their structure and neurophysiology, by comparison, are less obviously odd. Indeed, to a large extent the size of brain regions is predicted by the size of the whole brain. This does not mean that we have the same brain proportions as smaller-brained species. For example the percentage of our brain volume that is devoted to neocortex is higher than in smaller-brained species. However the extent of this disproportion is itself predicted by our brain volume, because among other primates, those with larger brains likewise devote a higher proportion to neocortex than those with smaller brains. Within a group of closely related animals such as humans and great apes, overall brain volume is thus an excellent predictor of brain structure.

Brain size is also a good predictor of intelligence. Species of primates can be ranked according to their general cognitive ability by assessing their performances on a range of cognitive tests. Across species this general cognitive ability is well correlated with total brain size – the correlation is stronger, for example, than it is with measures of relative brain size, such as those that control for differences in body size.[2] Such studies use average brain volumes for the species, measured in dead animals. Non-invasive measuring techniques also allow investigators to measure brain volumes in living individuals. They show that within species too, variation in brain size is related to intelligence. Rats with bigger brains solve cognitive tasks better. Humans with bigger brains have higher 'g' (general intelligence), more fluid ability and greater memory, though not greater crystallized ability. Correlations between brain size and cognitive ability in these studies of rats and humans are in the range of 0.3 to 0.5.[3]

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[2] R.O. Deaner, K. Isler, J. Burkart, C.P. van Schaik, 'Overall brain size, and not encephalization quotient, best predicts cognitive ability across non-human primates', *Brain, Behavior and Evolution* 70, 2007:115-24.

[3] J.C. Wickett, P.A. Vernon, D. H. Lee, 'Relationships between factors of intelligence and brain volume', *Personality and Individual Differences* 29, 2000: 1095-1122.

A good starting-point for explaining the evolution of uniquely human intelligence, therefore, is to account for the large size of our brains. The difficulty in doing so is that brains are exceptionally expensive. Their energetic running costs average some 8-10 times higher than those of skeletal muscle, and unlike a computer, brains can never be turned off. The more that brains are used, the more energy they consume. For example when subjects are asked to exert self-control in thinking, their body glucose levels measurably drop.[4] Overall human brains consume more than 20% of the energy used by the body at rest, far more than their weight would suggest. So the problem of explaining the evolution of human brain size becomes a problem of understanding how brains are powered. Where do we get the extra energy needed to fuel our big brains?

In theory, a species like humans that has a hungry brain and access to sufficient food might be able to increase its resting metabolic rate (the number of calories used per unit time to power the body when at rest) so as to divert extra calories to the brain. In actuality, however, this solution does not occur. Metabolic rate has been well measured in humans and related primates. Remarkably, in relation to body weight the resting human metabolic rate is exactly as expected for a typical primate. The discovery that we do not simply run our metabolism at a high overall rate is highly enlightening. It means that the only way for humans to devote disproportionate amounts of glucose to fuelling our large brain is to give relatively less energy to some other parts of the body.

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[4] M. T. Gailliot, R.F. Baumeister, C.N. DeWall, J.K. Maner, E.A. Plant, D.M. Tice *et al*, 'Self-control relies on glucose as a limited energy source: willpower is more than a metaphor', *Journal of Personality and Social Psychology* 92(2), 2007: 325-36.

Leslie Aiello and Peter Wheeler were the first to realize the significance of the unchanged human metabolic rate. They showed that most of the energy-hungry organs, such as liver, kidney and heart, have the same relative size and energy needs in the human body as in non-human primates. The only organ system that stood out by being relatively variable in size across species was the gut. Aiello and Wheeler found the human gut to be relatively small, including stomach, small intestine, caecum and colon. As a result Aiello and Wheeler concluded that the human gut uses relatively little energy. Their finding suggested that variation among species in the size of the gut might offer opportunities for the evolution of large brains.[5]

In line with their hypothesis, primate species with smaller guts indeed tend to have bigger brains. The obvious explanation for their small guts is that they have an especially high-quality diet, affording them the luxury of a reduced digested capacity. This proves correct.

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[5] L. Aiello, P. Wheeler, 'The expensive-tissue hypothesis: the brain and the digestive system in human and primate evolution', *Current Anthropology* 36, 1995: 199-221.

Primates that eat more animal matter and calorie-dense plants in the wild have especially high quality diets, and are found to have bigger brains than other primates.[6] Aiello and Wheeler also calculated the energetic savings for humans of having smaller guts than expected. The savings neatly match the extra energy needed because our brains are large.

These results combine into a simple and striking formula: Cooking is responsible for our small guts; and the small size of our guts allows us to power an increasingly large brain. So cooking gave us a bigger brain and higher intelligence than we could otherwise have managed.

The fact that the quality of the human diet is uniquely high fits satisfactorily with the human brain being uniquely large; but a diet of cooked food is not the only potential solution to the energy puzzle. Aiello and Wheeler themselves gave as much attention to meat as to cooking. When the brains of our presumed ancestors started growing beyond the ape size, between two and three million years ago, their possessors were beginning to cut meat from the bones of prey animals but they had certainly not become committed to cooking. So Aiello and Wheeler suggested that meat-eating was likely responsible for the initial rise in brain size, on the basis that meat-eating carnivores such as cats and dogs tend to have small guts. Their suggestion about cooking was that it could account for a later rise in brain size, around half a million years ago, when the evolution of *Homo erectus* into *Homo heidelbergensis* was marked by a notable increase in cranial capacity (from around 1000 to 1200 cubic centimetres). My own interpretation of the evidence is that *Homo erectus* was already adapted to cooked food by about 1.9 million years ago, because only cooking provides a ready explanation for the characteristically small guts and teeth found in *Homo erectus*. Furthermore there is no later time in human evolution when any subsequent reduction of the gut is recorded. My attribution of cooking as early as 1.9 million years ago is controversial however, because although it fits with the biological inference, direct archaeological evidence of the use of fire is inconsistent earlier than 400,000 years ago. So the conservative conclusion is that cooking began its contribution to the steady rise in human brain size sometime between 1.9 million and 400,000 years ago.

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[6] W.R. Leonard, M.L. Robertson, J.J. Snodgrass, C.W. Kuzawa, 'Metabolic correlates of hominid brain evolution', *Comp. Biochem. Physiol. Part A,* 135, 2003: 5-15.

Whenever cooking was developed, however, its impact on reducing the costs of digestion surely had a substantial effect on brain enlargement. The largest known brain of any ape or fossil pre-human that was definitely confined to raw food (*Australopithecus/ Homo habilis*) was a mere half of the volume of our more than 1400 cubic centimetres. If humans became adapted to cooked food as improbably late as 400,000 years ago, the result was to add only 200 cc of brain volume. More likely, on the assumption that cooking began with *Homo erectus*, brains roughly doubled in size under the influence of cooked food.

The impact of cooking did not have to stop there. While the first oddity of the human brain is its relatively large size, the second is the way it achieved this outlier status. Our ancestors have exhibited a near-continuous rise in brain size for more than two million years, eventually leading to a trebling of volume. During the same period other animals, by comparison, had no change in brain volume, or a much more modest increase. Since the benefits of elevated intelligence must have been particularly high in increasingly complex social groups, some have argued for a positive feedback loop: large brains enabled larger groups, which then intensified the advantages of being more intelligent. But while that kind of idea might explain the advantages of increasing cognitive ability, it misses the critical point that however strong the selection pressure in favour of large brains, and whatever benefit intelligence gave, the problem of the energetic constraint must also be solved. Unless our ancestors had higher metabolic rates than we do, which no evidence suggests, they had to fuel their brains from somewhere within their bodies.

In this context cooking offers interesting possibilities for the long-continued rise in brain size. The techniques of the first cooks were doubtless limited to placing roots, seeds or meat by a fire so as to roast them. Recent hunter-gatherers were still practicing those simple techniques in the last two centuries, but they also employed a variety of more complex skills. The earth oven was a technique that kept cooked food moist and even hinted of cuisine, because it allowed herbs to be added to the food. Earth ovens are evidenced from at least 200,000 years ago, and were probably worldwide. Varieties of sausage were made in several places. Pots and containers could be fashioned from plants such as bamboo, or from inverted turtle shells. Accumulated advances in cooking skill would have made food not only more palatable but also easier to digest. A more easily digested meal, in turn, would demand less energy from the gut, and spare more for other organs such as the brain.

There are other factors that may have contributed to solving the brain-energy crisis too. Species of birds with smaller breast muscles have bigger brains, indicating that energetically efficient locomotion can spare energy for the brain.[7] Travel is energetically cheaper in humans than in chimpanzees, and likely became so when our ancestors stopped regularly climbing trees almost two million years ago. Terrestrial adaptations of the human body might thus have saved further energy that could be diverted to the brain.

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[7] K. Isler, C.P. van Schaik, 'Costs of encephalization: the energy trade-off hypothesis tested on birds', *Journal of Human Evolution* 51(3), 2006: 228-43.

So cooking was not necessarily the only route to a larger brain, but its impact was very large. The adoption of cooked food as a staple part of the diet gave our ancestors increased energy, enabled them to reduce the size of important components of their guts, and therefore most likely enabled those with bigger brains to survive and flourish.

Nowadays hunter-gatherers who collect eggs return to camp with them when possible, and roast them by burying them in hot ashes. The practice is one of many with a deep history that revolutionized our ancestors' energy metabolism and paved the way for a larger brain and higher intelligence. When Edmund Burke quipped that there was reason in the roasting of eggs, he spoke a truer word than he could have imagined. We can rewrite Descartes: *Coquo, ergo cogito* – I cook, therefore I think.

TOURT OF VEAL[1]

Take a peece of Veal, blanch it, and mince it with twice as much of beefe suet, after it is well seasoned, make a sheet of fine paste, put your meat on it, in the middle of which you shall put what you have, as *beatills*, &c. Sugar it if you will, and when it is baked, serve.

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[1] P. La Varenne, *The French Cook*, Trans. I.D.G (London: Charles Adams, 1654), 57.

Theorizing Cuisine from Medieval to Modern Times: Cognitive Structures, the Biology of Taste, and Culinary Conventions

Vanina Leschziner and Andrew Dakin

INTRODUCTION

How do we come to think that certain flavour combinations are good and that some tastes are to be kept separate, or that one food is to be eaten prior to another? To be sure, individuals have idiosyncratic preferences, and experience strong likes and dislikes for different foods. Yet many of the deeply-held beliefs about food that guide individuals in their cooking and eating are socially-shared ideas about what is right and what is wrong that vary from one historical period and social context to another.

In the contemporary Western world, a basic principle that organizes the way food is cooked, served and eaten requires that sweet-tasting foods are kept separate from the other basic tastes.[2] Thus, there is a course that is preeminently sweet, dessert, which is only served after the consumption of courses that are preeminently non-sweet. This way of cooking and eating, however natural it may seem to a contemporary diner, has a relatively short history. As recently as the seventeenth century, a diner would have not only not had dessert at the end of a meal, but she would have had a large number of dishes that combined sweet and non-sweet tastes throughout a meal, served in what would to us appear to be no particular order.

Thus, even as the basic factors in cuisine – the foods, their chemical makeup, and our physiological responses to those chemicals – remain constant, our perception and theorization of food – the reasoning behind our methods for the selection, preparation, service and consumption of food – have undergone major transformations throughout history. In this article, we examine what is likely the most radical change in cuisine in the Western world during the Christian Era: the development of what is now known as modern French cuisine.[3]

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[2] Although human taste receptors respond to a broad assortment of chemicals, it is generally accepted that, qualitatively, this range evokes few distinct sensations; the standard basic taste model differentiates between sweet, bitter, sour, salty and savoury (or umami) tastes (J. Chandrashekar, M.A. Hoon, N.J.P. Ryba & C.S. Zuker, 'The receptors and cells for mammalian taste.' *Nature,* 444, 2006: 288-94, 288). It remains unclear how far along the gustatory sensory pathway cellular specialization is necessary to enable independent encoding of the distinct tastes (Ibid.; R.P. Erickson, 'A study in the science of taste: On the origins and influence of the core ideas.' *Behavioral and Brain Sciences*, 31, 2008: 59-105). While some criticize the basic taste model (Ibid.), it is, relative to alternative models proposing a continuum of tastes, more closely related to (and indeed reinforced by) modern culinary theory.

As we explain below, early modernity witnessed a major transformation in the theorization of cuisine and the rules for cooking and eating. Prescriptions and proscriptions about food grew in their autonomy from other disciplines, particularly medicine, allowing ideas about the experience of taste, rather than the supposed therapeutic properties of foods, to ascend as the guiding principles in the theorization of cuisine. Aided by a general epistemic shift in the way phenomena were classified, as well as by changing economic and institutional conditions, the autonomization of cuisine gave rise to a new conceptual organization of the basic tastes. Whereas in medieval cookery, all tastes were blended together in all manner of dishes, the sweet began to be dissociated from the non-sweet tastes in the seventeenth century. This dissociation marked the transition from medieval to modern French cuisine, as it constituted the conceptual foundation of the new culinary style.

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[3] We focus on France as a historical influence, given that this country is generally credited as the source of the modern culinary traditions of the Western world (P.P. Ferguson, 'A cultural field in the making: Gastronomy in nineteenth century France', *American Journal of Sociology*, 104, 1998: 597–641, 599; P.P. Ferguson, *Accounting for Taste: The Triumph of French Cuisine* (Chicago: The University of Chicago Press, 2004): 12, 30; P.P. Ferguson, S. Zukin, 'The careers of chefs', in R. Scapp & B. Seitz (Eds.), *Eating Culture* (Albany: State University of New York Press, 1998), 92; A. Trubek, *Haute Cuisine. How the French Invented the Culinary Profession* (Philadelphia: University of Pennsylvania Press, 2000), 3.

In this article, we first review the nature of medieval cookery, specifically its foundation in scholastic medicine and the implications of this relationship for the rules for cooking and eating.[4] Next, we examine the liberation of cookery from medical concerns and the codification of what is now known as modern French cuisine. We suggest a number of factors that contributed to the development of the modern perception and theorization of foods, including epistemic, economic, and institutional conditions occurring in early modernity, the chemical properties of certain foods, and biological attributes of the basic tastes. To conclude, we consider certain contemporary culinary trends that challenge, yet also hinge upon, the dissociation between the sweet and non-sweet tastes, to reflect upon the implications of these practices for the maintenance or transformation of this cognitive structure that, as we posit, underlies the institution of modern cuisine.

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[4] We focus on the recorded rules for cooking and eating, and not actual practice, as there is little historical data on actual practices from the late middle ages to early modernity. Insofar as extant sources consist of original books on cookery and dietetics, we can examine only prescriptions and proscriptions. Without a doubt, a gap between the information presented in books and what individuals actually did is possible.

OLD DIETETICS, COOKERY AND THE PROLIFIC USE OF SWEET INGREDIENTS

Prior to early modernity, cookery possessed far less autonomy as an area of activity than it does today. The aesthetic appreciation of food that provides the basis for modern cuisine was not yet the chief concern in formulating rules for the selection, preparation, and consumption of food. Instead, cookery in the Western world was governed by a system now known as the Old Dietetics, an understanding of health based on the theories of early natural philosophers.

The Old Dietetics was primarily premised on the theory of humours, inherited from the ancient Hippocratic School of medicine. The theory of humours held that every organism possessed a balance of two qualities, either hot or cold, and either moist or dry. The humoural qualities of an organism were largely (though by no means only) determined by the composition of its habitat. At the time, the natural world was understood in terms of the Great Chain of Being, a vertical linear taxonomy of life spanning from the earth to the heavens (see Figure 1).[5] The structure of this model reflected the belief in an ordered series of resemblances running through all living things.[6] This continuum spanned the four regions of the natural world corresponding with the classical elements fire, air, water, and earth, each of which was characterized by one of the four possible combinations of humoural qualities. It followed that organisms generally acquired the humoural qualities of the region in which they resided – for example, because water is cold and moist, fish tend to be cold and moist.[7] Each of the four possible combinations of the qualities was thought to be responsible for the production of a different dominant humour, or internal bodily fluid, which in turn dictated an organism's temperament, or predisposition to particular emotions, behaviours, and illnesses.

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[5] The figure depicted here is adapted from V. Leschziner 'Epistemic foundations of cuisine. A socio-cognitive study of the configuration of cuisine in historical perspective', *Theory & Society* 35, 2006: 421-43, 426, originally based on A. Grieco, 'Food and social classes in late medieval and renaissance Italy.', in J-L. Flandrin & M. Montanari (Eds.), *Food: A Culinary History* (New York: Columbia University Press, 1999), 308.

The health of human beings, it was believed at the time, depended on the maintenance of the ideal humoural balance particular to the species – a combination of hot and moist qualities. One's faulty lifestyle was thought to be the main cause of humoural

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[6] A. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* [1936] (Cambridge, Mass.: Harvard University Press: 1970). See N. Cusanus, *De docta ignorantia* [1440] (Lipsiae: In Aedibus Felicis Meiner, 1932) for a renowned example of medieval thought, and in particular an elaboration of the philosophical principles underpinning the Great Chain of Being.

[7] One could not assume, however, that all organisms residing in the same elemental region possessed the same humoural balance, for qualitative variance exists within a given elemental region (i.e. some bodies of water are colder than others, just as some sections of the same water body are colder than others), and other factors including age, sex, and form could affect the humoural qualities of an organism.

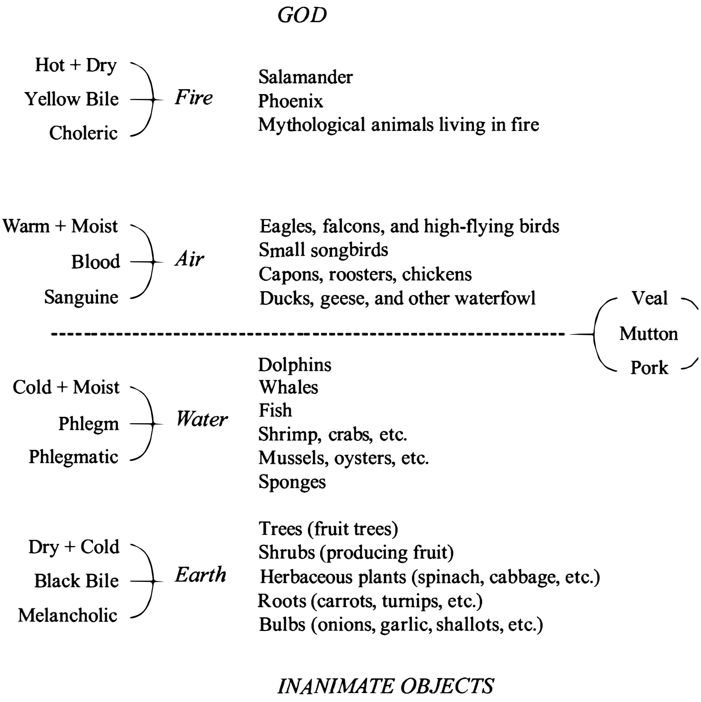
GOD
Hot + Dry
Yellow Bile
Choleric
Fire
Salamander
Phoenix
Mythological animals living in fire
Warm + Moist
Blood
Sanguine
Air
Eagles, falcons, and high-flying birds
Small songbirds
Capons, roosters, chickens
Ducks, geese, and other waterfowl
Veal
Mutton
Pork
Cold + Moist
Phlegm
Phlegmatic
Water
Dolphins
Whales
Fish
Shrimp, crabs, etc.
Mussels, oysters, etc.
Sponges
Dry + Cold
Black Bile
Melancholic
Earth
Trees (fruit trees)
Shrubs (producing fruit)
Herbaceous plants (spinach, cabbage, etc.)
Roots (carrots, turnips, etc.)
Bulbs (onions, garlic, shallots, etc.)
INANIMATE OBJECTS

Figure 1. The table of humours and The Great Chain of Being.

imbalance, which in turn led to illness.[8] The regulation of diet, being a fundamental part of an individual's lifestyle, was therefore regarded as the primary means of preventative and curative medical treatment.[9] Medieval cookery was principally structured around this Old Dietetic premise, that food had a therapeutic function through its effect on the diner's bodily humours.

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[8] R. Porter, *Disease, Medicine and Society in England, 1550–1860* (Cambridge: Cambridge University Press, 1993).

Initially, a logic of equivalence dictated the ideal diet for the healthy, while a logic of opposition was used to prescribe foods for the sick. Thus, healthy people, those with the ideal balance of hot and moist qualities, were to eat food of their like. In contrast, the unhealthy, or those with extreme temperaments, were to compensate for their humoural imbalance – someone driven to excessive dryness was thought to benefit from eating moist foods, for example. In the sixteenth century, the logic of opposition became the one and only dietetic rule, as the notion that opposed qualities contributed to equilibrium in the body took hold.[10]

More generally, the nutritional value of food was governed by a logic of similitude, much like that which served as the foundation of the Great Chain of Being. By virtue of their hot and moist humoural qualities, organisms located in close proximity to the human body in the Great Chain of Being were thought to possess enhanced nutritional value as foods, relative to those with more dissimilar qualities. Thus, animals were generally more nutritious than plants, mammals more so than fowl, and these more than fish. Another core property of foods, however, was their digestibility, understood as the capacity of organisms to transform environmental humours into easily digestible material. Based on the principle that the similar attract, while the dissimilar repel,[11] organisms living in the air were also thought to be the least strenuous on the body to digest, as air imparted to them its hot and moist qualities. This category included not only airborne animals, but also earthbound animals living at relatively elevated altitudes,[12] as well as plant matter growing on trees, for it 'rests on air,' as opposed to those growing on or in the earth.[13] Digestibility being the most important quality of foods, these plants and animals were held in the highest regard.[14]

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[9] B. Laurioux, *Les livres de cuisine médiévaux. Fascicule 77.* (Turnhout, Belgium: Brepols, 1997); T. Scully, 'Mixing it Up in the Medieval Kitchen', in M.-J. Arn (Ed.), *Medieval Food and Drink. Acta of the Center for Medieval and Early Renaissance Studies XXI* (Binghamton, New York: Center for Medieval and Early Renaissance Studies, 1995).

[10] K. Albala, *Eating Right in the Renaissance* (Berkeley: University of California Press, 2002); Porter, *Disease, Medicine and Society*; B. Turner, *Regulating Bodies: Essays in Medical Sociology* (London: Routledge, 1992).

But even nobility could not dine exclusively on the noblest of plants and animals, so the recipes of medieval and early modern cookbooks commonly instructed on the Old Dietetic practice of compensating for the use of less favourable foods by adding ingredients with beneficial humoural qualities, so as to improve the overall therapeutic value of the dish.[15] It is for this reason that medieval cookery was characterized by an abundant use of spices, especially cloves, cinnamon, nutmeg, ginger, and saffron, for these spices were deemed to be hot and dry.[16] Even more than these ingredients, medieval cookery was especially marked by a widespread and prolific use of sugar, then considered a spice. Sugar being the only spice with hot and moist qualities, the ideal qualities of the healthy human body,[17] it was more widely and abundantly used than any other spice.[18]

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[11] Albala, *Eating Right*, 71.

[12] B. Platina, *Platina. On Right Pleasure and Good Health* [1475]*: A Critical Edition and Translation of* De honesta voluptate et valetudine, trans. M. E. Milham (Tempe, Arizona: Medieval & Renaissance Texts & Studies, 1998), 229.

[13] J-L. Flandrin, 'From Dietetics to Gastronomy: The Liberation of the Gourmet', In Flandrin & Montanari (Eds.), *Food: A Culinary History.*

[14] As these foods tended to have a high economic as well as symbolic value, access to them was essentially exclusive to the social elites (J.-L. Flandrin, 'Seasoning, Cooking and Dietetics in the Late Middle Ages' in Flandrin & Montanari (Eds.), *Food: A Culinary History*).

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[15] See L. de Casteau, *Ouverture de cuisine* (Liège: Leonard Streel Imprimeur iuré, 1604); F. P. de La Varenne, *Le Cuisinier françois* [1651] (Paris: Chez Pierre David, 1654); Platina, *On Right Pleasure.*

[16] There is no historical evidence or logical support for the common contemporary assumption that spices were primarily used to mask the flavour of spoiled food (e.g. S. Mintz, *Sweetness and Power: The Place of Sugar in Modern History* [New York: Viking, 1985]). Medieval cookbooks do not support the theory, as their contents do not suggest that cooks were commonly beset by the problem of having to make use of spoiled food, nor are spices cited for this purpose (T. Peterson, 'The Arab Influence on Western European Cooking', *Journal of Medieval History* 6, 1980: 317–40, 320). Moreover, given that spices were extraordinarily expensive by contemporary standards, it seems unreasonable that those wealthy enough to afford the large quantities of spices reportedly used would have not been able to also procure fresh food (Peterson, 320; W. Schivelbusch, *Tastes of Paradise: A Social History of Spices, Stimulants, and Intoxicants* [New York: Vintage, 1993], 6). Lastly, just like the consumption of noble plants and animals, any abundant use of spices would also have inevitably served a symbolic purpose as a means of social distinction (Albala, *Eating Right*; Flandrin, 'Seasoning, Cooking and Dietetics').

THE SEPARATION OF THE SWEET FROM THE NON-SWEET TASTES

The rules for cooking and eating, however, began to undergo significant transformation in early modernity. Corresponding with the gradual erosion of belief in traditional scholastic medicine, the content of cookbooks published in France in the late seventeenth century demonstrates the declining influence of the Old Dietetics over the practice of cookery.[19] These new books still had references to the Old Dietetics, but they were now accompanied by new ideas,[20] the most significant of which was that taste, not just humoural balance, was a legitimate factor in choosing one's food, and that taste, just like humoural balance, varies from individual to individual.[21] Related to these notions of taste and individual variability, books of this period also reveal a diversity of opinions on health issues, certainly absent during the dominance of scholastic medicine, and an increased attention to regional variation as local habits gained relevance in the theorization of rules for cooking. In accordance with these changes, spices, particularly sugar, became much less widely used at the time.[22]

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[17] See Platina, *On Right Pleasure*. Platina, among other authors, called 'warm' what are otherwise referred to as 'hot' qualities.

[18] B. Laurioux, B, *Les livres de cuisine médiévaux*. Fascicule 77 (Turnhout, Belgium: Brepols, 1997). For recipes, see M. Black, *The Medieval Cookbook* (London: British Museum Press, 1992), Platina, *On Right Pleasure*; D.E. Scully & T. Scully, *Early French Cookery: Sources, History, Original Recipes and Modern Adaptations* (Ann Arbor: The University of Michigan Press, 2002), B. Wheaton, *Savoring the Past. The French Kitchen and Table from 1300 to 1789* (Philadelphia: The University of Pennsylvania Press,1983).

[19] Cookbooks published in France are representative of a much broader phenomenon taking place in Europe. This is to a large extent because, prior to modernity, distinctions in cuisine were based primarily on conditions of socio-economic and regional availability, rather than national tradition.

[20] J-L. Flandrin, *L'Ordre des mets* (Paris: Editions Odile Jacob, 2002); P. Hyman & M. Hyman, 'Printing the Kitchen: French Cookbooks, 1480–1800' in Flandrin & Montanari (Eds.), *Food: A Culinary History*.

The liberation of the perceptual and theoretical understanding of food from medical concerns was a gradual process, but by the end of the seventeenth century, cookbooks rarely referenced the humoural notions of the Old Dietetics, instead instructing the selection and combination of ingredients on the basis of their tastes. The practice of cookery began to be framed as an *art*,[23] and the consumption of foods as governed by personal preference rather than medicinal function. Thus, a new perceptual and theoretical understanding of food developed which, in aggregate, was eventually codified as modern French cuisine. This culinary system moved away from the abundant use of spices and preeminence of the sweet taste that characterized medieval cooking, to incorporate ingredients that were not commonly used in the middle ages (including white meats, fruits, and vegetables), novel basic preparations with butter and cream, and a variety of new techniques and rules.[24] By the eighteenth century, at a time when a whole range of scientific and artistic disciplines gained autonomy and became self-standing areas of activity,[25] cookery had ceased to be a dietetic subcategory of medicine, instead constituting a category of its own within the arts.[26]

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[21] L.S.R., *L'art de bien traiter* [1674] (Paris: Éditions Payot & Rivages, 1995).

[22] Albala, *Eating Right*.

[23] See Massialot, *Le cuisinier roïal et bourgeois* [1691] (Paris: Chez Charles de Sercy, 1698), 6 in Preface.

Yet, the declining influence of the theory of humours corresponding with the autonomization of cuisine from medicine can only serve to explain why spices and sweet ingredients were used more sparingly, but not why the sweet came to be perceived as dissociated from the non-sweet tastes such that the two categories constituted a fundamental dichotomy around which the emergent culinary system was structured.[27] Indeed, a more general and profound epistemic shift in the way phenomena were apprehended[28] was required to make the very construction of a dichotomy of tastes conceptually possible. Thus, a confluence of factors, ranging from the biological attributes of tastes and taste receptors, to economic, institutional, and epistemic changes, must be called on to explain why a dichotomy of tastes was constructed in early modernity, why the sweet and non-sweet categories served this purpose, and why this dichotomy became so central in structuring the understanding of food, the creation of dishes, and the organization of the meal.

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[24] Albala, *Eating Right*, 111; J-R. Pitte. *French Gastronomy: The History and Geography of a Passion* (New York: Columbia University Press, 2002).

[25] A. Abbott. *The System of Professions: An Essay on the Division of Expert Labor* (Chicago: The University of Chicago Press, 1988).

[26] Prior to the eighteenth century, cookbooks were catalogued together with dietetic treatises under the category of medicine. In 1764, in the *Traité des livres rares* ('Treatise of rare books'), cooking was classified as art for the first time (Flandrin, 'From Dietetics to Gastronomy', 431).

[27] V. Leschziner, 'Epistemic Foundations of Cuisine. A Socio-Cognitive Study of the Configuration of Cuisine in Historical Perspective', *Theory & Society* 35, 2006: 421-43.

Recalling the two models that we described earlier, the Great Chain of Being and the theory of humours, is instrumental here to grasp the epistemic structure within which medieval cookery existed. The Great Chain of Being (see Figure 1) represents two attributes that characterize pre-modern thought: the view of the universe as a continuum, and the interest in vague relations of similitude between things, constructed on the basis of resemblance of form.[29] The theory of humours, however, as well as the classical notion of the four elements (see Figure 1), symbolizes the very different cognitive tendency to code phenomena into binary sets.[30]

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[28] M. Foucault [1970], *The Order of Things: An Archaeology of the Human Sciences* (New York: Vintage Books, 1973).

[29] Foucault, *The Order of Things*; C. Lévi-Strauss [1962], *The Savage Mind* (Chicago: The University of Chicago Press, 1966); G. Lloyd, *Polarity and Analogy: Two Types of Argumentation in Early Greek Thought* (Cambridge: Cambridge University Press, 1966).

Though the tendency to construct binary sets may seem inconsistent with the claim that medieval thought was characterized by an attention to relations of resemblance and a view of the cosmos as a continuum, dichotomies were ultimately subsumed to the principle of equivalence and the view of the natural world as a continuous whole.[31] Furthermore, one must bear in mind that, prior to the seventeenth century, relations of identity, similitude, opposition and difference were rather vaguely understood, and little attempt was made to distinguish the nature of one type of relation from another beyond a matter of grading of the degree of closeness between objects denoted by each type of relation.[32] The seventeenth century witnessed an epistemic shift that entailed a move away from the organization of phenomena by means of vague relations of resemblance of form towards the ordering of phenomena through the ascertainable presence or absence of physical properties to establish relations of difference,[33] a requisite for the principled construction of dichotomies. Whereas prior to modernity, the ordering of natural phenomena ultimately entailed matters of grading, this epistemic shift represented the emergence of a very different cognitive style of establishing boundaries between phenomena.[34]

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[30] M. Douglas, *How Institutions Think* (Syracuse, New York: Syracuse University Press, 1986); Lévi-Strauss, *The Savage Mind*; Lloyd, *Polarity and Analogy*; M. Sahlins, *Culture and Practical Reason* (Chicago: The University of Chicago Press,1976), *Historical Metaphors and Mythical Realities: Structure in the Early History of the Sandwich Islands Kingdom* (Ann Arbor: University of Michigan Press, 1981), *Islands of History* (Chicago: The University of Chicago Press, 1985), *Culture in Practice: Selected Essays* (New York: Zone Books, 2000).

[31] Foucault, *The Order of Things*; Lloyd, *Polarity and Analogy*; Lévi-Strauss, *The Savage Mind*.

[32] Douglas, *How Institutions Think*; Lloyd, *Polarity and Analogy*.

While this change in the nature of classification was required for the construction of principled dichotomies, another condition was necessary to establish a dichotomy of *tastes*: a higher regard for sensorial experience. Being subject to bodily needs and temperaments, and affected by the environment, the senses had been considered too variable a means for acquiring knowledge during medieval times.[35] By the seventeenth century, the sense of taste, along with that of smell, was still not deemed a sufficiently reliable tool to be employed scientifically. As recognition of the validity leant by rigorous empiricism grew in early modernity, however, the senses were gradually accepted as a dependable means for acquiring knowledge, thereby allowing a dichotomy of taste categories to exist as a possible template for the perception and theorization of food. To understand why the dichotomy was constituted by the sweet and non-sweet tastes in particular, a dissociation that was absent in medieval cookery, one must examine the socio-historical, chemical, and biological significance of these categories.

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[33] This shift occurred with the development of experimental sciences, associated with which was a new interest in the study of the constitutive properties of phenomena (rather than their form), and the pursuit of analytic explanations (Foucault, *The Order of Things*). In short, scientific endeavours moved away from the construction of taxonomies toward the explanation of phenomena, and therefore from the exhaustive classification of objects on the basis of resemblances to the search for causes and reliance on judgment in selecting and synthesizing relevant properties (Ibid., 162).

[34] See Douglas, *How Institutions Think*. L. Fleck (*Genesis and Development of a Scientific Fact* [Chicago: University of Chicago Press, 1979]) characterizes the emergence of a new form of classifying and understanding phenomena as the emergence of a new thought style.

[35] See Foucault, *The Order of Things*; A. Hauser, *The Sociology of Art* (Chicago: Chicago University Press. 1982); C. Korsmeyer, *Making Sense of Taste: Food and Philosophy* (Ithaca, NY: Cornell University Press, 1999).

A transformation in the institutional position of sweets within cuisine occurred in early modernity that is significant in explaining the dissociation of the sweet from the non-sweet tastes. In the middle ages, sweets were classified as preserves in a category that encompassed all sorts of non-perishable items, from fruits cooked with honey or sugar, to pickles made with vinegar, mustards, spiced wines, soaps and perfumes. Preserves were a category separate from the rest of foods because they were deemed therapeutic more so than nourishing, and used to improve the overall humoural qualities of dishes.[36] The distinction of preserves from the rest of foods had a solid institutional basis, as preserves were not made by cooks, but by a specialist, the *officier de bouche*, and they were not featured in cookbooks but in their own specialized books.[37] Though the sweet taste was not yet conceptually distinguished from the other basic tastes within the category of preserves, this specialization represents the origin of the institutional separation of the sweet from the non-sweet, a separation that continues to this day, with distinct careers for chefs and pastry chefs,[38] and distinct recipe books.

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[36] M. Hyman, 'Les "menues choses qui ne sont de neccessité": Les confitures et la table' in C. Lambert (Ed.), *Du Manuscrit à la table. Essais sur la cuisine au Moyen Âge et répertoire des manuscrits médiévaux contenant des recettes culinaires* (Montréal: Les Presses de l'Université de Montréal, 1992), 282.

Certain economic conditions in early modernity also contributed to the gradual dissociation of the sweet from the other basic tastes. With the new European colonies in tropical countries, sugar turned from a luxury good into an inexpensive and readily available commodity.[39] This new level of abundance, together with the greater chemical combinatorial flexibility of sugar relative to the common sweeteners of the medieval period, particularly honey,[40] encouraged experimentation with sweets. During this period, sweet-tasting dishes therefore moved slowly from their ubiquitous presence throughout the meal towards a more restricted place at the end of the meal, circumscribed to entremets and desserts by the eighteenth century[41] and solely desserts later on.

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[37] Flandrin, *L'ordre des mets*, 133; Hyman, 'Les "menues"', 282; Hyman & Hyman, *Printing the Kitchen*, 395.

[38] See P.P Ferguson & S. Zukin, 'The Careers of Chefs' in R. Scapp & B. Seitz (Eds.), *Eating Culture* (Albany: State University of New York Press, 1998), 98.

[39] Mintz, *Sweetness and Power*.

[40] Honey had been widely used in the middle ages because it was what sugar became in modernity: inexpensive and readily available.

This transformation in the rules for serving food whereby sweet-tasting dishes became institutionally separated from the others in early modernity reinforced the conceptual dissociation of this taste from the non-sweet tastes. In the middle ages, table service had been structured in a varying number of sequential *services*, each of which consisted of multiple sorts of dishes that blended all basic tastes and were served at the table at the same time, including hors d'oeuvres, appetizers, soups, roasts, sweets.[42] This was the so-called *service à la française*, generally associated with the French court and its ostentatious customs, wherein a diner's place at the banquet table governed the dishes the diner was to consume. This serving style was replaced in the mid-nineteenth century by the *service à la russe*,[43] still in place today, wherein the meal is structured around *courses*, each of which consists of one dish, served in a sequence from appetizer, to entrée, and dessert.

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[41] Flandrin, *L'Ordre des mets*, 139.

[42] Flandrin, 'Structure des menus', 191; *L'Ordre des mets*, 13-15.

[43] The *service à la russe* acquired this name due to its introduction in France by the Russian Ambassador to Paris under the First Empire (P.P. Ferguson, *Accounting for Taste: The Triumph of French Cuisine* [Chicago: The University of Chicago Press, 2004], 89). It was also institutionalized in Russia under Peter the Great (D. Goldstein, 'Gastronomic Reforms under Peter the Great: Toward a Cultural History of Russian food', *Jahrbücher für Geschichte Osteuropas* 48, 2000: 481–510, 506).

Scholars generally account for the shift to the Russian serving style by the socio-political changes brought about by the French revolution.[44] The more egalitarian and simpler table service of the Russian style was better suited to a bourgeois society, and to the preparation, service, and consumption of food in the restaurant, the emergent social space devoted to fine dining.[45] While these factors influenced the demise of the *service à la française*, they do not explain why the serving style that replaced it sought to separate sweet from non-sweet tastes across a sequence of individual dishes.[46]

One must recall the changing epistemic configuration in early modernity to understand the motivation for this characteristic of the *service à la russe*. With no dissociation between the sweet and the other basic tastes either within a dish, within a *service*, or across the meal, the *service à la française* had corresponded with the principles reigning over medieval cookery. It was especially well suited to the Old Dietetic concern for maintaining an ideal humoural balance, in that serving multiple dishes at the same time allowed for each diner to select the food that was prescribed for their humoural idiosyncrasies.[47] However, this serving style became unwarranted and even impractical in early modernity, as the goal of cuisine was no longer associated with medical concerns but with the experience of taste. The *service à la russe* facilitated this growing aesthetic appreciation of food because, by bringing dishes from the kitchen to be eaten promptly, rather than having them all sit at the table for hours throughout the meal, it prevented food from losing its temperature and flavour before being consumed.[48]

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[44] J.-P. Aron, *The Art of Eating in France: Manners and Menus in the Nineteenth Century* (London: Peter Owen, 1975); N. Elias, *The Civilizing Process: Sociogenetic and Psychogenetic Investigations* (Oxford, Malden, MA: Blackwell, 2000); S. Mennell, *All Manners of Food: Eating and Taste in England and France from the Middle Ages to the Present* (Urbana, Chicago: University of Illinois Press, 1996).

[45] R. Spang, *The Invention of the Restaurant: Paris and Modern Gastronomic Culture* (Cambridge, MA: Harvard University Press, 2000).

[46] V. Leschziner, 'Epistemic Foundations of Cuisine': 421-43.

Moreover, the series of courses in the *service à la russe* offered perceptible temporal and spatial dimensions along which to anchor the emergent conceptual dissociation of taste categories. The sweet taste became temporally separated from the others in that it was consigned to the end of the meal, subsequent to the appetizer and entrée, courses that became predominantly non-sweet-tasting. It was spatially separated from these courses in that the table was cleared before the dessert was served. Indeed, the word 'dessert' has its etymological origin in the traditional practice of *desservir la table* (to remove the dishes), to let diners stand up from the table, converse or dance, to come back to have sweet dishes on a newly set table. This institutionally imposed spatial and temporal separation of the sweet-tasting course from the rest of the meal therefore reinforced the conceptualization of the sweet as dissociated from the non-sweet tastes.

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[47] Flandrin, 'From Dietetics to Gastronomy', 420; Leschziner, 'Epistemic Foundations of Cuisine', 437.

[48] Flandrin, *L'Ordre des mets*, 148.

The conceptual dissociation between the sweet and non-sweet tastes engendered by the courses of the *service à la russe* highlights the fact that there is not only a dichotomous relation between the sweet and non-sweet tastes, but that there is also a relation of markedness, wherein the sweet is the marked term and the non-sweet the unmarked.[49] In a relation of markedness, the marked term is defined with a high level of specificity and therefore occurs in delimited circumstances, while the unmarked term is defined more vaguely, and may even be a residual category, and is therefore something that appears more frequently.[50] In the cognitive structure of modern French cuisine, whereas the sweet is defined with precision (the presence of sugars) and is circumscribed to desserts, the non-sweet is indeed a residual category whose appearance is less restricted. This relation of markedness is relevant in considering some of the biological factors that may have contributed to a conceptual dissociation between these two taste categories, rather than others.

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[49] L. Waugh, 'Marked and Unmarked: A Choice Between Unequals in Semiotic Structure', *Semiotica* 38, 1982: 299–318, 301. The notion of markedness originates in the structural linguistics of Trubetzkoy (*Principles of Phonology* [1949] [Berkeley, CA: University of California Press, 1969]) and Jakobson (*Selected Writings, Vol. I. Phonological Studies* [The Hague: Mouton, 1971]).

[50] As Waugh explains ('Marked and Unmarked', 307), the relation of markedness is not a matter of absolutes, but rather something that is constantly subject to redefinition. Marked terms acquire their meaning as they relate to unmarked terms and to the context more generally.

First, while it is not unique in this regard, the sweet does hold a special status as one of the basic tastes that is intrinsically perceived as pleasant.[51] Whereas the unpleasant tastes[52] are generally indicators of toxicity or potentially harmful acidity, and therefore serve to moderate or deter the consumption of substances which exhibit them, the pleasant tastes can be used to infer the macronutritional content (in terms of fats, proteins, and carbohydrates) of substances which exhibit them, and facilitate the development of dietary preferences for these substances as foods.[53] In short, the hedonic properties of the basic tastes serve adaptive physiological functions with behavioural consequences that inevitably contribute to the perception and theorization of foods. In particular, the positive hedonic value connected to the sweet taste serves to promote the detection and consumption of sugars, the most basic and fundamental sources of metabolic energy.[54]

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[51] Umami and saltiness are similarly classified as pleasant tastes (J. Chandrashekar, M. Hoon, N.J.P. Ryba, C.S. Zuker, 'The receptors and cells for mammalian taste', *Nature* 444, 2006:288-94, 289; A. Carleton, R. Accolla & S.A. Simon, 'Coding in the mammalian gustatory system', *Trends in Neurosciences* 33, 2010: 326-34, 331.

[52] Bitterness and sourness are classified as unpleasant tastes (Carleton et al).

[53] Chandrashekar *et al.*

[54] Ibid., 289.

Even bereft of their sensorial effects, the nutritional significance of sugars independently contributes to a preference for sweet-tasting foods, establishing them as the most favourable dietary material. Recently published laboratory research shows that rodents prefer sweet relative to other pleasant-tasting (i.e. nutritious) foods even when they cannot perceive the tastes.[55] The findings suggest that the regulation of glucose metabolism resulting from the ingestion of sugars is sufficient to stimulate brain dopamine centres, thereby developing and reinforcing a behavioural preference for sugars over other available macronutrients.[56] In effect, when sensorial differences are removed, the physiological consequences of consumption alone are sufficient to establish a preference for sweet relative even to other pleasant-tasting foods. Thus, the sweet taste is indeed marked relative to the non-sweet tastes, in that the nutritional significance of sweet-tasting foods, combined with their intrinsic pleasantness, is sufficiently strong to elevate the behavioural preference for these foods more than for foods of any other taste, facilitating a conceptual dissociation of the sweet from the non-sweet tastes. The institutional separation of sweet-tasting foods from the rest of dishes in a meal in modern French cuisine may be associated with this natural coveting of dietary sugars.

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[55] X. Ren, J.G. Ferreira, L. Zhuo, S.J. Shammah-Lagnado, C. Yeckel & I.E. de Aruajo, 'Nutrient selection in the absence of taste receptor signaling', *The Journal of Neuroscience* 30, 2010: 8012-23.

[56] Ibid.

Another property of the sweet taste renders it a particularly likely candidate for dissociation from the other basic tastes in modern French cuisine: the sweet is both the least suppressed and the strongest suppressor of other basic tastes when they appear in combination.[57] Indeed, when individuals are made to sample all possible binary, ternary and quaternary mixtures of sweet with sour, salty, and bitter tastes, and asked to attribute individual intensity ratings to each of the basic tastes appearing in each sample, they invariably perceive sweetness as the dominant taste.[58] Notably, the perceptual bias for the experience of sweetness occurs at the expense of perceiving tastes that indicate potentially harmful qualities of a food,[59] suggesting that the detection and consumption of macronutrients, particularly of dietary sugars, supersedes the detection and avoidance of toxins as the primary function of the gustatory system.[60] Moreover, the finding indicates a possible perceptual motivation for the dissociation of the sweet from the non-sweet tastes, as it implies that this dissociation, more than any other between a singular marked taste and residual group of tastes, better enables the perception of all tastes. Insofar as taste was gaining appreciation as a standard of judgment during the transition to modern French cuisine, the dissociation of the sweet from the non-sweet tastes was an ideal fit, and itself functioned to reinforce this conceptual organization of the basic tastes.

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[57] B.G. Green, J. Lim, F. Osterhoff, K. Blacher & D. & Nachtigal, 'Taste mixture interactions: Suppression, additivity, and the predominance of sweetness', *Physiology & Behaviour* 101, 2010: 731-37.

[58] Ibid.

[59] High levels of salt consumption heighten the risk of hypertension, and as we mentioned previously, bitter and sour tastes are indicators of potential toxicity (Chandrashekar et al.; Green et al.).

[60] See Chandrashekar et al.

A number of factors therefore influenced the dissociation of the sweet from the non-sweet tastes, including the socio-historical, chemical, and biological significance of these categories. As we argue below, this dichotomy remains a pervasive cognitive structure in many contemporary high cuisines influenced by the French style, even as a trend is burgeoning among innovative chefs in high-end restaurants to experiment with non-sweet ingredients in desserts.

THE SWEET VERSUS NON-SWEET TASTES IN CONTEMPORARY HIGH CUISINE

In the previous section, we examined a transformation in the rules for the selection, preparation, service, and consumption of food, which led to a perceptual and theoretical dissociation of the sweet from the non-sweet tastes. We suggested that the autonomization of culinary practices, particularly from medical concerns, allowed for taste to gain appreciation as an organizing principle in cuisine. A general epistemic shift in the way phenomena were classified, specific economic and institutional conditions, the chemical properties of certain foods, and certain biological attributes of the basic tastes, we argued, were all important factors in the perceptual and theoretical dissociation of the sweet from the non-sweet tastes. Sweet-tasting foods were thus separated from those with non-sweet tastes, and were consigned to the end of the meal, thereby reinforcing the institutionalization of the marked relationship between the sweet and non-sweet tastes. This relationship between the two categories had a central role in structuring the culinary system that was eventually codified as modern French cuisine, a system that still informs prescriptions and proscriptions across many contemporary Western culinary styles.

Indeed, there is plenty of evidence that the dissociation of the sweet from non-sweet tastes continues to structure Western cuisines in the organization of contemporary cookbooks and restaurant menus, where dishes that are preeminently sweet are essentially consigned to their own separate section, desserts. To be sure, sweet ingredients do appear in dishes outside of the realm of desserts, such as in cold appetizers or with braised meats, but many of these dishes can be traced back to medieval cookery (melon and prosciutto or *duck à l'orange* are good examples), and so are holdovers from older times rather than products created within the modern culinary structure. Regardless of whether the dishes that combine sweet and non-sweet tastes originate in medieval cookery or not, such dishes are arguably exceptions in a cuisine that is structured around the dissociation of the sweet from the other basic tastes, wherein foods are essentially perceived to be of either sweet or non-sweet character.[61]

There is a trend, however, developed in contemporary high-end restaurants in the past few years, that combines sweet and non-sweet ingredients in a way that is entirely novel. In contrast to the incorporation of sweet ingredients into the realm of the non-sweet, the practice that is to be traced back to medieval custom (and beyond), the new trend sees the non-sweet encroaching upon the sweet. A few years ago, contemporary elite chefs working within Western cuisines began to create innovative desserts through the combination of non-sweet ingredients, not typically used in desserts, with more standard sweet components. These chefs incorporate herbs such as thyme or rosemary, or spices such as pepper or cumin; they substitute fruits in traditional recipes with ingredients like parsnips or tomatoes, or replace cream or ricotta with strong-tasting cheeses such as a Roquefort or aged Cheddar. A widely popular ingredient in elite restaurants in the past few years, bacon has now made appearances in cakes, cookies and ice cream.

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[61] In contrast to medieval cookbooks, contemporary books provide evidence of the role of the dichotomy between sweet and non-sweet tastes as an organizing logic of cuisine. Not only are books structured around this dichotomy, but also if there are recipes that combine sweet ingredients with non-sweet ingredients, authors generally preface them with a comment that denotes the extra-ordinary nature of the recipe. In addition, interviews with elite chefs conducted by one of the authors (see V. Leschziner, 'Kitchen Stories: Patterns of Recognition in Contemporary High Cuisine', *Sociological Forum* 22, 2007: 77-101) also provide evidence that combining sweet with non-sweet ingredients is a practice that, even if growing in popularity, is perceived as out of the ordinary.

Besides the culinary novelty of these creations, the practice of making desserts with non-sweet ingredients typically consigned to non-sweet courses represents an innovative pattern of cognition with regard to the relations between taste categories. In contrast to the medieval custom of adding sweet ingredients in all sorts of dishes, in the contemporary combination of the sweet and non-sweet, it is the unmarked category (the non-sweet) that moves into the marked one (the sweet). Since membership in the residual category easily outstrips membership in the precisely marked category, a vast number of combinatorial possibilities exist for this innovative practice in contemporary Western cuisines.

However, that the practice of using non-sweet ingredients in desserts innovates on convention, both culinary and cognitive, and that there is great potential for this practice, is not to be taken as an indicator of a radical change in the underlying cognitive structure of modern cuisine. This is not only because using non-sweet ingredients in desserts is, for the moment, only a trend in elite restaurants – for it may, in time, trickle down and become socially widespread, just as the custom of eating a sweet course at the end of the meal did in early modernity. Rather, if this trend is unlikely to change the structure of cuisine as it was formed in early modernity, it is because of the biological, socio-cognitive, and institutional attributes of the sweet taste. Insofar as sweetness is the strongest suppressor and least suppressed of the basic tastes when appearing in combination, using non-sweet ingredients in a dessert will be largely ineffective in changing the ultimately sweet character of the dish. As it follows, the addition of non-sweet ingredients into desserts is not likely to alter the marked character of sweetness, and therefore the cognitive and institutional separation of this basic taste from the others.

Examining this recent trend in contemporary cuisine sheds light on two important arguments put forth in this article. First, in purposefully challenging the dissociation between the sweet and non-sweet tastes, the current trend of using non-sweet ingredients in desserts actually demonstrates the extent to which this dissociation has a central role in structuring the selection, preparation, service and consumption of food in modern cuisine. Second, that this trend is unlikely to change the structure of cuisine as it was formed in early modernity, indicates the significance of analyzing cognitive structures, along other more commonly studied factors, to understand how and why systems of rules that govern areas of social activity develop, endure, and change.

LIGHT CYAN BLUE

Breast of chicken, one per serving

Vanilla ice cream (high quality real vanilla, not cheap artificial stuff)

Vanilla extract or, preferably, beans

Frozen orange juice concentrate

Brown sugar

Corn starch

The breast of chicken can be with or without bone, or may be half of a split chicken, including a leg, etc. – it really doesn't matter. What is important is that the skin and fat remain.

For the orange sauce, in a small pot, on low heat, warm up half a can of the orange juice concentrate, mixing in a teaspoon or two of brown sugar. The sauce should be sour, not sweetened with the brown sugar; the sugar is only there to add a touch of flavour, not sweetness. Add corn starch to the sauce to thicken it until the viscosity is similar to thick molasses. Maintain on a very low heat or otherwise keep warm until serving.

Grill the chicken to preference. However, the skin should be crispy and the meat should remain very fatty; retain the fat, rather than draining, as needed.

The vanilla ice cream should be very cold and hard, such that it scoops into balls and will take longer to melt.

The chicken should be served hot (but not excessively so), right off the grill (with a little pouring of fat over it, if desired), topped immediately with one or two scoops of ice cream sprinkled with just a bit of vanilla, this all topped with enough orange sauce to cover part of the chicken and ice cream but not to drown it. Speed is of the essence here, as the idea is for the diner to be able to experience the contrasting heat of the chicken and the coldness of the ice cream for as long as possible before temperatures equalize.

Serve with a glass of light (wheat) beer flavoured with lemon, and a glass of red wine.

The Human Sensoria and a Synaesthetic Approach to Cooking

Sean A. Day,
with contributions courtesy of
James Wannerton

> *[T]hat perceptions are not absolutely determinate and singular is obvious from the fact that each sense is an abstracting mechanism. Sight by itself informs us only of colors and forms. No one can pretend that the images of sight are determinate in reference to taste. They are, therefore, so far general that they are neither sweet nor non-sweet, bitter nor non-bitter, having savor nor insipid.*
>
> CHARLES SANDERS PEIRCE, 1868

THE SENSES, COOKING, FOOD, AND EATING

Which sensory modalities are involved in ‘eating’? ‘Flavour’ involves far more than just the sense of taste, or even the combination of taste with smell; we might also consider at least the components of temperature (which divides into at least two separate senses), vision (which itself is comprised of at least four components),[1] hearing (which, in humans, separates speech sounds, musical sounds, and 'other' sounds), touch, pain, and kinetics.

This opens up the question of how many 'senses' there are as per the medical sciences. But, equally and perhaps more importantly, it raises the question of how many senses a given particular culture counts, how those senses are integrated, and, for that group of people, what the hierarchy of the senses is. The Aristotelian paradigm, for instance, which still infuses much of our thinking, holds that there are five senses, ranked from most to least important as follows: sight; hearing; smell; taste; and touch. However, it should also be noted that in *De Anima* 'taste' and 'seeing' are defined as forms of 'touch'.[2] This model was later reaffirmed by Descartes. Thomas Aquinas, however, did argue for 'taste' to be placed higher than 'smell' (along with 'touch' ranking at the top, within certain structures), and Isidor of Seville attempted to (re-)assert the connection of *sapor* ('taste') with *sapere* ('knowledge') and *sapienta* ('wisdom').[3] Various Christian, Muslim and Jewish theologians equated touch with the body, and thus consequentially sex and lust; touch thus became deemed the most sinful or shameful of the senses.

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[1] See, e.g., S. Zeki, *A Vision of the Brain* (Oxford: Blackwell Scientific Publications, 1993).

[2] See S. Stewart, 'Remembering the Senses', in D. Howes (ed.) *Empire of the Senses* (Oxford and New York: Berg, 2005), 59-69.

[3] See R. Jütte, *A History of the Senses* (Malden, Mass.: Polity Press, 2005).

Since taste, unlike sight, hearing and smell, is also obtained via touching items, and thus also in direct contact with the world, taste also became sinful.

Yet, it is not too difficult for us to find other constructs of 'the senses'. The Desana (Wirá), a Tukano people living in Columbia, for example, are extremely careful to discern between their five different senses of vision (or sight), smell, taste, hearing, and touch. However, for the Desana, what is essential to all of this is how the senses integrate in concordance with their cosmology, with a main focus being on colours.[4] As in many cultures throughout the world, Desana life is infused with a learned system of colour symbolism that operates synaesthetically. Thus, for example, conceptually, combining a certain colour with a certain temperature will result in producing a specific odour; that is, 'odour' is comprised of colour and temperature. Or, the sound of a small bone flute is perceived as red, hot, and having a male odour; these concepts combine such that a tune played on the flute evokes youthful happiness and the taste of a fleshy fruit, deemed very erotic by young women.[5] Flavour is thought to derive from odour, but is deemed less important;

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[4] See C. Classen, 'McLuhan in the Rainforest', in Howes, *Empire of the Senses*, 147-63.

[5] See, G. Reichel-Dolmatoff, *Amazonian Cosmos: The Sexual and Religious Symbolism of the Tukano Indians* Chicago: University Press, 1971; G. Reichel-Dolmatoff, 'Cosmology as Ecological Analysis: A View from the Rain Forest', *Man* 2, 1976: 307-18; G. Reichel-Dolmatoff, *Beyond the Milky Way: Hallucinatory Imagery of the Tukano Indians* (Los Angeles: UCLA Latin American Center Publications, 1978).

still, kin groups are differentiated by flavours.[6] All of this integrates with the Desana's use of *Banisteriopsis caapi*, known as ayahuasca or yage, which contains harmine, harmaline, tetrahydroharmine, and the primary psychoactive component, dimethyltryptamine (with the addition of *Psychotria viridis*), combining to form a strong hallucinogen which frequently produces synaesthesia and sensory heightening.

Cooking is also conceived of as a colour process. Smoking meat is believed to transform the potentially dangerous yellow component of the meat into a safe red. After the meat is smoked it is cooked in a pot to render it an edible brown. The tripod structure used for smoking meat symbolizes this colour transformation: the lower part is said to be yellow, the grid in the centre is said to be red, and the upper part, from which the processed food is removed, is brown, the colour of edible food. Fire itself is said to contain the yellow of the sun and the red of the earth in its flames, and the blue of the Milky Way in its smoke, making it a symbol of cosmic energy.[7]

There have been numerous experiments which have shown quite conclusively that the perception of a flavour can be enhanced by the intensity of a colour, even when the colour is not of a typical natural or culture-based association with the flavour; given three beakers of solutions with equal amounts of strawberry flavouring, one coloured dark blue will be perceived as 'stronger' than one coloured faint blue, which in turn will be considered 'stronger' than a clear liquid.[8] Likewise, you can trick someone into perceiving the flavour of a white wine as being that of a red wine just by dying it red.

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[6] G. Reichel-Dolmatoff, 'Desana Animal Categories, Food Restrictions, and the Concept of Colour Energies', *Journal of Latin American Lore*, 4, no. 2, 1978: 243-91.

[7] Classen, 'McLuhan in the Rainforest', 157-8.

However, while the focus on colour's relationship to flavour is fairly common, other aspects of vision often get overlooked. For example, current research at the University of Edinburgh's Department of Psychology suggests that humans have an innate or early-learned tendency to associate round or spherical objects with sweet and square, cubic objects with sour. This extended to experiments in which equally sweetened candies were considered to be sourer if shaped as cubes rather than spheres.[9] We could extrapolate from this and, for example, consider the effects on the flavours of desserts served on round, triangular, or square plates.

Texture can also play a significant role: crunchy potato chips are different in flavour than soggy ones; there are reasons why certain pastas are served *al dente* or not; likewise for escargot and scallops. We could also look to the amount of masochistic pleasure induced by various chilies.

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[8] See, e.g., the episode 'De smaak van moeders stem', from the Dutch television series *Noorderlich*, for Donderdag 27 juni, 2002.

[9] Simner et al. (forthcoming); preliminary findings from this research were presented by Julia Simner at the 8th Meeting of the American Synesthesia Association, Nashville, TN, Oct. 1 – 3, 2010.

I present these issues so as to pose the following questions: What about when we create recipes where the edible creation is a spandrel[10] or secondary outcome of the process? What if the recipe does not focus primarily on 'taste' or 'smell'?

The purpose might, for example, be tactile, and in the preparation, not in the actual eating: Consider making mud pies. If you are quite involved in playing, there will often be a specific recipe, which needs to be followed rigidly in certain aspects, but that can be modified in others (e.g., four different varieties of 'spices', and three of 'toppings'). The main attraction of making mud pies might be squishing the mud, or feeling the little chunks of twigs, stones, bugs, and other items integrated in them; or the movements involved in rolling out the pie 'dough' and then shaping it into form. One can then also play at eating the mud pies, but that is often secondary to the play of preparation – you play at 'cooking' more than 'eating'. We can extrapolate from this to consider that almost all human cultures have foods meant to be eaten by hand – from Huli in the Southern Highlands of Papua New Guinea eating sweet potatoes, to Hoosiers in the Midwest US eating cheeseburgers and fries – where providing the proper tactile experience is an essential part of the preparation, or 'cooking', process.

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[10] See S. Gould, 'The Exaptive Excellence of Spandrels as a Term and Prototype', PNAS 94, Sept. 1997: 10750-55.

Let's next take a quick look at the attraction of the kinetic: In the United States, where I currently reside, there are few foods deliberately eaten live. There are, of course, various bacteria cultures, such as those in yogurt and cheeses, and there are also oysters. But bacteria and oysters don't wriggle. Elsewhere in the world, eating live things is far more common. In Germany, for example, we find *Würchwitzer Milbenkäse*, with live mites, *Tyroglyphus casei*, which are consumed; these live mites, but usually in smaller quantities, may also be found in other cheeses, such as Spanish *Cabrales* cheese and French *Mimolette*. However, again, one usually cannot feel the mites moving around on one's tongue while eating these cheeses. But then there is Italian *casu marzu*, cheese, which comes with *Piophila casei* maggots; these may be large enough to feel wriggling on your lips and tongue, especially as the maggots are also known to leap distances up to 15cm.

With Korean *sannakji*, you can readily see and feel the chopped octopus wriggling in your mouth; the small octopuses may instead be served whole, so that you initiate the killing of the octopuses with your teeth, which is far wiser than swallowing them whole live. Similarly, there are Japanese *odori ebi*, 'dancing shrimp', *Pandalus borealis*; and Chinese 'drunken shrimp'; but, although they are live, they are often served stunned and non-moving. We could also mention Japanese *ikizukuri* and Taiwanese *Ying Yang* fish.

But these are all 'fancy restaurant' things, quite a bit different than the general hunter-and-gatherer's grabbing up some termites and popping them into her mouth, or finding a good-sized spider or beetle and chomping into it. For about eighty percent of the world, insects and arachnids are still a part of 'common-folk' cuisine; for example, ants in traditional mole sauces, termites in the African Kalahari area, or locusts in Arabia. Yet insects or arachnids still haven't appeared as the 'secret ingredient' on *Iron Chef*, or as a challenge item on *Top Chef*. As Tom Turpin, of Purdue University's Entomology department points out,[11] shrimp, lobsters, and crabs, like insects and arachnids, are also crustaceans; these items turn up frequently on such shows. Turpin laments that the gourmet attitude seems to be 'that if the creature lives in the sea it is edible, but if it lives on the land it is not'.

Tangentially, regarding the question of why we eat certain things, this also brings up the matter of eating things – such as worms, bugs, or spiders – for fun or on a dare. This also relates to such things as the Purdue Bug Bowl's Cricket Spitting Contest,[12] at which many

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[11] http://www.agriculture.purdue.edu/agcomm/newscolumns/archives/OSL/1994/January/011394OSL.html.

[12] http://extension.entm.purdue.edu/bugbowl/events.html.

(non-live, freeze-dried) crickets are unintentionally – or intentionally – consumed.

And, of course, from here we can consider the whole realm of aphrodisiacs, from absinthe to species of *Zygophyllum* and beyond.[13] In terms of what we are looking at here, aphrodisiacs are an interesting group of items: With some, the intent is to provide pleasure via the flavour, which is then expected to be extended into erotic pleasure. With others, such as certain chilies, the intent is oral pain, or pain to the genitals or other body parts. Yet for others, the focus is mainly visual and tactile play, via the item's similarity to a penis, vulva, breast(s), or other body part(s). While there are very specific recipes for the precise preparation of many aphrodisiacs, the resulting flavour of the product might be insipid, horrendous, or nauseating – but that's not the point.

FLAVOUR-RELATED SYNAESTHESIAE

Synaesthesia[14] is the general name for two sets (or 'complexes') of over sixty related cognitive traits. In the first set, 'sensorial synaesthesiae', stimuli to one sense, such as smell, are involuntarily simultaneously perceived as if by one or more other senses, such as sight and/or hearing. For example, the sounds of musical instruments might make one see certain colours, each colour specific and consistent with the particular instrument playing. Or the taste of espresso coffee could make one see a pool of dark green oily fluid about four feet away. One highly documented case of synaesthesia involved Michael Watson, 'the man who tasted shapes',[15] who synaesthetically felt at or within his right hand shapes and textures corresponding to different flavours – the flavour of spearmint, for example, felt like cool smooth glass columns.

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[13] See, e.g., R. Stark, *The Book of Aphrodisiacs* (New York: Stein and Day, 1980).

[14] The word 'synaesthesia' comes directly from the Greek συν- (syn-) 'union', and α⊠σϑησις (aisthesis) 'sensation', thus meaning something akin to 'a union of the senses'. 'Synaesthesia' is the British English spelling of the word; in American English, it is often spelled 'synesthesia', without the first 'a'. Both the American and British plural forms end with an 'e'.

With the second group of synaesthesiae, which some call 'ordinal sequence' and 'spatial sequence' synaesthesiae, certain sets of things which individual cultures teach us to put together and categorize (and also usually serialize) in some specific way – like letters, numbers, or people's names – also evoke some kind of sensory addition, such as a smell, colour or flavour. The most common forms of ordinal sequence synaesthesiae involve such things as coloured written letter characters (graphemes), numbers, time units, and musical notes or keys. For example, the synaesthete might see, about a foot or two before her, different colours for different spoken vowel and consonant sounds, or perceive numbers and letters, whether conceptualized or before her in print, as coloured. A friend of mine always perceives the letter 'A' as pink, 'B' as blue, and 'C' as green, no matter what colour ink they are printed with.[16]

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[15] See R. Cytowic, *The Man who Tasted Shapes* (New York: Putnam, 1993).

Richard Cytowic posited diagnostic features of neurological synaesthesia;[17] synaesthesia is: involuntary and must be elicited; durable; and generic regarding its perceptions. The majority (somewhere around 80% -85%) of synaesthetes who 'see things' do so 'inside the head', as if the image is projected onto a screen or just 'in the mind's eye'. The 'screen' is usually located 'on the inside of the forehead' or 'in the eyes', although for some synaesthetes it may be at the top of the head or even in the back, at the base of the skull. Or, for those in this group, there is instead a 'feeling of the colour'; that is, for example, the sound of middle C on a piano 'feels' red.[18]

For those who do see things 'out there', the images may range from a half metre or less away to fifty metres or more, although most are around the one-half to three metre range. Members of this latter group of synaesthetes are currently commonly called 'projectors'.[19] It is possible for a multiple synaesthete to be both a projector of one or more types and a non-projector of other types, or even for a synaesthete to be both in regards to one type, varying between projecting and non-projecting with situations.

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[16] For more regarding the different types of synaesthesia, see S. Day, 'Some Demographic and Socio-cultural Aspects of Synesthesia', in L. Robertson, N. Sagiv, eds, *Synesthesia: Perspectives from Cognitive Neuroscience* (New York: Oxford University Press, 2005), 11-33; also http://home.comcast.net/~sean.day/html/types.html.

[17] See R. Cytowic, *Synesthesia: A Union of the Senses* (New York: Springer-Verlag, 1989); see also the second edition (Cambridge, Massachusetts: MIT Press, 2002), 67-70.

[18] See M. Dixon, *et al.*, 'Not All Synaesthetes are Created Equal: Projector versus Associator Synaesthetes', *Cognitive, Affective & Behavioral Neuroscience* 4, no. 3, 2004: 335-43.

'Durable' here means that the associations and relationships stay the same; this is also known as 'consistency'. For example, if the sound of a piano is sky-blue, it always has been and always will be that synaesthetic colour. 'Generic' primarily pertains to synaesthetically perceived visual shapes. The shapes are basic geometrics, like circles, triangles, curves, spirals, clouds, or blobs, rather than complex structures such as, say, Winston Churchill's face, the Notre Dame cathedral of Paris, or the Chicago skyline.

Currently, there are two main theories as to the cause of congenital synaesthesia: the cross-activation theory and disinhibited feedback theory. The cross-activation theory, previously often called the 'adjacency' theory, proposes that congenital synaesthesia emerges from cross-activation of adjacent regions of the brain. For example, a region of the brain involved in identifying graphemes lies adjacent to region V4 of the visual cortex, which handles colour processing; cross-activation might result in 'coloured letter' synaesthesia.[20] The cross-activation might be occurring due to atypical pruning of connections during infancy; that is, synaesthesia might be the result of neotenic retention[21] of neuronal connections. The disinhibited feedback theory, on the other hand, proposes that synaesthesia results from a reduction in the amount of inhibition along neural pathways.[22] The rate of feedback from association areas (e.g., the parietal lobe and limbic system) to primary sensory areas of the brain is usually regulated by a set balance of excitation and inhibition. However, if this rate were atypical due to developmental aberrance (genetic or epigenetic causes) or disrupted via drugs such as LSD or mescaline, synaesthesia might result. (I will note, though, regarding drug-induced synaesthesia, that while there are indeed cases both of flavour as the inducer [triggering sensation] for synaesthesia, and flavour as the concurrent [resulting synaesthetic perception], such occurrences are extremely rare, even in terms of the rarity of synaesthesia itself.) We need to keep in mind that the cross-activation and the disinhibited feedback theories are not mutually exclusive.

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[19] Ibid.

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[20] See e.g. V. Ramachandran, E. Hubbard, 'Synaesthesia: A Window into Perception, Thought and Language', *Journal of Consciousness Studies* 8, no. 12, 2001: 3-34; R. Cytowic, D. Eagleman, *Wednesday is Indigo Blue* (Cambridge and London: MIT Press, 2009).

[21] See S. Gould, *Ontogeny and Phylogeny* (Cambridge, MA: Belknap Press of Harvard, 1977).

[22] See P. Grossenbacher, C. Lovelace, 'Mechanisms of Synaesthesia: Cognitive and Physiological Constraints', *Trends in Cognitive Sciences* 5, no. 1, 2001: 36-41.

It should be pointed out that congenital synaesthetes do not get to choose their associations between things, and which things get associated with which has nothing to do with likes or dislikes, 'good' or 'bad' or any other emotional aspects. For example, I like the sound of French horns, but dislike the school bus yellow colour they synaesthetically evoke. I also like the sound of saxophones, and love the electric neon purple shapes they evoke. I dislike the flavour of certain colas, along with the synaesthetic colours produced. That is, likes may go with dislikes, or *vice versa*, or likes may go with other likes, etc. And this holds throughout the synaesthete's entire life.

One of the classic scenes of synaesthesia research occurred on 10 February 1980, as neurologist Richard E. Cytowic accompanied artist Michael Watson while the latter finished preparing dinner for a party.[23] Tasting a sauce for a roasted chicken, Watson suddenly declared, "Oh, dear [...] there aren't enough points on the chicken."[24] With some persuading, he went on to explain to Cytowic: "I know it sounds crazy, but I have this thing, see, where I taste by shape. [...] Flavors have shape, [...] I wanted the taste of this chicken to be a pointed shape, but it came out all round. [...]

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[23] See R. Cytowic, *Synesthesia.*

[24] Ibid., 3.

Well, I mean it's nearly spherical, [...] I can't serve this if it doesn't have points." Watson went on to state that he mainly felt things synaesthetically rubbing against his face or sitting in his hands. "When I taste something with an intense flavor [...] the feeling sweeps down my arm into my fingertips. I feel it – its weight, its texture. Whether it's warm or cold, everything. I feel it like I'm actually grasping something."[25]

Regarding 'flavour to touch' synaesthesia, the primary gustatory cortex, which is the first cortical area to be involved in taste, lies directly posterior to the somatosensory cortex (S1). If we consider the adjacency theory of synaesthesia causation, this could be a factor in why 'the man who tasted shapes' had such synaesthetic perceptions. This area also lies directly above the insular cortex, another area of multimodal convergence.

I myself have 'flavour to visual/spatial' synaesthesia; rather than being 'in the mind's eye', I 'project' my synaesthetic perceptions as coloured, textured geometrical forms to precise locations in front of me.[26] Other types of gustation-related synaesthesiae also exist, although they are extremely rare. One of these other types is 'musical sounds to flavour'. Sound is processed in the upper portion of the temporal lobe, taste in the lower portion; again, for the 'sound to flavour' synaesthete, there could be connections between these regions. The character Des Esseintes, in Huysmans's *À Rebours* ('Against Nature'), built a type of 'musical timbres to (liquor) flavours' keyboard, with which, for example, the sound of a clarinet was equated with the 'sour' and 'velvety' taste of dry curaçao, the flute with mint and anisette. However, as stated in the story, this was not a display of any type of actual synaesthesia on the part of Des Esseintes but rather an attempt at synthesizing a new form of artistic expression.

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[25] Ibid., 4.

[26] A very preliminary 'work-in-progress' attempt to depict some of my synaesthetic perceptions for various flavours and smells may be seen at: http://home.comcast.net/~sean.day/sean-foods.htm.

A subscriber to the Synesthesia List[27] wrote to tell me:

> I've always had a connection between music and taste. I associate certain tastes in my mouth associated with particular instruments and notes. It is strongest when I listen to individual instruments and the clearer and less 'muddy' the pitch, the stronger the taste. Some examples: Violins taste like lemons. Cellos can be orange, or cherry if they play very low. Bass is cherry. Woodwinds tend to be 'herbal' – like mint or some kind of herbal tea.

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[27] The Synesthesia List is an international e-mail forum I have operated for the past eighteen years. Currently, it has over 660 members, from over 46 countries around the world. More than half of these are synaesthetes, of many different types. Other members include neurologists, psychologists, medical doctors, linguists, musicians, and people from many other academic disciplines. The main language of the group is English, but other languages do appear from time to time.

An e-mail from a ‘touch to taste’ synaesthete reported:

> Peaches, when I touch them, taste nothing like peaches. There are many foods I don’t eat with my fingers because the synaesthetic taste produced by the texture of the object clashes so badly with the taste of the food itself. I also have the smoothest eating utensils I could buy so they don’t affect the taste of the food as much. Conversely, there are some foods (seasoned octopus salad, for instance) which I prefer to eat with my fingers because the synaesthetic taste enhances the taste of the food. Truth is, most things don’t ‘match’.

However, it is not just a matter of the feel of food items. Cameron La Follete wrote the following to me:

> I’m picky about which cats I pet, because, depending on the coarseness of their fur, I taste different things. The softest fur tastes of rich butterscotch pudding. A coarser fur tastes of sweetened oatmeal. My own cat is pretty good; he tastes of butterscotch, not so very rich, and mixed with some tapioca. [She added:] I’ve always liked flannel and silks best because of their tastes [...] The flannel skirt I’m wearing tastes of a rich pumpkin/squash soup. I hate washing flannel for the first time, because it causes the fabric to become less soft and the taste changes. I wear wool sweaters

> next to the skin, but they taste of meat and potato stew – heavy and filling and rather coarse, so I tend not to be very hungry when I am wearing them.

PHONEME TO FLAVOUR

A very interesting type of synaesthesia involves speech sounds or whole words evoking synaesthetic flavours.[28] Speech sounds for a given language are called the 'phonemes' of that language, so this type of synaesthesia is called 'phoneme to flavour' synaesthesia. If the word, as a whole unit, evokes the flavour, that's called 'lexeme to flavour'.[29] Now, here, we are not just talking about something like the word 'coffee' making you *think* of the flavour of coffee. We're talking about someone actually tasting the flavour, in their mouth, in high detail. (Keep in mind that, just as it is the brain that sees, and not the eyes, likewise it is the brain that constructs 'flavour', and not the tongue, nose, throat, and such.) But, furthermore, we're also talking about a word like 'confess' having the flavour of coffee, or the word 'microscope' evoking the flavour of carrots. Lexeme-to-flavour synaesthesia may be due to cross-activation or increased connectivity between an area in the anterior insula (lying below Broca's area) involved in speech perception and production and the adjacent primary gustatory area of the brain.[30]

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[28] One of the earliest – and perhaps the first – recorded case of such synaesthesia may be found in G. Ferrari, 'Una varieta nuova di sinestesia', *Rivista di Psicologia* 3, 1907: 297-317; see also G. Ferrari, 'Una nuovo caso di sinestesia uditivo-gustativa', *Rivista di Psicologia Applicata* 6, 1910: 101-4.

[29] See J. Ward, *et al.*, 'A Comparison of Lexical-Gustatory and Grapheme-Colour Synaesthesia', *Cognitive Neuropsychology* 22, no. 1, 2005: 28-41.

A friend of mine living in England, James Wannerton, has this type of synaesthesia. For James, certain specific speech sounds produce corresponding flavours in his mouth. The hard /g/ sound in the words 'argue' and 'begin', for example, produces the flavour of yoghurt; the combination of the /s/ and /p/ sounds in the words 'super' or 'peace' results in James tasting tomato soup. This happens to James whether he speaks the word, hears the word, reads it, or just thinks it.

This synaesthesia emerged in James when he was young, and was fully established and set before his mid-teens. Because of this, the flavours that he tastes for words are all from foods he ate as a young child; not flavour experiences he had later on as an adult. So, for example, he experiences synaesthetic flavours of candies he has not actually consumed since he was a teenager. This is an excellent example of how cultural factors may overlay the neurological underpinnings of synaesthesiae and shape their products.

The names of food items themselves will tend to taste like the food being named. Thus, for example, the word 'sausage' will taste like sausage. Then certain phonemes of that word will be taken, and those sounds

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30. Ibid.

will extend into other words. So, for example, the ‘J’ – /d_3/ – sound in ‘sausage’ also appears in the word ‘college’, making it also taste like sausage.

I decided to ask James what flavours the phrase ‘Culinary Institute of Charleston’ evoke. He replied:

> A thick slice of cucumber, a dash of semolina mixed with a thin type of bland flavoured meat of some description. The strongest flavour though is one I can only describe as sweaty, cheesy feet. Not the sort of thing I’d like to hear before breakfast!

So, what about the phrase ‘Trident Technical College’? James replied:

> This is okay. Semi-soggy Sugar Puffs, a metallic paint type of flavour, an odd, watery taste very much like the left-over vinegar you’d find in a pickled onion jar. Then the deal-breaker – a lovely, lingering flavour of a slightly cold sausage sandwich. [He added:] The way it ‘works’ for me is that I get taste after taste constantly. Some are weak, some strong. It’s the strong ones that cause problems for me as they tend to linger – a little like the afterglow when a halogen bulb is switched off. These lingering flavours mix with new ones. This sometimes tastes horrible!

'Phoneme to flavour' synaesthetes often also report aspects of texture and temperature as part of their synaesthetic experiences; that is, for example, the word 'rake' not only tastes like fried bacon, but it is crisp, oily and rather cold.[31] These sensations are felt on the tongue and in the mouth.

Unlike 'grapheme to colour' synaesthesia, in which, for example, the word 'red' might induce a synaesthetic perception of green – a phenomenon known as the 'alien colour effect'[32] – 'phoneme to flavour' synaesthesia apparently displays no such effects for the names of foods, such as the word 'bacon' tasting of spinach.[33] However, note that, contrariwise, with my own 'flavour to visual/spatial' synaesthesia, I cannot think of a particular instance which does *not* display the alien colour effect, even when the *name* of the food, in English, is a colour word. For example, 'oranges' and 'limes' produce synaesthetic shades of blue; turnip and salad 'greens' create shades of purple; 'white' and 'red' wines both make shades of blue; 'white sauce' and 'brown sauce' both produce shades of greyish puce and lavender; and egg 'whites' do not produce any colour. I do note that bleu cheese is a purplish-blue colour; however, that is because cheeses, and dairy products in general, are usually blue. The particular flavourings of bleu cheese push my resulting synaesthetic colour towards purple.

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[31] See ibid.

[32] J. Gray et al., 'Implications of Synaesthesia for Functionalism', *Journal of Consciousness Studies* 9 [2002]: 5-31.

[33] See Ward et al, 'A Comparison of Lexical-Gustatory and Grapheme-Colour Synaesthesia'.

James Wannerton wrote to members of the Synesthesia List:

> I [also] experience colour to taste synaesthesia. Red: liquid jam; the stuff you find at the top of jam jars that have been sitting for a while. Orange: oranges. Yellow: Opal Fruits (Starbursts). Green: wine gums. Blue: thick ink. Indigo: a taste of rubber mixed in with the kind of meat you find in meatloaf. Violet: powdery, slightly inky. I get tastes for most colours, although, unlike my word/taste synaesthesia, it doesn't seem to me to be as specific. For example, all shades of red give me the same taste, the strength altering depending on how 'primary' or bright the colour is. [...] Most of my colour tastes appear to be sweet or tarty, and texture plays a very important part in the process.

Wannerton also wrote the following to me in a personal message:

> Creating a virtual meal using just words is something I automatically do whenever I write or say anything. Every word has to pass through my own personal 'synthesaurus' before I commit it for posterity. It

gives writing an extra dimension for me although it does lengthen the creative process somewhat. Writing is the only occasion whereby I have some modicum of control over what I synaesthetically taste. While working as a freelance journalist back in 1998, I was asked to produce a full page feature on the possible cultural impact of changing from pounds sterling to the euro. I wrote the article as if it were a banquet: The intro consisted of *hors d'oeuvres* tasting words, the article body was the main course (I even managed to squeeze a sorbet in there as well) and the closing paragraphs were made up of sweet, dessert tasting words. This took me the best part of all night but I was immensely pleased with the final article. The thing that really appealed was the fact that no one else had any idea whatsoever!

The word 'dinner' itself actually has the taste and texture of the traditional English Sunday Roast but all mashed up together into a smooth puree kind of dish. 'Lunch' tastes of very thin ham slices and 'breakfast' tastes of crunchy bacon – the thin kind that you have all the time in the States. When people ask me about the 'worst' tasting word I've ever heard, I always default to 'cook', or even worse, 'cooking'. I'd never ever use those words unless forced to as I am now! Very, very strong – taste and texture of the horrible black, crunchy burnt bits you get around the top of pans. Yuk!

FLAVOUR TO COLOUR

As to causations for the specific correlations between foods and colours in my own synaesthesia, unfortunately I have not yet discovered much. I have conducted many experiments upon myself, but almost all would probably not pass current standards of scientific rigour; as to experiments conducted by others, I have only participated as a subject in about seven. About the only things found so far are good reasons to speculate that it is citric acid which produces the sky blue colour I see in all citric fruits I have tried so far; here, I have been tested, and citric acid alone in water will produce the same synaesthetic colour, the intensity of the perceived colour correlating with the intensity of the solution. Less certain is what might be producing the shades of blue I see for dairy products; it may be lactic acid, but this has not yet been adequately tested. Likewise, there is the frequent orange colour seen for fish and some other seafoods, and the shades of purple seen for many green, leafy vegetables; I have no clue yet regarding these, although, for the seafood, there might be early childhood cultural experiences involved. On the other hand, I now have reason to think that the shades of pink and purple I see for cucurbits might tie to one or more chemicals found in most, rather than to a cultural connection with the pink flesh of watermelons.

But, again, we need to keep in mind that we cannot always just look towards a reductionistic neurochemical answer to this question. Keep in mind, for example, that James Wannerton's synaesthetic flavours for phonemes are culture-based: they are only food flavours from his childhood, and for example, the flavour of bacon turns up not only in the word 'bacon' but also specifically in certain other words with the same /k/ sound in a similar phonetic environment.

However, also note that Wannerton's synaesthesia operates here a bit differently to my own: For Wannerton, with his 'phoneme to flavour' synaesthesia, all of the correspondences were shaped during childhood. While new words might be encountered, the underlying phonemes remain the same, and connect to the same flavours established during his teen years. For me, on the other hand, with my 'flavour to visual/spatial' synaesthesia, even now at the age of forty-eight I can still encounter new flavours, and, with them, new, unique synaesthetic colour combinations.

My 'flavour to visual/spatial' synaesthesia does have a little bit of influence on my behaviour when shopping for food items. For example, dairy products produce shades of blue for me. The grocery stores here sell different types of milk in containers with different coloured labels and caps. I tend to most commonly buy '2%' milk. At one store I shop at, this comes in blue-labeled cartons; at another, 2% has a green label, and it is ‘skim’ milk which has the blue label. So, at the second store, I frequently find myself grabbing the blue carton, only to have to put it back and take a green one instead. I’ve examined my line of thinking, asking myself if it is just the case that I’m used to the blue label, so that is why I go after it. But no; that’s not how it works. What goes through my head is not initially a matter of the label at all. Rather, it is ‘milk is blue’, so I am looking for blue milk. Thus, likewise, I will tend to focus on and often at least consider grabbing containers of sour cream, any type of cheese, or ice cream in blue containers, regardless of the brand or whether it is a flavour I really care for. I am more likely to focus on coffee if it is in dark green packaging; more likely to grab beef if it is in dark blue packaging, chicken if it is in sky blue, spinach if it is in purple. However, I do note that I don’t look for beer or wines, nor for orange juice, with blue labels or packaging.

CONCLUDING STATEMENTS

The culinary arts are rapidly expanding as they increasingly turn to incorporate the latest cutting edge science and technology. This can readily be seen with the current draw of new techniques emerging via chemistry and physics into Molecular Gastronomy.[34]

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[34] See, e.g., H. This, *Molecular Gastronomy* (New York: Columbia University Press, 2002/2006).

It is my sincere hope, however, that, in *addition* to this (emphatically as an addition; not as a replacement), attention may also be turned to the latest cutting edge findings from the neurosciences, including psychopharmacology. Consider, for example, that, from research on macaques, there is implication that the posterior area of the orbitofrontal cortex is one of many places in the brain of humans and allo-primates which apparently acts to converge gustatory, olfactory and visual sensory data.[35] Not only are there neurons in this region found to respond to stimulation in each of the three modes but also (at least) bimodal neurons which respond to both taste and olfaction, or to taste and visual stimuli. I am looking to prominent figures in the culinary arts to be on the forefront of leading what I hope will be a revolution resulting in a drastic paradigm shift of our model of the human sensoria, bringing in new, experimentally-supported concepts of the integration and interactions of sensory modalities, and incorporating the current 'embodiment' approach that 'the mind' – and thus 'the senses' – have components in interplay throughout the entire body, and not just within the skull.

Investigations into the effects of LSD, ayahuasca, and other drugs have given us indications that the disinhibited feedback theory of synaesthesia causation

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35. E. Rolls, L. Baylis, 'Gustatory, Olfactory, and Visual Convergence within the Primate Orbitofrontal Cortex', *Journal of Neuroscience* 14, no. 9, Sept. 1994: 5437-52.

has merit; this is further supported by research on synaesthetes involving amyl nitrite,[36] hormones such as melatonin and effects on serotonin receptors[37] (which has expanded to also looking at SSRIs such as Prozac), but also on such 'basics' as alcohol, aspirin, caffeine, and codeine. Added to this, studies on altered states of consciousness (ASCs) indicate that virtually all people – congenital synaesthetes and non-synaesthetes alike – experience synaesthesia at least four or five times per year, while entering into, within, or emerging from an ASC; most frequently, this is during hypnagogic stages. The implication here is that virtually all people – congenital synaesthetes and non-synaesthetes alike – can and do experience synaesthesia from time to time; and thus 'food'-induced synaesthesia; and, from time to time, perhaps synaesthetic flavours. And this doesn't have to be via, say, the addition of harmine to your beef stock. Instead, it could result from the proper mixture of chilies, fruits and roasted ants in a mole sauce. Or even just getting the right wine and cheese combination.

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36. See R. Cytowic, *Synesthesia;* Eagleman, *Wednesday is Indigo Blue.*

37. See D. Brang, V. Ramachandran, 'Psychopharmacology of Synesthesia; The Role of Serotonin S2a Receptor Activation', *Medical Hypotheses* 70, no.4, 2008: 903-4.

SYNAESTHETES' COOKBOOK

I gained a certain notoriety in the Netherlands[38] for my synaesthesia-based recipe for grilled chicken topped with ice cream and orange sauce, which prefaces this text.

This recipe, which I have prepared many times for myself and at least three times for others, is an exercise in subtlety and extreme precision for me. Every ingredient except the brown sugar synaesthetically produces a shade of light cyan blue[39] for me; but each shade just so slightly different! There are also differences in the appearance of texture or viscosity for what I synaesthetically see for these flavours: for the chicken, the texture is like ceramic tiling with a slightly oily sheen (the skin and fat of the chicken are essential here); ice cream produces a texture of thick latex paint; vanilla, of a thin oil-based paint, such as used for painting plastic model airplanes; oranges and lemons, the inside white flakey part of a lemon peel; beer, watery milk; red wine, whipping cream. Note again that all of these are of almost –but not exactly – the same shade of sky blue. The brown sugar adds just the faintest trace of faint light grey with a lavender tinge. I could use pumpkin (pie) flavoured ice cream instead of vanilla, and this would add a light lavender instead of the sky blue of vanilla. Putting together this recipe is like composing a Maxfield Parrish painting, with one shade and texture of blue carefully and exactly blending into the next.

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[38] See *Red Mondays and Gemstone Jalapeños*, directed by J. Fowler, for the Research Channel, http://www.youtube.com/watch?v=6vs-ez62DVc.

[39] Around RGB 180, 255, 255.

So, here, a recipe is totally personal, verging on the creation of visual art; the resulting flavour combination is a spandrel – quite secondary. However, I do actually enjoy the flavour very much. This recipe was recently revived as a classroom discussion topic by Dr. Romke Rouw, of the University of Amsterdam's Department of Psychology.

Finally, James Wannerton proposes the following set of 'phoneme to flavour' recipes:

> "Bicycle parts are usually small." This sentence contains words that create a lovely taste of breakfast. Rice Krispies, covered in sugar and doused in milk, not cold milk but not warm either. Crunchy in part but on the whole, slightly soggy in texture.
>
> Asking someone called Debbie (doughy bread) if she's noticed (salad leaves and sticks) that Thomas (tomato slices) is a popular name for boys this year, would summon up the perfect hors d'oeuvres salad dish.
>
> My companions for the main course would ideally have the names Ian (lamb), Colin (cauliflower), Hilary (sliced potatoes) and Stephanie (sage & onion balls). With someone called Stockard pouring the gravy.

Pudding could be: Simon (sliced apple), query (single cream) with a dollop of Block (ice cream) and a France (thin wafers) or two. The cheese and biscuits would be best served by a waiter call Richard.

Coffee would be coffee!

Dear Nellie

Your sweet benificence of Bulbs I return as Flowers, with a bit of the swarthy Cake baked only in Domingo.

Lovingly,

Emily.

2 pounds Flour –
2 Sugar –
2 Butter –
19 Eggs –
5 pounds Raisins –
1 1/2 Currants –
1 1/2 Citron –
1/2 pint Brandy –
1/2 – Molasses –
2 Nutmegs –
5 teaspooons
    Cloves – Mace – Cinnamon –
    2 teaspoons Soda –

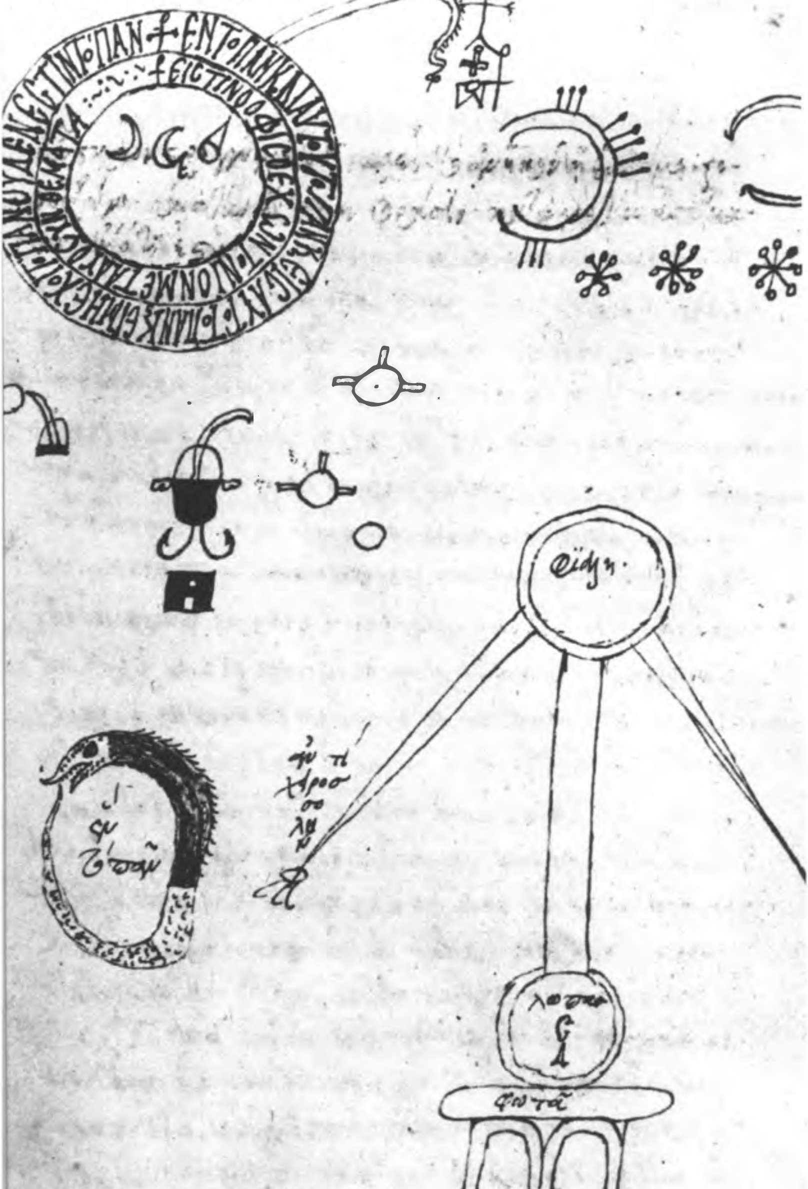
Beat Butter and Sugar together –
Add Eggs without beating – and beat the mixture again
Bake 2 1/2 or three hours, in Cake pans, or 5 to 6 hours in Milk pan, if full –

Black Cake (A Recipe from Emily Dickinson, for Emily Dickinson)

Jeremy Millar

Recipe taken from a letter to Mrs. J. Howard Sweetser from Emily Dickinson, summer 1883.
Card with embossed text, 100mm x 170mm,
Edition of 1000.

κλεοπάτρας χρυσοποιΐας


ΕΝ ΤΟ ΠΑΝ ΚΑΙ ΔΙ ΑΥΤΟΥ ΤΟ ΠΑΝ ΚΑΙ ΕΙΣ ΑΥΤΟ ΤΟ ΠΑΝ ΚΑΙ ΕΙ ΜΗ ΕΧΟΙ ΤΟ ΠΑΝ ΟΥΔΕΝ ΕΣΤΙΝ ΤΟ ΠΑΝ
ΕΙΣ ΕΣΤΙΝ Ο ΟΦΙΣ Ο ΕΧΩΝ ΤΟΝ ΙΟΝ ΜΕΤΑ ΔΥΟ ΣΥΝΘΕΜΑΤΑ
ἓν τὸ πᾶν
ἄνω τι χρυσοσωλην
θεῖον
λοπας
φῶτα

Ec[h]ology of the Désêtre

Dan Mellamphy and
Nandita Biswas Mellamphy

> *Though the logos is common to all, the many live as if they had a wisdom of their own.*
>
> **HERACLITUS**

> *under such flattering colour and repainting, the terrible original text* homo natura *must again be recognized*
>
> **NIETZSCHE**

The following is a work of geo-philosophy beyond the bounds of Friedrich Nietzsche (its 'founder' according to Deleuze and Guattari)[1] yet very much in the spirit of his Zarathustra: 'true to the earth'[2] and its 'terrible text'.[3] What is terrible about the terrible text that is true to the earth is that, with and in it, there is no *hors-texte*[4] – there is but one context to consider and to consume. With and in the context of planetary ecology, of a planet-wide ecosystem, everything is ecological – there is but one *logos*, one *logic*, one *world:* the geo-logical one. This accords with the statement of Nietzsche's great precursor, Heraclitus the Ephesian, that there is but one *logos*, hence no *dia-logoi.*[5]. Having no other context to consider or consume, no 'other' or 'outside' (or 'inside') as such, the planet turns upon and feasts upon itself, its own text, like the alchemical *ourobouros* or self-devouring serpent.[6] To envision ecology in this way is terrible indeed, for one cannot engage it dialectically, one cannot have a dialogue with it. It has only one language, one *logos:* that of the *ouroboros*, this worm, serpent or dragon (old English

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[1] G. Deleuze and F. Guattari, *Qu'est-ce que la philosophie?* (Paris: Éditions de Minuit, 1991), 82.

[2] F. Nietzsche, *Thus Spoke Zarathustra: A Book for All and None*, Prologue §3: 'I implore you, my brothers, remain true to the earth'.

[3] F. Nietzsche, *Beyond Good and Evil: Prelude to a Philosophy of the Future*, §230.

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[4] J. Derrida, *De la grammatologie* (Paris: Éditions de Minuit, 1967), 227. 'There is nothing outside of the text'/ 'there is no outside-text' (trans. Gayatri Chakravorty Spivak, Baltimore: Johns Hopkins University Press, 1976), 158.

[5] Hērákleitos ho Ephésios, via Sextus Empiricus, *Adversus Mathematicos* §7 §§132-3.

[6] *Al khem*, the black or fertile earth, that compost which the Greeks called *chthonos* and the Romans *humus* (root of all things *human*), is the etymological origin of alchemy and current-day chemistry. The Greek *ouroboros*, the self-consuming serpent (*ουρά-βόρος*, 'tail-devourer'), is an emblem of alchemical transmutation and of transmutation's mysterious reticulation (*mysterium coniunctionis*) as Carl Jung states in his *Mysterium Coniunctionis*, ¶513: 'within the age -old image of the ouroboros lies the thought of devouring oneself and turning oneself into a circulatory process'; the ouroboros symbolizes the 'feedback process' in which the supposed 'clash of opposites' turns out – or turns *in* – to be naught but the knot of 'the One' primal *logos*, the alchemical matrix, its transductive *prima materia* (Princeton: Princeton UP, 1970), 365.

wyrm).[7] Just as the worm translates all things back into black earth (*al khem*), Nietzsche suggests that to be true to the earth is to be retranslated and to retranslate things back into the 'terrible ground-text of *homo natura*', their vermicular black-earth b[l]ackground.[8]

The *melanosis* (Latin *nigredo*) of a dark night's 'pitch black', the *leukosis* (Latin *albedo*) of a white cloud's 'silver sheen' and the *erythrosis* (Latin *rubedo*) of the fiery sun's 'golden blaze' are the classical stages of the alchemical / metamorphic / morphogenic process. Like Mandelbrot's fractals, each of these 'stages' is in addition a recursion of the entire process – the *melanotic*, *leukotic* and *erythrotic* stages each in turn unfolding their respective *melanotic*, *leukotic* and *erythrotic* phases (these, of course, *in turn* recursing – i.e. being further recursions again). The process infolds and enfolds itself, subsumes and consumes its unfolding. Hence, indeed, what could be called the heraldric hieroglyph of 'the great work' as such: namely the drakon *ouroboros*, the ouroboric *drakontos*. This cosmic and chaotic dragon, like the fiery phoenix, suspires and expires in an autotelic *ekpyrosis:* its consuming conflagration ultimately eclipses and envelops its own ipseity.

Literally an unending, undulating, serpentine 'devourer', the Alchemists' *ouroboros*, the all-devouring dragon, embodies the entelechy of alchemy, the golden goal of which points back to black – back to the beginning and foundation (the b[l]ackground) of all things. The beginning and foundation (the b[l]ackground) is in this sense not the past; it presents itself (paradoxically perhaps) as that which is *forthcoming* – that which is always *comingforth* – and yet, strange as it may seem, as that which 'comes forth' *backward.*

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[7] http://www.etymonline.com/index.php?term=worm

[8] Nietzsche, *Beyond Good and Evil*, §230: 'under such flattering colour and repainting, the terrible original text *homo natura* must again be recognized'.

The all-consuming, hence self-consuming, cycle or 'vicious circle' of ourobouros is moreover the feedback loop or cybernetic circuit of every existing thing ('good' or 'bad'), of 'existence' as such. From this alchemi-cybernetic perspective each and every existent thing turns out to be a coil or short-circuit (measurable in time and in space, hence chronotopological) in and of this ontological *ouroboros* (the latter chronotopologically *immeasurable* by dint of its 'deviations', although accorded the immeasure of an *aion:* the range of an 'epoch', 'era' or 'age'). The ontological dragon, or *drakontos* as such, is in this respect what Nietzsche called the *Wille zur Macht:* the *will to power* which infuses and suffuses existent things. Every thing is, from this perspective, an agent and *agencement* (i.e. an arrangement) of this more monstrous 'will', whether aware of it or not.

This is a *hideous gnosis*. The *hisda* here is in point of fact a *horror vacui*, a fear of the void and of being voided, of being devoid of self-will and of one's self as such.

So what could a mathesis of this horrific gnosis consist in? The void inscribed in the *ouroboros*-loop, the great *zero-summa* of the alchemists, is the very void that Giovanni Malfatti di Montereggio discerned in the first part of his *Studien über Anarchie und Hierarchie.*[9] Malfatti argued that 'numerical characters' – and indeed all characters – are 'nothing but [...] modifications of the elliptical zero qua hieroglyph of man and world'[10] and that this 'hieroglyph' (like the so-called alchemical or homeopathic 'signature' – the trace left behind after a substance has been diluted beyond any trace of itself[11] and thus the presence of an absence) is by nature *obscure*, *occluded*, *occult.*[12]

Malfatti expressed the matter via the decade which the Pythagoreans understood in terms of a tetract (since 1 + 2 +3 + 4 = 10)[13] and figured in the form of a tightly-knit triangle (its most compact arrangement).[14] Malfatti suggested in his study that the *tetractys* (i.e. the *mathesis universalis*) should be taken, like the drakon *ouroboros*, to be *coiled* rather than angled, thus more *circular* than angular, with *curves* instead of edges: hence in the end, from the very beginning, *ovoid*, *ellipsoid*.[15] Everything that counts and can be accounted, every individual existent as such, has as pre-individual quantum this mystical matrix symbolically expressed as an ovoid (that is, a triangle the angles of which are oblique). As *mathesis universalis*, this ovoid *tetractys* has a universality that, for all of its computational complicity, must nevertheless be distinguished from its various versions or actual aspects as an existence

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[9] See **Collapse** III.

[10] Giovanni Malfatti di Montereggio (Jean Malfatti de Montereggio), *Études sur la Mathèse, ou Anarchie et Hiérarchie de la Science* (trans. Christien Ostrowski, intro. Gilles Deleuze, Paris: Éditions du Griffon d'Or, 1946), 11.

[11] The Paracelsian physician Christian Friedrich Samuel Hahnemann suggested in his 1796 *Versuch über einNeues Prinzip zur Auffindungder Heilkräfte der Arzneisubstanzen, Nebst Einigen Blicken auf die Bisherigen* (his *Essay on a New Principle for Ascertaining the Curative Powers of Drugs*) that active, activated, or 'succussed' dilutions exponentially increase the homeopathic (i.e. curative) 'force' of subtances, and that the greatest homeopathic force is reached precisely at the point when the succussed dilution no longer contains any trace of the diluted matter; this is the point of both greatest or maximal dilution and force. At the point of total dilution all that remains of a subtsance is its force or energy 'signature'.

[12] *Phusis kruptesthai philiei:* 'nature loves to hide', wrote Heraclitus (Fragment 123).

[13] Pythagoreans claimed that *all numbers* and thus *everything that counts*

(and/or can be *accounted* for) exist[s] within the parameters of the founding and grounding decade (the *tetractys* of 1+2+3+4 or 10) since every number after 10 is but a repetition of this first and fundamental set (*1, 2, 3, 4, 5, 6, 7, 8, 9, 10* followed as they are by [1]*1,* [1]*2,* [1]*3,* [1]*4,* [1]*5,* [1]*6,* [1]*7,* [1]*8,* [1]*9* and so on). See the following footnote.

[14] 'The kernel of Pythagorean wisdom is the *tetractys* or 'four-group' made up of the numbers 1, 2, 3, 4, which add up to 10. They are represented in a pebble figure, in the form of the "perfect triangle",

1 1
2 2 3
3 4 5 6
4 7 8 9 10,

and the available sources, from Posidonius on, show how these four numbers contain not only the basic intervals – fourth, fifth, octave, and double octave – but also, according to the Platonic pattern: point, line, plane, and solid,' explains Walter Burkert in *Lore and Science in Ancient Pythagoreanism*, trans. Edwin Minar (Cambridge: Harvard University Press, 1972), 72.

[15] Giovanni Malfatti di Montereggio (Jean Malfatti de Montereggio), *Études sur la Mathèse, ou Anarchie et Hiérarchie de la Science* (trans. Christien Ostrowski, intro. Gilles Deleuze, Paris: Éditions du Griffon d'Or, 1946), 7. See **COLLAPSE III**.

prior to, subtly sustaining, and eventually consuming its various existents, its distinctive *numbers*, *figures* and *forms*.

The ouroboric zero described by Malfatti seems utterly empty, devoid of content. 'The metaphysico-mathematical zero seems to us to be null, to be nothing, whereas, on the contrary, it is everything':[16] the metaphysico-mathematical void, far from simply being devoid, is the very *mater* and *pater panton*,[17] the very engine of ontogenesis. This ontogenetic and autoconsumptive *kybernetes* qua cybernetic feedback-loop finds its echo, after Malfatti, in the Deleuzo-Guattarian *corps sans organes*[18] and Simondonian *centre actif initial*[19] – the latter also called *l'unité magique primitive*,[20] *ontos* of the universal cybernetic (Simondon's *cybernétique universelle*).[21] Its circuit is a circuit always in formation, a *dromology* the *logos* of which is (like the *logos* of Heraclitus and the Pythagorean *tetractys*) both *pagan aenaou* and *panta chorei*, ever-flowing and always-in-motion

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[16] Malfatti, *Études sur la Mathèse*, 11.

[17] *Polemos pater panton:* 'War [is the] father [of] all' wrote Heraclitus (Fragment 53).

[18] The now-all-too-[in]famous concept first formulated in the late 1940s by Antonin Artaud and later developed in 1969, 1974 and 1980 by Félix Guattari and Gilles Deleuze.

[19] G. Simondon, *Du Mode d'Existence des Objets Techniques* (Paris: Éditions Aubier, 1958), 159-160.

[20] Ibid.

[21] G. Simondon, *L'Individuation à la Lumière des Notions de Forme et d'Information* (Grenoble: Éditions Jérôme Millon, 2005), 561.

(dromological).[22] It 'consists, abstractly but really, in relations of speed and slowness between unformed elements,' explained Deleuze and Guattari in *A Thousand Plateaus;*[23] it is a void ovoid in and through which events, happenings, haecceities, differentiate themselves schizologically (that is, via schizogenesis, Simondonian *dédoublement*).

At this level – degree zero or zero intensity[24] – 'we discover nothing more than spatio-temporal dynamisms, that is to say agitations of space, holes of time, pure syntheses of *space*, *direction* and *rhythm*,' as Deleuze explains. 'The most general characteristics of branching, order and class, right on up to generic specifications, already depend on such dynamisms', he continues; for example, 'beneath the partitioning phenomena of cellular division we again find instances of [this] dynamism: cellular migrations, foldings, invaginations, stretchings' – 'these constitute,' he argues, something along the lines of 'a "dynamics of the egg",' and 'in this sense the whole world is an egg'[25] precisely in the sense the Dogons (here Dragons) held.[26] But the Dragon itself *is* this Dogon egg, this ovum – for the drakon *ouroboros* is the oosphere or field of operation defined by Deleuze and Guattari as that 'milieu of pure intensity' which could be called the veritable *ground zero* and b[l]ackground (*al khem*) of all production.[27] What is important is to understand that this *drakontos*, *tetractys*, or alchemical *kybernetes* 'is not regressive': that 'on the contrary, it is perfectly contemporary', since it is the field of every operation. All that can and does take place does so as metastatic calcinations, metastable calculations, toxic contractions from the occluded tetract (i.e. the occulted *drakontos*, *tetractys*, *kybernetes*). Every existent or potentially existent thing can and does exist, in this respect, as a recoiling or contracting from the coils of the drakontological *tetractys* qua ouroboric *matrix*, as if recoiling and contracting-in-fear from the terrifying plenitude of the void.

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[22] *Legei pou Herakleitos hoti 'panta chorei kai ouden menei', kai potamou rhoei apeikazon ta onta legei hos 'dis es ton auton potamon ouk an embaies':* 'Heraclitus is supposed to say that 'all things are in motion and nothing at rest', and he compares them [i.e. 'all things'] to the stream of a river, and says that you cannot go into the same water twice' (Plato, *Cratylus* 402a). 'It is frequently mentioned that the Pythagoreans, in their oath by the *tetractys*, called it the 'fount and root of ever-flowing nature': *pagan aenaou phuseos rhizoma t'ekhousan*' (Hippolytus Romanus, *Philosophumena* I,§2:555, quoted in Walter Burkert, *Lore and Science in Ancient Pythagoreanism*, trans. Edwin Minar, Cambridge: Harvard University Press, 1972, 72).

[23] G. Deleuze and F. Guattari, *A Thousand Plateaus*, trans. B. Massumi (Minneapolis: University of Minnesota Press, 1987), 507.

[24] Ibid., 164.

In Book One of *Dune*, a Hippasus-figure from the 'Bene Gesserit' society of sorceress-pharmatechnicians becomes what she is by becoming poison, by ingesting the matter that is precisely what's the matter with her.

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[25] G. Deleuze, *Desert Islands and Other Texts 1953-1974*, ed. David Lapoujade, trans. M. Toarmina (New York: Semiotexte, 2004), 96.

[26] Hence the diagram of 'The Dogon Egg and the Distribution of Intensities' that illustrates the relevant section of *A Thousand Plateaus*.

[27] Deleuze and Guattari, *A Thousand Plateaus*, 164.

"'This is a drug,'' she said to herself upon ingesting the poison, but a drug 'unlike any other drug of her experience, and Bene Gesserit training included the taste of many drugs.'[28] Ingesting the drug, she experienced what William Burroughs famously called (via a concise Kerouacian gloss) the event of a 'naked lunch': that frozen moment when one sees what is there at either end of one's fork ('a psycho-kinesthetic extension of herself'): 'all this was happening in a frozen instant of time', she noted; a frozen instant when she 'confronted [...] a pit of blackness' and 'whirling silence' at her 'core'.[29] 'That is the place where we cannot look,' she thought – the placeless, ever-displaced 'place' that is always out of time, hence timeless.[30] Placeless, this place was neither (strictly speaking) within her nor without her, or at once (intimately and timelessly) within and without her: a 'danger boiling around her', 'within' her (as and at the 'cellular core': that 'pit of blackness from which she recoiled').[31]

This impersonal and/or prepersonal 'pit' of autochthonic, alchemical 'blackness' whirled in melanotic motion as the engine of her actual individuation, and in her individual recoil from it she initially mistook it – this pit of blackness, this *melanosis*, this whirling void – for the poison. 'I could change it,' she thought; 'I could take away the drug-action and make it harmless.'[32] But in the midst of *melanosis*, in the midst of this self-overcoming, 'she sensed this would be an error': she intuited in this instance (if only vaguely, ill-seen and ill-said) that she herself, as an individuated existent, might be the poison, rather than *it*, this *pit*, this melanotic *motor*, this ever-whirling *engine* or dromological *dragon* of ongoing individuation. Her action, her 'being', is itself 'the drug action': existent being, being at odds with the pre-individualized hence non-existent existence (understood as cosmogenic 'chaos', or in the words of Deleuze and Guattari via *Finnegans Wake*, a veritable 'chaosmos', *chaosmogenesis*), makes the entire *ouroboros* or *chaosmos* heave, expulsing it as indigestible.

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[28] F. Herbert, Dune I: *Dune* (Philadelphia: Chilton Book Company, 1965), 283.

[29] Ibid.

[30] Ibid., 283. It is 'always out of time, hence timeless' perhaps because it the very becoming of time – the *maha kāla* of Vedic philosophy. The Sanskrit *kāla* also designates darkness: the darkness of the aforementioned pitch-black pit, above.

[31] Ibid., 283.

What the desert ecologist Liet Kynes described as 'ecological literacy' in *Dune*[33] and what Leto Atreides described as 'the eco-language of Dune'[34] is what Nietzsche in his *Prelude to a Philosophy of the Future* described as an ecological or physiological translation (a translation back into *phusis* or nature). 'To translate man back into nature,' back into 'that eternal basic text of *homo natura*,' is 'a strange and insane task, but it is a task [nonetheless]':[35] the task of the one who is *attuned* to, and indeed an *echo* of, the earth. It is the ec[h]ological work. 'I beseech you, my brothers, remain faithful to the earth,' pleads Zarathustra.[36] The logic or *logos* of the ecologist is not that of the egological operative: its vernacular is instead *vermicular*, an unspoken and unspeakable *wormtongue*, the *logos alogos* of *earthworms*, which drags us back to the serpentine *dragon*. It is the language of egos drawn back into the dust, mixed into the mud, sunk into the sand from which they had distinguished themselves as environmentally indigestible existents. 'To exist is to stand out, away from the background [...] existence,'[37] Atreides preaches; hence the background existence or milieu as such is affirmed when the foregrounded existent is translated, ingested and amalgamated into its alchemical context, its *drakontos*. Existents, for the ecologist and/or Nietzschean-Atreidian physiologist, are read in the context of their ultimate collapse, their eternal return to the earth (*alkhem*); the ecophysiologist thus calls-forth the chthonic dragon, the serpentine destroyer and phoenix-like renewer.

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[32] Ibid., 286.

[33] Ibid., 218.

[34] F. Herbert, Dune III: *Children of Dune* (New York: Ace Books, 1976), 267.

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[35] F. Nietzsche, *Beyond Good and Evil*, §230.

[36] F. Nietzsche, *Thus Spoke Zarathustra: A Book for All and None*, 'Prologue' §3

[37] F. Herbert, Dune III: *Children of Dune* (New York: Ace Books, 1976), 226-7.

From this ecophysiological perspective, beings are the pasigraphs of what 'must come to pass':[38] elements in a greater ouroboric hieroglyph. These elements are essential because they are ecologically instrumental in the face of the overwhelming *ouroboros* (i.e. *drakontos*): they are particular masks through which the otherwise inexpressible (i.e. that which otherwise would utterly overwhelm) is partially, pasigraphically, expressed. The particular is formed as a problem to be resolved: it is a problematic point or a crisis-point in ongoing ouroboric ontogenesis, hence the signature as such of a poison. To stare at the serpent *ouroboros* is an endeavour that ends in blindness; blindness can be avoided and yet insight gained through techniques of ec[h]ology which read existent entities environmentally and their restricted economies within the purview of greater generality.

Such ec[h]ology is admittedly homeopathological: it re-inserts or re-inscribes particular poisons into the poisoned system from which they were concocted and thereafter decocted, decanted or recanted. Each poison is existentially expulsed in and as a crisis: expulsed until its signature, i.e. the structure of its poison, has been resolved. The ec[h]ologist assists in and attends to such a resolution so that the poison may be realized as such and re-integrated (i.e. re-ingested) into the general, overarching or underlying ouroboric system. Step one, then: recognize that existent things are poisons 'held in cellular bondage'.[39] Step two: rather than deny or work against such poisons, accept the poisons for what they are. Step three: assist in its formation, formulation, realization, so that the existent poison can become precisely what it is – namely, the signature of an environmental symptom (which 'stand[s] out, away from the background [...] existence,'[40] 'spinning in relative stability').[41] Step four: have this signature resign-and-thus-resolve-itself within its greater context ('mingle the waters' homeopathically, as the Bene Gesserit Jessica says).[42] 'This will permit you to harness any relative stability' or existent being as such[43] as an ec[h]ological instrument. 'Anything can be a tool,' the practitioner of *taqiyya*[44] and Bene Tleilax 'Bijaz' explained in the second book of *Dune* – anything that exists, including individual *people*, individual *phenomena*, even *poverty and war*;[45] and as Liet Kynes stated in the first book, 'to the working planetologist the most important tool is human beings ... Men and their works have been a disease on the surface of their planets' and 'nature tends to compensate for [such] diseases, to remove or encapsulate them, [then] to incorporate them into the system in her own way.'[46] The 'way' of the planet or of the ecological system is the 'way' of its echo the ecologist. The wordless language of the world, its *logos alogos*, is the language of alchemy, *al khem:* that of the earth. To speak this language is to break with words and with the world of words in order to engage that of its 'maker', the wor[l]dmaking worm, the open-mouthed ontological *ouroboros*. Words and worlds are 'worked out' from the belly of this beast: the great *drakontos*.

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[38] Ibid., 281.

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[39] Ibid., 32.

[40] Ibid., 226-7.

[41] Ibid., 251.

[42] Herbert, Dune I: *Dune*, 286; her son Paul would later likewise mingle time and space ouroborically and thereby also 'overrun himself' as well as 'los[e] his position in time' – or more precisely *loosen* (rather than *lose*) himself into it 'so that past and future and present mingled without distinction' (Ibid, 305).

[43] Herbert, Dune III: *Children of Dune*, 251.

[44] See R. Negarestani, 'The Militarization of Peace: Absence of Terror or the Terror of Absence', *Collapse* I, 53-91.

This beast, in some sense, is all belly: the *ouroboros* is the sovereign *stomachos*, the Greek *stoma* and its *Wille zur Macht*. *Stoma*, in Greek, designates any orifice, any opening, any aperture – most commonly a mouth.[47] The worm (or *wyrm:* 'serpent, dragon')[48] is one great mouth, one great stomach, one long oesophagos or cyclonic aperture. According to Georges Bataille, we approximate the worm, or become a kind of dragon, whenever we are overwhelmed and, open-mouthed, throw back our heads in horror and/or laughter and/or anguish and/or ecstasy: 'The overwhelmed individual throws back his head, frenetically stretching his neck in such a way that the mouth becomes, as much as possible, an extension of the spinal column, [...] as if explosive impulses had to spurt directly out of the body through the mouth in the form of screams'.[49] In the midst of being overwhelmed, a human is thus somehow sub- or super-human, hence a veritable über- and/or unter-menschliche Wurm, if only for a monstrous moment – one wherein the individual human is no longer demonstrable. In this condition, a condition at once pre- and post-human, the inhuman *logos alogos* that arises from within the depths of human being (as if inhumed, entombed or encapsulated[50] therein) attests to the beckoning- and ultimate becoming-*worm/stomachos/Shai-Hulud* of man. According to Frank Herbert, Wormsign is a sign of overcoming (i.e. an *Überwindung*), a sign of the coming ecophysiological 'overhuman' or 'overman' (i.e. the *Übermensch*), in *Dune*.

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[45] Herbert, Dune II: *Dune Messiah*, 210.

[46] Herbert, Dune I: *Dune*, 218, 220.

[47] http://www.etymonline.com/index.php?term=stoma

[48] http://www.etymonline.com/index.php?term=worm

Bataille and Herbert lead us into the *stomachos* or 'pit of blackness'[51] (i.e. the *maw*, the *mouth*, the yawning *chasm*) of a pitched battle which could indeed be called a veritable *estomachia:* a *stoma*-centric, *orifician* and ultimately *orphic* (nocturnal, pitch-black)[52] war. The second Leto Atreides, like the sequestered Hamid Parsani in Negarestani's *Cyclonopedia*, teaches his people 'how to turn the Earth into the coiling body of *Tiamat*,'[53] the colossal *Shai-Hulud;* this is his *mathesis*. The task is one of monstrous *melanosis: al deshret* as *al kemi*'s primary principle, desert-like 'wasting away' as the first phase of regeneration, recultivation. The seed planted in the black soil must decompose like one in the desert: the desert (*al deshret*) is in league, ec[h]ologically, with its oft-opposed fertile black soil, albeit only in the context of that 'chemistry of openness'[54] which acephalously opens onto[55] and is in this way radically open to *both ends* and *both beginnings*, enantiodromically – i.e. only in the space-time of the nemathetic earthworm, the ouroboric serpent, the all-consuming dragon, qua sovereign *stomachos* . The stomach is the kitchen – the crucible, curcurbit and cavity of culinary matters – through which transduction and transductive transmutation passes.

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[49] G. Bataille, 'Mouth' in *Visions of Excess*, trans. A. Stoekl (Minneapolis: University of Minnesota Press, 1985), 59.

[50] Herbert, Dune I: *Dune*, 220.

[51] Herbert, Dune I: *Dune*, 283.

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[52] Orphism, from the Greek *orph[n]e* and *orph[n]os*, designates that which operates under cover of night (i.e. in the dark, the pitch-black); see the entry from Henry Liddell and Robert Scott's *Greek-English Lexicon* available online via the *Perseus Project* on the Tufts University website: http://www.perseus.tufts.edu/hopper/morph?l=o%29%2Frfn-h&la=greek

[53] R. Negarestani, *Cyclonopedia: Complicity with Anonymous Materials* (Melbourne: Re.press, 2008), 50.

[54] R. Negarestani, 'A Good Meal', http://www.cold-me.net/text/meal.html.

[55] R. Negarestani, 'Acephalous Mouth', in *Channel 93: The Journal of Wounding and Wounds*, http://www.channel83.co.uk/articles/acephalous-mouth.php.

This is the 'hypothesis [that] must be hazarded'[56] according to Nietzsche: to perceive through the world's representation[s][57] (beyond 'the Berkeleyan and Schopenhauerian' senses)[58] the vast, intertwined, primitive and formative ('pre-form')[59] belly of a manifold beast,[60] to see in the interplay of moralizing subjects and mechanized objects the mathetic *melanosis* of an overarching or underlying *Wille zur Macht*. Understanding *will to power* in this way enables the inspired perception of existents as products of drakontological [in]digestion, of an ontogenic and ouroboric metabolism 'in which all organic functions, including self-regulation, assimilation, nutrition, secretion, and change of matter' form power constellations [*Machtkonstellationen*] which even in the face of their existent individualities are nevertheless 'contained in a mighty unity';[61] this is why Nietzsche states altogether ec[h]ologically that 'the world seen from within, the world defined and designated according to its 'intelligible character', would simply be *will to power*, and nothing else'.[62] This inspired vision discerns the *désêtre* within and without every *être* from the peculiar perspective of the so-called 'third eye'[63] or volcanic 'pineal eye'.[64] The open 'third eye' bears witness to the burning vision of 'the time of the stomach'[65] that churns and burns all it consumes in accordance with 'the eternal law of transformation.'[66] The *désêtre* as such is drakontological, homologous with the *drakontos;* the drakon *ouroboros* is its basic context, the 'eternal basic text' of its nature (or *phusis*) and 'the fundamental will of its spirit' (or *stoma*), as Nietzsche suggests in his 'Prelude to a Philosophy of the Future'.[67]

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[56] F. Nietzsche, *Beyond Good and Evil*, §36.

[57] i.e. through 'the great third eye which looks out into the world through the other two' as Nietzsche states in *Daybreak: Thoughts on the Prejudices of Morality*, §509.

[58] Nietzsche, *Beyond Good and Evil*, §36.

[59] Nietzsche, *Beyond Good and Evil*, §36.

[60] 'the spirit most resembles a *stomach*,' the *belly* of a beast, states Nietzsche in *Beyond Good and Evil*, §230.

[61] 'Everything still lies contained in a powerful unity' states Nietzsche in *Beyond Good and Evil*, §36.

Standing out as individual existent from this basic context, one who would be drakontological (i.e. its *homo logos*), one who would open this eye, is with respect to its ec[h]ology a *pharmakon:* an actual existent *poison*. The *pharmakon* is expelled (as the indigestible or the non-metabolizeable) from that ecophysiological *drakontos* which as sovereign *stomachos* consumes everything, hence it is expelled only to be re-ingested, expelled so that it can be decrypted and then re-absorbed, re-encrypted. Thus becoming-*désêtre* is an ec[h]ological endeavour, assisting in this decryption through the self-realization, self-description, and pharmacological re-translation of the existent *pharmakon* as such. And this act of re-translation or gradual re-ingestion, propelled by pharmacological self-realization, itself in fact propels the ecophysiological engine: the indigestible is the impetus, the inciter, of ongoing ouroboric progression. Each indigestible concrescence is in other words the basis for further propulsion (and for *phusis* as such) in so far and in as much as it 'figures itself out' and thereby resolves its pharmaco-ecophysiological equation. This strange or rather uncanny *mathesis* underpins the one Palimbasha presents in the third book of *Dune*, where the worm-work of Dune's *Übermensch* is described as a thoroughgoing *mathesis universalis*.[68] In Simondonian terms this would be a veritable *kybernetes universalis*[69] the guiding or governing principle of which could be called the permutational individuation of the metaphysico-mathematical zero.[70]

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[62] Nietzsche, *Beyond Good and Evil*, §36.

[63] F. Nietzsche, *Daybreak: Thoughts on the Prejudices of Morality*, §509.

[64] G. Bataille, *Visions of Excess*, 77-98.

[65] Frank Herbert, Dune IV: *God Emperor of Dune* (New York: Ace Books, 1984), 237.

[66] F. Nietzsche, *The Pre-Platonic Philosophers* (trans. G. Whitlock, Chicago: University of Illinois Press, 2001), 62-3.

[67] F. Nietzsche, *Beyond Good and Evil*, §230.

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[68] Herbert, Dune III: *Children of Dune*, 234.

[69] G. Simondon, *L'Individuation,* 561.

[70] Malfatti, *Études sur la Mathèse*, 8.

Ec[h]ological literacy or attunement to 'eco-language'[71] in this context means becoming the consummate nihilist, ec[h]ological work being a nihilistic unworking pursued to its furthest extremes. This is the work of Nietzsche's 'great' rather than 'petty' politics[72] and 'great' rather than 'particular' health[73] – these designating nothing other than the grand operation by which man overcomes nihilism through the affirmation of its most extreme and radical form (*viz.* eternal recurrence). The 'great politics' of total affirmation proceeds by way of an ongoing double-crossing and betrayal of existents. The twist, of course (or the cyclonic twist-*within*-the-twist), is that the trajectory of negativity and negation ('the most world-denying of all possible ways of thinking'[74]) leads ec[h]ologically to the affirmation of the eternity of all existence[75] which is nothing more and nothing less than the death of negativity – Nietzsche's post-nihilistic insight. The consummate nihilist annihilates to the point at which nihilism consumes itself, to the point of nihilism's

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[71] Herbert, Dune III: *Children of Dune*, 267.

[72] F. Nietzsche, *Beyond Good and Evil* §208.

[73] F. Nietzsche, *The Gay Science* §382, 346-7.

[74] F. Nietzsche, *Beyond Good and Evil* §56.

[75] This is what Nietzsche calls 'the ideal of the most high-spirited, alive and world-affirming' in *Beyond Good and Evil* §56, and what Levinas instead calls an absolute 'horror' in his early essay 'Il y a' (*Deucalion* 1, 1946, 141–154, in *Time and the Other*, trans. R. Cohen [Pittsburgh: Duquesne University Press, 1987], and in his *Existence and Existients*, trans. A. Lingis [The Hague: Martinus Nijhoff, 1978, republished in Pittsburgh: Duquesne University Press, 2001]).

annihilation, its ultimate ungrounding in and as the zero-ouroboros .

Alchemical (hence ec[h]ological) *melanosis* is *destruction-as-transduction:* it is a destruction that transduces ec[h]ological existence. But it also (as an echo) hastens the ec[h]ophysiological genesis of an entirely new constellation of forces. It is by way of its 'metaphysico-mathematical' unity[76] that utter destruction can in its transduction reticulate the very void it destructively engineers and engenders, thereby inaugurating another era, age, *aion* or *yuga*. Georges Bataille would call this a destruction of restricted economies that opens onto the general – in this case drakontological or ecophysiological – economy. The restricted opens onto the general, the individual onto the transidividual and transductive[77] or ultimately overhuman/*übermenschlich* economy. Great politics and great health are the transductive effects of drakontological digestion – the effects, in other words, of *Wille zur Macht* understood as an ouroboric and vermicular Will-to-power. Rather than egocentric and egological, their operative principle or *kymatik kybernetes* is instead *ecological* and *alchemical:* a politics of putrefaction, to paraphrase Negarestani[78] – a '*mathesis* and politics of decay.'[79] *Will to power* is therefore far from psychological in nature; it is in principle and process a *psychophagy* as opposed to a *psychology*, a 'force of violent destruction'[80] that ingests the individual – *all* individuals – and alchemically digests it or digests them. It is a process of *désêtrement* the *'désêtre'* of which is the *über*- and/or *unter-menschliche Wurm* that is the very hieroglyph of Nietzsche's *Übermensch* and the vehicle as such of a *volonté d'estomac*(*hia*).

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[76] Malfatti, *Études sur la Mathèse,* 11.

[77] G. Simondon, *Du Mode d'Existence des Objets Techniques* (Paris: Éditions Aubier, 1958), 248.

[78] R. Negarestani, 'Undercover Softness: An Introduction to the Architecture and Politics of Decay', Collapse VI, 379-430.

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[79] Ibid., 381.

[80] Nietzsche, *The Will to Power*, §23.

Spiritual Meat: Resurrection and Religious Horror in Bataille

Eugene Thacker

> *Let us eat and drink, for tomorrow we die.*
>
> *1 CORINTHIANS*

> *Each of us does nothing but carry a corpse about.*
>
> PHILO

> *Let me be the food of wild beasts through whom it is possible to attain God.*
>
> IGNATIUS OF ANTIOCH

RESURRECTION; OR, CANNIBALISM

In his treatise *The Resurrection of the Dead*, Athenagoras of Athens, the second-century Christian apologist, notes a number of perplexing problems in the Christian idea of resurrection. Like many Christian thinkers of the period, Athenagoras conceives of resurrection in material terms; resurrection for him implies the resurrection of the body, with all its parts intact. But this idea poses some basic questions. Knowing that bodies decompose and decay, how is it possible to 'raise up' a body at all, let alone a body that is 'incorruptible'? In response to the criticism that the resurrection of the dead is impossible, Athenagoras makes reference to the *fiat* of divine intervention. As he notes, 'that same power can reunite what is dissolved, and raise up what is prostrate, and restore the dead to life again, and put the corruptible into a state of incorruption'.[1] Furthermore, to this divine being will belong the capacity 'to separate this, I say, and unite it again with the proper members and parts of members, whether it has passed into some one of those animals, or into many, or thence into others, or, after being dissolved along with these, has been carried back again to the original elements ...'.[2]

But here Athenagoras runs into a problem. It is not only that the dead are dead, and cannot be made living again; it is that in resurrecting the body one is necessarily resurrecting the corpse, a corpse that could be in an advanced stage of decomposition, or worse, could have become food for beasts. Athenagoras summarizes the logic of his critics:

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[1] *The Treatise of Athenagoras on Resurrection of the Dead*, trans. M. Dods, G. Reith, and B.P. Pratten, in *The Ante-Nicene Christian Library, vol. II: The Writings of Justin Martyr and Athenagoras* (Edinburgh: T. & T. Clark, 1867), III, 427.

[2] Ibid.

> Since, then, bodies are thus consumed, and the members and parts composing them are broken up and distributed among a great multitude of animals, and by means of nutrition become incorporated with the bodies of those that are nourished by them, – in the first place, they say, their separation from these is impossible; and besides this, in the second place, they adduce another circumstance more difficult still. When animals of the kind suitable for human food, which have fed on the bodies of men, pass through their stomach, and become incorporated with the bodies of those who have partaken of them, it is an absolute necessity, they say, that the parts of the bodies of men which have served as nourishment to the animals which have partaken of them should pass into other bodies of men, since the animals which meanwhile have been nourished by them convey the nutriment derived from those by whom they were nourished into those men of whom they become the nutriment.[3]

Athenagoras must acknowledge that the resurrection of the body brings with it a number of paradoxes. First, while the body is subject to the temporal processes of aging, illness, and decay, the resurrected body is supposedly free from all these, and yet is still a body. Second, the doctrine of the resurrection of the dead says little about what kind of body is resurrected – in particular, how the resurrected body is related to the earthly, living, un-resurrected body. Is the resurrected body exactly identical to our own living bodies, and if so, at which point in our lives does our living body provide the avatar, as it were, for the resurrected body? Finally, Athenagoras notes several seemingly minor, though peculiar, objections raised against the resurrection doctrine, one of which deals with eating, metabolism, and excrement. Supposing that the earthly body of a dead person is allowed to decompose, its parts returning to the earth and the worms, and supposing that the earth then serves as soil for the growth of plants, and supposing that human beings then eat those plants, are we to assume that cannibalism – albeit an indirect cannibalism – has taken place? And if so, how can the resurrection of the body occur when the dead body has disintegrated so far as to be nearly impossible to re-assemble?

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[3] Ibid., IV, 427-8.

While he does not definitely answer all these objections, Athenagoras' problems remain more interesting than his solutions. In his discussion of resurrection, Athenagoras articulates two different processes: the process through which the matter of the corpse is broken down, transformed, and incorporated within non-living matter (including that of other living beings), and the process through which the dead are re-animated and re-assembled in a superlative, almost speculative afterlife. In this vertical, double articulation – the body rising up, the body sinking below – Athenagoras' treatise also traces a lateral articulation, one that describes the incessant and non-teleological transformation of matter, to the point where matter simply becomes identical with this incessant and non-teleological transformation. In short, Athenagoras' treatise happens upon a *culinary* transformation of matter that goes beyond the literal acts of eating, digestion, and metabolism, and tends to become a generalized principle of the world itself.

But in Athenagoras' treatise, this lateral articulation stands in a conflicted relationship to the vertical one. When the body becomes the decaying corpse, life is always in excess of itself – especially after life, where the processes of decay and disintegration carry on another type of life, whose endpoint, in so far as there can be said to be an endpoint, is the excess of matter as fertilization or as excrement. Put crudely, in such metabolic and metamorphic processes, *life is shit*. We die, and our decomposing bodies become prepared as food for worms, returning to their inorganic origins for which the boundary separating living and non-living no longer holds. Our bodies are broken down, bit by bit, where another, unhuman life carries on in excess of our bodies.

In the process of re-animation and re-assembling, life is not just death, but death manifest as the corpse, the living body become a cold, dead thing broken down into its material constituents. While it reaches ever greater heights as a perfected, spiritual life after life, it resists its own immateriality, remaining embodied, living, and even anatomized; and yet this same body is also reassembled from the basic elements of the earth, with which it has merged. In resurrection, *life is dirt*. We die, and our bodies are either buried or burned, in either case undergoing a reduction to an elemental materiality in which the boundary separating the organic from the inorganic no longer holds. Bodies become ash and dirt, we become atmospheric smoke and elementary particles.

Everything that happens in the life of resurrection happens outside of life – that is, after death. The living body must first become a corpse, so that it can enter the continuity of material transformations of decomposition and regeneration; likewise, the corpse must be disseminated into innumerable elementary particles, so that it can be re-embodied in the logical conundrum that is the resurrected life. What both of these processes have in common is a kind of life that bears little relation to any vitalist, organismic, or biocentrist concept of life. In both processes, the dead are transformed into the living, but a kind of living that requires the negation of life *by* life. In both processes, what is produced is not simply a renewed life, but a qualitatively different situation that can only be described in the language of paradox: the life that never changes, grows, or decays; the life that is always negating itself, always undergoing transformations.

As Athenagoras acknowledges, the critics of the resurrection doctrine have a hard time reconciling these two forms of life. It would seem that the life of the corpse would decompose the corpse to such an extent that it could no longer exist, or that it would become identical with the earth. In fact, the life of the corpse seems to be a direct threat to the life of resurrection; the more the life of the corpse breaks down the body into its constituent elements, the more implausible it seems that the body's parts can be re-assembled at the moment of resurrection.

Athenagoras' defence of resurrection rests, perhaps unsurprisingly, on a political theology of the miracle. Just as the Creation is an exceptional, miraculous act of the divine, so is resurrection a miraculous act, despite its apparent implausibility. In other words, Athenagoras' concern is to separate these two forms of life. The life of resurrection counteracts the life of the corpse, in spite of all that the life of the corpse does to render the corpse identical with all that is non-corpse (soil, roots, worms, etc.). That said, the life of resurrection nevertheless remains resolutely corporeal, rather than leading towards an ethereal, disembodied, spirituality.

At the extreme point of Athenagoras' problem is the life that is so perfect it is, in fact, death (the eternal life of resurrection), and the death that is so metamorphic that it is in excess of life, culminating in the pure excess of decomposition, fertilization, and regeneration. These two forms of life come together in a concept of material transformation that is 'culinary': The decaying corpse and the re-animated soul are two aspects of a more generalized culinary process through which the very materiality of the world is continually 'cooked' (and eaten).

THREE VARIATIONS ON THE CULINARY

Here it is necessary to make a few distinctions regarding this idea of the culinary. At one level, there is the culinary considered as cooking, where cooking entails a whole set of activities that have come to anthropologically define the human: the preparation of food; the techniques of transforming non-food materials into food for consumption; the human cultural practices of eating, be they social, religious, or leisure-based. Here cooking is *nourishment*, at all levels, from the biological to the cultural. Cooking-as-nourishment is regarded as an activity specific to humanity, a form of technics that separates the human from the animal, a cultural form that includes the aesthetics of taste, the expression of cultural difference, and the intertwining of culture and economy in global food production and consumption. In this register, cooking is indelibly – and exclusively – a human endeavour, a 'restricted' form of the culinary.

Cooking is, anthropologically speaking, the root of culture and the mirror of the human.

What would it mean to consider an unhuman cooking? Here we venture into a consideration of the culinary, not in a restricted, anthropic sense, but in a generalized sense. A generic cooking, a 'general' culinarism. Here cooking is not restricted within the ambit of human culture – but neither is it naïvely democratized by bestowing it on higher animals, primitive humans, or even aliens.[4] Instead, we can ask: What would it mean to consider cooking as an anonymous process of the world as such? Cooking would have to be considered as non-teleological, benefitting neither biological health, nor cultural representation, nor economic imperative. More importantly, this generalized cooking would bypass the well-worn metaphysical boundaries that define cooking in a restricted, anthropic sense: living/non-living, organic/inorganic, natural/artificial, human/animal, and so on. Perhaps this generalized cooking would be a way of thinking the world as a continual morphology of matter and energy, but indifferently to the instrumental wants and desires of 'cooking' in the restricted sense. This would be a generalized cooking as *transformation*. Cooking in this general sense is the horizon of political economy. The world is continually cooked, and this generic cooking comes to overlap nearly perfectly with a concept of impersonal, anonymous transformation.

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[4] That said, the 1962 Twilight Zone episode 'To Serve Man' (based on a Damon Knight short story) remains one the most acute critiques of anthropic notions of culinarism.

But even this notion, removed as it is from the anthropocentrism of cooking-as-nourishment, must still presume a basic dichotomy between stasis and change, between resource and product, between that-which-changes and that-which-is-changed. Thus cooking-as-transformation appears indebted to a metaphysics of generosity, of a flux and flow of matter and energy, of a dynamic continuum of transformation. But the question we pose here is whether there is a third sense of 'culinarism,' one that is critical of the notion of cooking-as-nourishment (and its anthropic conceits), but which also departs from the notion of cooking-as-transformation (with its over-reliance on the presentism of generosity).

What would an unhuman, anonymous cooking be like that is also non-teleological and non-generous? Athenagoras (and later, Bataille) already gives us a hint of this type of cooking in his two forms of life-negation: the gradient stretching from the decomposing corpse to the emptied soul, figures of life that must necessarily negate themselves, without simply destroying themselves. If this is a continual transformation, perhaps it is an indelibly tragic one, ultimately failing to hold all the particles together, ultimately flailing in the attempt to re-assemble them. Here cooking is nether nourishment nor transformation, but really cooking as *desolation*.

A desolate cooking involves processes of evacuation, elimination, emptying. The aim is neither to re-instate nourishment and the human imperative to recuperate and recycle, nor to rush headlong into a naturalized glorification of the flux and flow of the phenomenal world. In its desolate mode, a generalized culinarism would entail a shift from a philosophy of cooking (the hermeneutics of human taste and culture; what cooking means or signifies in its restricted register), to a cooking of philosophy – cooking-as-desolation understood as a movement towards the *indistinction* of everything that cooking-as-nourishment and even cooking-as-transformation would lay as the foundation for philosophy's hermeneutic imperative.

Resurrection brings together the strange materiality of the corpse with the equally strange, equally anonymous process of eating – in fact, resurrection is, in a sense, the point where they perfectly overlap. Whether it is in the bowels of the earth or in the specular forge of the heavens, there is, for Athenagoras, a life that continues after life. The question that he does not ask, or cannot ask, is whether these two types of life – the life of resurrection and the life of the corpse – are not so much in opposition to each other, as mutually convertible into one another. This is, however, a question that Georges Bataille does ask, and, to jump ahead a little, his response is that only a concept of life that is rooted in negation – that is always being 'cooked' – can reveal the ways in which resurrection is also decomposition, the way in which the corpse is also this anonymous, unhuman 'cooking.'

EATEN AND/OR DEAD

Resurrection entails all the promises of the perfected, yet still corporeal, life after life, but is undermined by the problems concerning the disintegration of the corpse and its integration with the earth. Here Athenagoras isolates a problem that is worth examining in greater detail: how can life be thought in such a way that it is not simply negated by death? Or, more simply: *what is the life that is not negated in death?*

Addressing this question means addressing the tendency in Western thought to regard the question of life as philosophically tethered to the question of being. This implies a positivity to the concept of life, either as a subset of being (life is that which presumes a minimal concept of being), or as superfluous to being (life as the becoming of being). This is one of the central questions in Bataille's work, particularly in his posthumously published text *Theory of Religion*. Bataille returns again and again to this idea of a negative concept of life – especially when life itself becomes indissociable from a certain degree zero of material transformations. And while Bataille was certainly no Christian apologist, works such as *Theory of Religion* do take up many of the issues raised by Patristic thinkers such as Athenagoras. The difference, however, is that for Bataille theology is really *atheology*, or theology without a head, mysticism without God, the divine without the spiritual. Bataille's question is, then, a variant of Athenagoras': *what is the life that is not negated in death, but that is itself negation?*

But what would it mean to think of life in terms of negation? It would have to be something different than the negation of life – as in, for example, the individuated death or perishing of the living being. Here life is simply a positive for death as a negative, the latter having no other value than as that which is the negation of life. But it would also have to be something different than life itself negating something else (whether for survival or preservation). In this quasi-Darwinian notion, life is only negative by virtue of its propensity for growth and consumption; one form of life negates other forms of life through its overcoming of life in general.

Bataille does sometimes think of life as being negated – his recurrent example of ritual sacrifice has at its core the negation of life, though for Bataille this act of life-negation takes place within a larger economy of forces, a solar economy based on prodigality. And Bataille does often speak of life in terms of excess – in fact, one of Bataille's ontological principles is that of excess, and in particular the excess of vital energy that, Bataille insists, governs the play of anonymous forces of the planet. Life is excess, but for Bataille life is only excess in so far as it is useless; it obtains what Bataille once called a 'unemployed negativity' at its core, an excess that can only be expended. The *negativity* of life is, for Bataille, not the *negation* of life (as death or perishing), and neither is it the growth, or prodigality, or agglomeration of life (in cycles of growth, decay, and growth).

To understand what life-negation is for Bataille, we have to look more closely at the arguments made in *Theory of Religion*. One of Bataille's insights here is that, metaphysically speaking, it is in religion that the highest and the lowest orders come into intimate contact with each other. This contact Bataille often calls 'continuity' (other terms he uses include 'intimacy' and 'immanence').[5] In continuity all distinctions are blurred, and individuation and differentiation give way before a vast, unhuman abyss Bataille calls 'immensity'.

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[5] Bataille's fairly consistent use of the term 'continuity' invites a closer examination of the relation between Bataillean 'continuity' and the mathematical 'continuum'. Bataille appears to favor a dynamic and excessive flux (as per his metaphor of animals existing "like water in water") that would seem roughly analogous to the non-empty, connected continuum in mathematical topology – though perhaps Bataille may have trouble with the mathematical apriori of geometric space over time (which his concept of 'expenditure' seems designed to overturn). Similarly, the continuum thesis in Cantorian set theory presents a rigorous and formalized description of mathematical infinity. We can imagine that Bataille may agree with its impetus – the articulation of an excess (a numerical excess) that cannot be counted – though one wonders if Bataille would have trouble with the notion that such un-countable excess can ever be fully circumscribed within the ambit of mathematical thought.

But we as human beings, living in a human world, rely on individuation and differentiation; we live, in Bataille's terms, in a world of discontinuity. Though rare and exceptional, there are practices or exercises by which we as human subjects are divested of our subjectivity and the self-world relation, and Bataille returns again and again to examples of this divestiture: in ritual sacrifice, in eroticism, in mystical ecstasy, in meditation or prayer, even in our interaction with useless objects, such as jewellery, bodily fluids, or poetry. As human subjects, however, we must always return to the discontinuous world, in which subject is distinguished from object, self from world, one person from another.

A central tenet in Bataille's philosophy of religion is that religion constitutes the search, within discontinuity, for an absent continuity. For Bataille, any comprehension of the significance of the religious impulse in human beings must necessarily begin at the level of the animal. Animals, for Bataille, exist already in a state of continuity. With the animal, there is no subject and object, or self and world. Unburdened with the Kantian apparatus of consciousness, '[t]he animal is in the world like water in water.'[6] How exactly is the animal's continuity manifest? As Bataille notes, '[t]he immanence of the animal with respect to its milieu is given in a precise situation … *the situation is given*

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[6] *Theory of Religion*, trans. R. Hurley (New York: Zone, 1989), 23.

when one animal eats another.'[7] Attempting to adopt a non-anthropomorphic position, Bataille notes that, while we as human beings may attribute qualitative differences to animals (from the scientific study of predator-prey relations to poetic evocations of the 'king of the beasts'), for animals themselves all differences are only quantitative.[8] Animality is continuity because it is fundamentally the lateral distribution and re-distribution of matter – and eating is the primary testament to this animal materiality. 'What is given when one animal eats another is always the *fellow creature* of the one that eats. It is in this sense that I speak of immanence.'[9]

But the world as continuity continues to haunt the discontinuous world of humanity. Bataille remains committed to the notion that there is some part of the continuous world embedded in humanity, some part it cannot be rid of, but that cannot be totally sublimated. Continuity, for Bataille, can be accessed but is not intelligible; for this access has as its precondition the negation of accessibility.[10] Again, there is something of the tragic in Bataille's notion of continuity, for it is not ever fully realized or achieved.

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[7] Ibid., 17.

[8] By 'quantitative' Bataille does not mean 'mathematical' in a strict sense, but a differential in the power relation between one animal and another, between eater and eaten. This takes Bataille into a Nietzschean (and perhaps, even, Spinozist) reading of culinarism, in which the so-called quantitative difference of eater and eaten ('like water in water') can only ever be thought outside that immanent relation.

[9] *Theory of Religion*, 17.

[10] This idea is explored in my essay 'Mediation and Antimediation', in E.

But its failure can happen in several ways. For Bataille, traditional religion – his main target is Christianity – has failed in that it has attempted to transform continuity itself into a thing, condensed into the anthropomorphic, personal, temperamental God. For Bataille, the concept of the divine comes to describe this haunting:

> If we now picture men conceiving the world in the light of an existence that is continuous ... we must also perceive the need for them to attribute to it the virtues of a *thing* 'capable of acting, thinking, and speaking' (just as men do) ... So the positing, in the world, of a 'supreme being', distinct and limited like a thing, is first of all an impoverishment.[11]

It seems, then, that even the theological notion of God is implanted within the discontinuous world of things, one being among other beings. But if this is the case, then at what moment does the living being enter into continuity? Bataille gives two instances, instances which remarkably mirror Athenagoras' discussion on resurrection: The first instance has to do with eating.

Hörl (Ed.) *The Technological Condition/Die Technologische Bedingung* (Berlin: Suhrkamp Verlag, 2011).

[11] Ibid., 33-4.

Bataille has already mentioned the role that eating plays in animality – it is the expression of continuous being. Human beings do eat, of course, but not in this sense. As Bataille notes, 'man does not eat anything before he has made it into an object ... man is an animal that does not *have a part* in that which he eats.'[12]

Bataille's other instance in which the living being opens onto continuity has to do with the corpse. This is also related to eating. For human beings, 'the eaten animal can be posited as an object only provided it is eaten dead.'[13] The transformation of the living body into a corpse is the necessary human prerequisite for the corpse to be transformed into food. But we never refer to our food as a corpse. The corpse is not only a dead thing, but a qualified dead thing. It is a dead thing with a kind of shadowy excess hovering around it, seeping from its pores. The corpse is simply that which remains, the remainder that does not go away, that persists in its thick, weighty, thingness, but which is never reducible to that thingness. Bataille discusses Western culture's ambivalence towards the corpse: '... the spirit is so closely linked to the body as a thing that the body never ceases to be haunted, is never a thing except virtually, so much so that if death reduces it to the condition of a thing, the spirit is more present than ever: the body that has betrayed it reveals it more clearly than when it served it.'[14] The corpse reveals life in a direct, dichotomous sense, as the thing that formerly contained life, as a thing that was formerly inseparable from life. The separation of life and body results in the dead facticity of the corpse. As Bataille notes, 'In a sense the corpse is the most complete affirmation of the spirit.'[15]

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[12] Ibid., 39.

[13] Ibid.

With this in mind, we can extract from Bataille's *Theory of Religion* a sort of abbreviated typology, one in which a material concept of life is thought of in terms of negation: There is, first, *the dead life*. The dead life is the twofold life of the corpse, at once the paradoxical affirmation of a life that no longer exists, and a continuation of the life of decay, decomposition, and disintegration. In its first aspect, the dead life affirms the basic split between the living and non-living, the living body and the body reduced to a thing. But in its second aspect, the dead life frustrates this boundary, as the decomposition of the corpse into its elements cuts across the boundary of the living and non-living.[16]

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[14] Ibid., 40.

[15] Ibid.

[16] My treatment of the decay, decomposition, and disintegration of the corpse shares some affinities with Reza Negarestani's essay 'Undercover Softness: An Introduction to the Architecture and Politics of Decay', (**Collapse** VI). While I share with Negarestani the notion of decay as infinite negation (perhaps, as negativity that is not negative), I am placing the decay of the corpse within the context of an unhuman, anonymous 'eating' (really, a metabolic general economy), such that the eaten and the dead come to overlap. My reading of Bataille suggests that, in short, a certain type of mysticism comes to encompass this overlapping.

Secondly, there is *the eaten life*. The eaten life is also twofold: the discontinuity of eating in humanity, and the continuity of eating in animality. In its first aspect, the eaten life is predicated on a basic distinction between human and animal, with the resultant hierarchies and taboos that follow from that distinction. In its second aspect, the eaten life does not acknowledge, or is indifferent to, the human-animal distinction, existing only as the material transformation of elementary particles, 'like water in water.'

For Bataille, both the animal and the corpse participate in divine immanence, which we as human beings cleave away into a naturalized transcendence, either through the conceptual dyad of human/animal and food, or through the affiliation of the corpse with the thing and the dyad of living/non-living.

Bataille sees in these two enigmatic states a kind of negative immanence that he aligns with the experiences of mysticism. Both the eaten and the dead, those things we name as things, are for Bataille simply names that really designate an unassignable, unhuman state – the state of absolute dissolution that is also continuity, and which, for Bataille, is simply another name for the *divine*.

CANNIBAL CORPSE

For Bataille, divinity is indelibly material. But this materiality is not one of a naturalized generativity or prodigality, and neither is it that of an infinitely calculable mechanism. It is materiality with a certain black gravity, a materiality with an emptiness at its core, a thickness of negation that does not abstract or elevate, but that saturates, that obfuscates, that renders desolate. This is Bataille's own brand of apophatic culinarism, an unhuman and anonymous cooking that corresponds to the indistinct and indifferent sphere he calls continuity. Continuity is this gradient along which everything that is, becomes indistinct and yet not immaterial.

But these passages between the divine and the material are not exclusive to Bataille's work; as we have suggested, Bataille borrows them from a long-standing discussion in Patristic theology concerning resurrection, the body, and the flesh. These debates have been unearthed and enlivened in Caroline Walker Bynum's study *The Resurrection of the Body in Western Christianity*. As Bynum notes at the outset, 'the resurrection of the body is always tied to divine power.'[17] Resurrection is tied to sovereign power, either in its ability to intervene in the natural order of things

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[17] *The Resurrection of the Body in Western Christianity, 200-1336* (New York: Columbia University Press, 1995), 2.

(e.g. the miracle of the resurrected body), or as an assertion of dominion over the workings of nature (e.g. the governance of the resurrected in eschatology). At the same time, resurrection is often described by theologians in terms of naturalistic or proto-biological tropes (e.g. the seed metaphor in Paul, processes of growth and hypergrowth in Origen). These characteristics come together in what Bynum identifies as the central philosophical problematic of resurrection in Christianity: the problem of continuity.

In Bynum's study, while the religious subject of early Christianity is markedly different from the modern subject, the notion of personhood is nevertheless an important element in the doctrine of resurrection. In Bynum's study, the body is central to Christian theology's notion of selfhood or personhood. Thus, formal and material continuity in the body is necessary for the survival of the person in resurrection. In short, if the survival of the body is necessary for the survival of the person, then it follows that the resurrection of the body is necessary for the resurrection of the person. Without personhood, there is no immortality, and in this way personhood (and by extension corporeality) is necessary for immortality and the eternity of the afterlife.

But if the body is necessary for resurrection, what kind of body is it that is resurrected? If the resurrected body is decaying or in parts, then will the resurrected person also be a fragmented or decaying person? We see here a variant of Athenagoras' problem with which we began. How can the doctrine of resurrection ensure that the resurrected person will also be a resurrected body (since body is required for personhood), and how can it ensure that the resurrected body will be a unified, consistent, and whole body?

Bynum goes on to identify two aspects of the problem of continuity in the Patristics. The first is what she calls the problem of 'material continuity'. The problem of material continuity is, simply put, the problem of maintaining a stable and coherent personhood across successive transformations, including growth, old age, death, and resurrection. How can one be sure that the resurrected body is the same resurrected person as when that person was alive? Further, finer-grained questions follow from this: if there is an identity between the once-living body and the resurrected body, to what point during one's earthly life does the resurrected body correspond? Is it a teenage body, an adult body, a middle-aged body, an elderly body? Material continuity, with its mélange of Aristotle filtered through Neoplatonism, is forced to deal with the metaphysics of the stasis of change. At the centre of the material continuity problem is a modal disjunction between the living, earthly body and the afterlife of the resurrected body. While the former is subject to and defined by temporality, process, and change, the latter is – so the argument goes – 'living' in a sense outside of time. The ontological de-coupling of earthly life and afterlife is necessary to establish the qualitative difference between the earthly and divine, but in so doing it leaves in its wake an irrevocable gulf between the temporal and the eternal.

Coupled with the problem of material continuity is a second problem, what Bynum refers to as the problem of 'chain consumption'. Like the material continuity problem, the problem of chain consumption deals with how to maintain the identity of personhood through successive changes.[18] But whereas material continuity deals with the changes to the body (and person) during life, chain consumption deals with the changes to the body (or corpse) after life. As we have seen in the case of Athenagoras, resurrection was not only a corporeal affair, it was thought of in roughly atomistic terms. If the body is composed of parts, then resurrection is equal to re-assembly. But the mysterious and gothic processes of decay and decomposition threaten to break the body down into so many parts that re-assembly becomes impossible. In addition, the corpse is not only decomposed, but it is also eaten. The corpse is eaten by a whole bestiary, from brooding vultures hovering in the sky to the patient feasting of worms in the earth. And this is where the theological problematic enters the scene. If we as human beings eat the flesh of an animal, and that animal has just eaten the corpse of a fellow human being, how has that once-human corpse not been forever lost in the endless chain of eater and eaten? As we've seen, apologists such as Athenagoras were unwavering in the face of such questions. Bynum notes that 'Athenagoras assumes that even the eaten dead must rise.' If cannibalism is a threat to the identity of the resurrected body, then the stomach is the grave.

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[18] We should also note the significant contribution of structuralist anthropology to the idea of culinary transformation, in which the culinary is not only material, but semiotic and semantic as well. In a sense, Lévi-Strauss' analysis in *The Raw and the Cooked* extends Bynum's analysis to include the culinary transformation of both signs and souls.

These two problems of material continuity and chain consumption invite us to think about resurrection in Bataillian terms. The continuity that the doctrine of resurrection attempts to preserve is precisely that which is negated in Bataille's notion of continuity (which he also calls 'radical immanence' or the 'intimacy of the outside'). From Bataille's perspective, the twin problems of material continuity and chain consumption provide glimpses into a continuity that not only negates the preservation of the body, but also the person. They are problems for precisely this reason, just as, for Bataille, the eaten life (the eating of animality) and the dead life (the decomposing corpse) provide us with ephemeral glimpses into continuity. Both problems dovetail on what comes to be an unavoidable topic of Patristic discussions on resurrection

– that of cannibalism. In cannibalism meat and corpse are brought together – the corpse as food, and food as the corpse – culminating in a series of material dissolutions whose serial negativity opens onto what Bataille calls continuity. As Bynum notes, Christianity 'retained the notion that the person in some sense survives in hard, material particles, no matter how finely ground or how widely scattered. The grave will not consume us'.[19] But whereas for Bataille continuity signified a radical immanence or indistinction, apart from the discontinuous world of subject and object, for the Patristics continuity is the continuity of identity across successive transformations – it is, in short, *the continuity of discontinuity*.

Such ideas emerge over a long period in which the ritual apparatus of Christianity takes shape: 'Christians first opposed then adopted the Roman funerary meal. By the fourth century, the Eucharist was celebrated in graveyards ...'[20] Eventually eating and burying begin to overlap and move towards the taboo region of the eating of the dead: '... cannibalism – the consumption in which survival of body is most deeply threatened – was a charge pagans levelled against Christians and Christians against pagans. Polemicists for both positions assumed that cannibalism is the ultimate barbarism, the ultimate horror.'[21] At the limit of this convergence is a strange point at which the Eucharist comes to overlap almost perfectly with the doctrine of resurrection. Bynum paraphrases the defence of thinkers such as Tertullian, Irenaeus, and Athenagoras: 'To eat (if it were really possible) would be to destroy – and to take over – the power of the consumed ... [E]ven if executioners feed our bodies to the beasts and then serve those beasts up on banquet tables, we are not truly eaten. To rise with all our organs and pieces intact is a victory over digestion – not only the digestion threatened by torturers and cannibals but most of all that proffered by natural process itself.'[22]

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[19] *The Resurrection of the Body in Western Christianity*, 55.

[20] Ibid.

In the political theology of resurrection, the resurrection of the body is not only a victory over the restricted economy of eating (culinarism-as-cooking), but it is also a victory over the more generalized economy of material continuity itself (culinarism-as-transformation). And this latter claim, so strongly asserted in the Patristics, is precisely what Bataille contests with his generalized culinarism and the concept of continuity. So, while Bataille appears to borrow the terms of the Patristics in his discussion of religion, he also stands apart from them in his emphasis on continuity as at once inaccessible and a zone of indistinction or indifference (culinarism-as-desolation).

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[21] Ibid.

[22] Ibid., 55-6.

We can extend our abbreviated typology here, keeping in mind the theological and historical perspective provided by Bynum's study on resurrection. With Bataille, we had the *dead life*, the life of that which remained after death. We can extend this to talk simply about the dead life as the *corpse*. The corpse is at once that which decays and decomposes, and that which stubbornly remains in its thick facticity. The corpse is the materiality of the material continuity problem.

With Bataille we also had the *eaten life*, the life of the eater and eaten, be it in animal continuity or human discontinuity. This can likewise be extended to talk about the eaten life simply as *meat*. If the corpse is decay and decomposition, then meat is metabolism, digestion, and fertilization. Meat is the materiality of the chain consumption problem.

In these pairings – the dead life and the eaten life, the corpse and meat – we have a passage from one form of life determined within the human metaphysical framework (living/non-living, human/animal, etc.), to another, anonymous form of life whose precise function is to dissolve, transmute, and render indistinct this same anthropic metaphysics; and it is this latter process that points to a generalized culinarism, cooking as an anonymous property of the world.

EATEN ALIVE AND/OR BURIED ALIVE

In an early written fragment, Bataille wonders whether there is, in the Hegelian concept of negation, an 'unemployed negativity' that remains inaccessible – or in excess of – the dialectic and its seemingly infinite capacity for sublimating the negative. This inclination is explored in *Theory of Religion*, where Bataille discusses the relationship between animal continuity (in the act of eating) and the life of the corpse (in the act of becoming food for worms) – again, 'meat' and 'corpse'. Just as the corpse becomes food for worms, so does meat emerge from the dead corporeality of the living being. But these are simply so many instances of a more generalized culinarism, of which the indistinction between eater and eaten, and the eaten and the dead, are the exemplars. This insight reveals an indelibly material aspect to what are ostensibly religious concerns, resulting in what Bataille calls an 'ambiguous horror.' Generalized culinarism is therefore tied, for Bataille, to the ambiguous horror of the eaten and the dead, meat and corpse.

But this ambiguous horror Bataille mentions is not simply the emotion of fear, the stimulus/response of fright, or even the existential dread of death – all of these imply an object of experience that threatens the subject, all the while maintaining a separation between subject and object. The ambiguous horror, in these senses of the term, is not only inescapably anthropocentric, but it is also invariably dialectical. For Bataille, however, horror is necessarily something unhuman. If it can be described in affective or even emotional terms, that is because it is, at its core, a fundamentally non-anthropomorphic affect – the affect of the unhuman. It is, really, a *religious horror*. Religious horror arises, for Bataille, from the 'impoverishment' of religious anthropomorphism we cited earlier, encapsulated in what Bataille calls the desire for a 'supreme being'. The supreme being – Bataille's target here are the monotheistic religions, though his claim applies to pagan gods as well – is continuity recuperated into discontinuity, the God made thing. On the one hand the supreme being allows for the Kantian concepts of causality, relation and modality to be applied even to the supernatural domain, such that the supreme being has both 'isolated individuality' and 'creative power'. In this attempt at having one's (theological) cake and (eucharistically) eating it too, there is the attempt to preserve the element of the divine as 'indistinct' and 'immanent existence'.

The problem, for Bataille, is that in introducing the concept of the supreme being, one also attempts to comprehend continuity through the lens of discontinuity, in effect making the supreme being a being like other beings, along a sliding hierarchy of greater or lesser beings. 'The objective personality of the supreme being situates it in the world next to other personal beings of the same nature ... Men, animals, plants, heavenly bodies, meteors ...'[23] The kind of equivalency that results is a relative equivalency between discrete, individuated things, greater or lesser, supreme or subordinate. But this generalized equivalency is not the same as the continuity (or intimacy, or immanence) of which Bataille speaks. For even though the concept of the supreme being is, for Bataille, universal, at the same time 'the operation seems to have failed everywhere'. At best the supreme being becomes a symbol, an icon, an image that, when examined directly, necessarily gives way to negative concepts (as in Anselm's famous definition of God, as that beyond which nothing greater can be conceived).

In a sense, then, religious horror is the implausibility or the impoverishment of the supreme being, at the same time that there remains something profoundly negative in the absence of the supreme being. Religious horror is the horror of religion – of its failure despite its success, of its all-too-humanity, of its claims for continuity in the language of discontinuity, of its confused confirmation and refusal of the Kantian antinomy. *Religious horror is the generalized 'cooking' of the divine.*

If for Bataille the 'horror' that he discusses is really religious horror, what is it that makes this religious horror different from other kinds of horror (fear, fright, *Angst*)? One difference is that these existential-phenomenological definitions of horror rely on a basic metaphysical dichotomy of life and death, and the horror elicited in the passage between them. But there is a transformation that is neither that of life into death nor death into life, but a kind of hypostasis of persisting, subsisting, and abiding – the religious horror of passing time.

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[23] *Theory of Religion*, 34.

We can describe Bataille's onto-theological problematic as the following: on the one hand, an immanent immersion in divine continuity, and on the other hand, a transcendental split between subject and object that guarantees the intelligibility of divine continuity. The former (divine continuity) can only be thought via the latter (subject-object split), but the latter by definition negates the former (the material dissolution of the subject-object split opening onto the material continuity of divinity). For Bataille, the only way out of this double-bind is by going headlong into it, and we can suggest that, for Bataille, this means understanding religion in terms of horror. In this sense *religious horror is a non-philosophical attempt to think of life in terms of negation, but a negation that is not negative.* This life, at once a hypostatized materiality and yet an immanence of negation, opens onto what he variously calls continuity, immanence, or intimacy: 'What is intimate, in the stronger sense, is what has the passion of an absence of individuality, the imperceptible sonority of a river, the empty limpidity of the sky: this is still a negative definition, from which the essential is missing.'[24]

Bataille gives the name *divine* to this onto-theological problematic. The divine names not a supreme being or transcendent reality, but the necessarily implausible or impoverished character of the transcendent, when it comes to stand in for the discontinuity of continuity. The divine is this generalized culinarism that is different from either culinarism-as-cooking or culinarism-as-transformation. But, for Bataille, this divine continuity must necessarily remain tragic, not 'out there' and yet never comprehended: 'This continuity, which for the animal could not be distinguished from anything else ... offered man all the fascination of the sacred world, as against the poverty of the profane tool (of the discontinuous object).'[25] For Bataille this element of the divine is to be distinguished from animal continuity, even though it may derive from it: 'The sense of the sacred obviously is not that of the animal lost in the mists of continuity where nothing is distinct ... Moreover, the animal accepted the immanence that submerged it without apparent protest, whereas man feels a kind of impotent horror in the sense of the sacred. This horror is ambiguous ...'[26]

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[24] Ibid., 50-1.

[25] Ibid., 35.

[26] Ibid., 35-6.

The divine is, for Bataille, the irresolution of the material and spiritual. Divinity is not expressed in the heady drama of disembodied, ethereal spirits, and neither is it expressed through the back door transcendence of the ritual of the everyday. Instead, divinity for Bataille derives from the inaccessibility of the continuous 'cooking' of the world, and humanity's *negative* awareness of this inaccessibility.

The religious horror of the eaten and the dead reveal different aspects of the religious horror of which Bataille speaks. They also extend our abbreviated typology thus far. But whereas the previous terms – the eaten and the dead, meat and corpse – were still predicated on an ontological split between life and death, which was then confused or rendered ambivalent, here the indistinction is followed to its logical conclusion, in some cases nearly inverting the terms.

On the one hand, we have the life of resurrection, the dead life, which, as decomposing and disintegrating, is also the corpse. In horror films, the corpse becomes more than a corpse when the life of resurrection in fact coincides with, or even precedes, the death of the living body and its internment. It is not simply that life precedes death temporally, but, in a near-inversion, the life after life is ontologically prior to the corpse. That is, the corpse becomes the *buried alive*.

On the other hand, we have the life of the eater and the eaten, the eaten life, which, in the continuity of animality, and in the transformation of the corpse into food for worms, is also meat. Here the inversion takes place between the dead and the eaten. The dead is not simply that which is temporally prior to the eaten, but the eaten is ontologically prior to the dead, in the sense that a kind of anonymous digestion or metabolism courses through the living, the dead, and the eaten all together. In a sense, life only begins after having been eaten. In short, meat becomes the *eaten alive*.

ABJECT ORIENTED ONTOLOGY

For Bataille, religious horror, and the impossible experience of continuity on which it is founded, is always subsumed within the real order in a tenuous, ambivalent way: 'The real order does not so much reject the negation of life that is death as it rejects the affirmation of intimate life, whose measureless violence is a danger to the stability of things, an affirmation that is fully revealed only in death.'[27] Again: 'Death reveals life in its plenitude and dissolves the real order.'[28]

The limit that Bataille confronts in the idea of religious horror is that of the unhuman. On the one hand, there is the pull towards absolute continuity, and the dissolving of all boundaries and individuation. This is counter-balanced by the pull towards discontinuity, and the limit of this thought of continuity for the human being. The two culminate in what Bataille calls the 'contagiousness of the divine,' the enigmatic revelation of an inaccessibility that is the result of the dissolution of a split between subject and object, that is nevertheless necessary for the dissolution to be thought as such.

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[27] Ibid., 46-7

[28] Ibid., 47.

On the surface, this seems to describe the concept of the abject, as found in psychoanalytic theory. The abject is that which is neither subject nor object, a repudiated element that serves as a reminder of a threatening, primal repression prior to subject-object relations. But the abject, at least in this guise, remains tethered to a psychoanalytic framework, with its language of repression, lack, and desire. It remains tied to the paradigm of a therapeutic, human subject, even as this subject is constantly threatened and made anxious by the abject. The abject is always regarded from the stance of the subject (even if a subject under erasure). Nevertheless, the abject is relevant, in that it persists and subsists through a certain type of materiality. 'The corpse,' writes Julia Kristeva, 'that which has irremediably come a cropper, is cesspool, and death: it upsets even more violently the one who confronts it as fragile and fallacious chance ... refuse and corpses *show me* what I permanently thrust aside in order to live.'[29]

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[29] *Powers of Horror: An Essay on Abjection*, trans. L. Roudiez (New York: Columbia University Press, 1982), 3.

As we've seen, the meat and the corpse, the eaten alive and the buried alive, these are the philosophemes of religious horror, forms of life paradoxically constituted by and through negation. What begins in the discontinuity of human life, is extended in and is coursed through by the continuity of the life after life – the decomposing corpse, food for worms. Furthermore, the point of contact between the eaten and the dead – meat and corpse, the eaten-alive and buried-alive – is a culinary one, but a kind of culinarism that is quite different from the usual, anthropological meaning (culinarism-as-cooking) or from the naturalistic meaning (culinarism-as-transformation). The culinary continuity of the eaten and the dead, of meat and corpse, is an unhuman 'cooking' (culinarism-as-desolation) that renders *indistinct* everything that an anthropic pretence to gustatory culture – the culture of taste, food, and humans relating unilaterally to nonhumans – would claim as its metaphysical privilege.

Given this, what would it mean to consider a notion of the abject without the human, or better, a 'religious' notion of the abject? If psychoanalysis approaches the abject from the side of the subject, what of the other side, the side of the object? But such a perspectival shift would be doomed to failure, for there can be no objective abjection, just as there can be no humanity in continuity, no humanity within meat and corpse, the eaten and the dead. Would this not require a philosophy that remains as sceptical of an object-oriented ontology as it is suspicious of a subject-oriented ontology? Perhaps we can propose something less than a unified theory; perhaps we can propose a pun. Let us consider the lesson of religious horror in Bataille – that *the world abjects the human*. Would this not require an *abject-oriented ontology*?[30]

We have seen that, for Bataille, the transformation of the animal into a thing is 'a basic human given' that also provides the conditions for the emergence of religion.[31] The animal can be reduced to a thing in the two ways that we have discussed: as the eaten and the dead. 'Thus the eaten animal can be posited as an object provided it is eaten dead.'[32] But the true articulation of the human as human comes not just in reducing the animal to a thing, whether it be eaten or dead. The true ascendency of the human comes in the articulation of the introconversion of the eaten with the dead. The human emerges not because animals are eaten or dead, but because they are always potentially one becoming the other, eaten *and* dead. The process by which this happens is a culinary one, one in which culinarism-as-desolation is reduced to culinarism-as-transformation, one in which culinarism-as-transformation is reduced to culinarism-as-cooking. There is a reductionism to the culinary that is analogous to anthropism. 'Indeed,' as Bataille continues, the animal 'is fully a thing only in a roasted, grilled, or boiled form … the preparation of meat is not primarily connected with a gastronomical pursuit: before that it has to do with the fact that man does not eat anything before he has made an object of it.'[33]

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[30] Given a certain predilection for acronyms in theory today, abject-oriented philosophy could be abbreviated as AOO (as in "oww," it hurts...).

[31] 'The definition of the animal as a thing has become a basic human given. The animal has lost its status as man's fellow creature, and man, perceiving the animality in himself, regards it as a defect.' (*Theory of Religion*, 39).

[32] Ibid.

This provides one explanation – a philosophical one, rather than an anthropological one – for the taboo regarding cannibalism. As Bataille affirms, this type of reductionist culinarism is deeply associated with the production of the human: 'Concerning that which I kill, which I cut up, which I cook, I implicitly affirm that *that* has never been anything but a thing.'[34] And yet, '[t]o cut up, cook, and eat a man is on the contrary abominable'.[35] This is because the type of culinarism we are discussing is a human culinarism – indeed the terms 'human' and 'cooking' imply each other. Cannibalism, however, troubles this, resulting in a culinarism of the human, in which the human itself becomes reduced to an object, the eaten and the dead. But as Bataille jibes, with echoes of Montaigne, cooking a human corpse really 'does no harm to anyone; in fact it is often unreasonable not to do something with man … despite appearances, even hardened materialists are still so religious that in their eyes it is always a crime to make man into a thing – a roast, a stew …'[36]

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[33] Ibid.

[34] Ibid.

[35] Ibid.

The corpse's enigmatic persistence leads to another type of culinarism, one that, for Bataille, momentarily opens onto the limit that is continuity. In a sense, the corpse continues the life of matter that it has always been, even when it was a living, breathing and discontinuous subject. The corpse knows no absolute change, no fundamental shift, no momentous passage from life to death; it only knows that continuity of material and energetic transformations that we, from the night-side of life, refer to as decay and decomposition. For the corpse, everything is culinary, whether it is the body that eats or the body that is eaten. We are invited to think about another type of culinarism, one that has little to do with the production of the human subject (and its corresponding food-object). Not only am I a corpse (a corpse not-yet), and not only am I meat (food for worms), but at the limit of an unhuman culinarism of the world, I am just 'stuff' (and even this says too much). This is Bataille's version – a desolate culinarism, a culinarism that must assume a cooking without a 'cook,' a generic 'eating' without eaters and eaten, a *that* cooking is without a *how* cooking is – not a reduction of culinarism to cooking, which would reinforce and reproduce the human, but a culinarism that is, in short, the *reductio ad absurdum* of the human.

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[36] Ibid., 39-40.

For Bataille, the 'divine' names this impossible experience, the unhuman experience of the world – including the self – as fundamentally unhuman. This divinity is also horror, but this horror exists on several levels. At the human (perhaps all-too-human) level, it is the existential horror of death, of what will happen to me – and my body – after death. But it is also the gothic horror of the corpse, of the embodied, subjectified, living being rendered as thing, as inert, impersonal facticity. Knowing as we do that even the corpse does not stay the same, there is also the culinary horror of meat (of food, of digestion, of metabolism), of the crossing of the threshold between the living and the non-living, while never ceasing to be material, of becoming food for worms and other living beings. Finally one arrives at the *religious horror* of this unending cycle not only of growth and decay, but of eating and being eaten. This horror opens onto a certain mystical state of the realization of the continuity of all things, a kind of theological metabolism in which the eaten and dead overlap almost exactly. In this sense Bataille's *Theory of Religion* is really something like a non-philosophy of mysticism, but a mysticism of the eaten and the dead: 'Only a world in which beings are indiscriminately lost is superfluous, serves no purpose, has nothing to do, and means nothing ...'.[37]

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[37] Ibid., 29.

The Metaphysics of Predation[1]

Eduardo Viveiros de Castro

In the two watershed works of 1962, *Totemism Today* and *The Savage Mind*, where the 'prestructuralism' of *Elementary Structures*... begins to give way to the 'post-structuralism' of *Mythologiques*,[2] Lévi-Strauss establishes a paradigmatic contrast between 'totemism' and 'sacrifice' which has come to assume, for me, a status one could describe as properly mythic, allowing me to formulate more distinctly what I had confusedly perceived as being the limits of structural anthropology. Limits in the geometrical sense of the term – the perimeter of jurisdiction of the Lévi-Straussian method – as well as in the mathematico-dynamic sense – the attractor towards which certain virtualities of this method tend. This contrast has been important, in particular, for a rereading of Amazonian ethnography in the light of research carried out among the Araweté, a Tupi-speaking people of the east Amazon.[3] It has played a pivotal role in my enterprise of rethinking the meaning of warfare cannibalism and of shamanism, two central (or rather 'de-central') cosmopolitical institutions of the Tupi and other Amerindian societies.

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[1] Excerpted from *Métaphysiques Cannibales* (Paris: PUF, 2009), with the kind permission of Presses Universitaires de France.

[2] See E. Viveiros de Castro, 'Xamanismo transversal: Lévi-Strauss e a cosmopolítica amazônica', in R. C. de Queiroz and R. F. Nobre (eds.), *Lévi-Strauss: leituras* brasileiras (Belo Horizonte: Editora da UFMG), 79-124.

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The question of the existence of 'sacrificial' rites in indigenous Amazonia poses the problem of historical and typological relations between the cultures of the lowlands of South America and the Andean and Meso-American state formations, where sacrifice is an essential theologico-political device. Behind this problem we discover in turn that, more vast, of the emergence of the State in so-called primitive societies. In Amazonia, the phenomena upon which specialists' attention is concentrated is that of shamanism, given that the shaman seems sometimes to assume the proto-sacerdotal appearance of a delegate of transcendence. But the Americanist consensus is that the classic, franco-sociological definition of sacrifice,[4] which continues to serve as the general reference for the discipline, does not give a satisfactory account of the complex of South American shamanism.

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[3] E. Viveiros de Castro, *From the Enemy's Point of View: Humanity and Divinity in an Amazonian Society* (Chicago: University of Chicago Press, 1992).

[4] H. Hubert and M. Mauss, *Sacrifice: Its Nature and Functions* [1969] (Chicago: University of Chicago Press, 1981).

However, the connection between Araweté ethnography and the notion of sacrifice was not impressed upon me directly on the basis of the shamanic practices of these people, but rather on the basis of its eschatological discourse. Araweté cosmology reserves a place of honour for posthumous cannibalism: the celestial divinities (the *Mai*) devour the souls of the dead as they arrive in the sky, as a prelude to the metamorphosis of the latter into immortal beings, like those who devour them. As I have argued,[5] this mystical funerary cannibalism is an obvious structural transformation of the bellico-sociological cannibalism of the sixteenth century Tupinamba who constituted the most important Tupi-speaking tribe, inhabiting the Brazilian coast, mostly in Rio de Janeiro and Bahia.

It would doubtless be useful to recall some of the general traits of Tupinamba cannibalism. It was a very elaborate system centred on the ceremonial capture, execution and devouring of war enemies. The prisoners, frequently taken from people of the same language and culture as those of their capturers, might have lived for some considerable time alongside the latter, before undergoing a solemn execution on the central place of the village. They were generally well treated, living freely but monitored during the whole duration of the long preparations for the great rite of execution; it was usual to give them women of the group as wives – the captives being thus transformed into affines ('enemy' and 'brother-in-law', in old Tupi, are said in the same way: *tovajar*, a term whose literal meaning is 'opposite'). We can already see the way in which Amerindian predation implies the question of affinity, as Lévi-Strauss observed ... The ritual cycle culminated at the moment of the putting-to-death of the captive, an act that had the status of an initiation for the executioner (who obtained a new name, underwent commemorative scarifications, gained the right to marry and have children, posthumous access to paradise, etc.), after which the captive's body was devoured by the entire audience, that is to say the hosts and those invited from neighbouring villages, but excepting the officiant-killer, who not only did not partake of the captive, but entered into a period of funerary reclusion. In other words, he engaged in a process of identification with the 'opposite' that he had just put to death.

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[5] Viveiros de Castro, 'Xamanismo transversal'.

The anthropophagy of the Tupinamba has frequently been interpreted as a form of 'human sacrifice', either in the figurative sense of the expression, by certain of the early chroniclers, or in a conceptually precise sense, as with one of the founding fathers of sociology in Brasil, Florestan Fernandes,[6] who applied Hubert and Mauss's schema to the sixteenth century Brazilian material. To do this, however, Fernandes postulated something that did not figure in his sources: a recipient of the sacrifice, a 'supernatural entity'. According to him, the sacrifice was destined for the spirits of the dead of the group, avenged and celebrated by means of the execution and the eating of the war prisoner.

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[6] F. Fernandes, *A função social de Guerra na sociedade Tupinambá* [1952] (São Paolo: Livraria Pioneira Editora/EDUSP, 1970).

In my monograph on the Araweté, I contested the idea that supernatural entities would be implicated in Tupi cannibalism, and that their propitiation would be the reason for the rite. It is true that, precisely in the Araweté case, we find 'supernatural entities' playing the role of the active pole of the cannibal relation. But, according to my reading of the eschatology of that people through the lens of Tupinamba sociology, this supernatural condition of the devourers is of no great importance. I argued that the Arawete *Mai* (their gods) occupy the place that, in the Tupinamba rite, was occupied by the group in the subject position – the group of the murderer and his allies, who devoured the captive – whereas the place of the object of sacrifice, the captive of the Tupinamba rite, is occupied by the dead of the Araweté. The living Araweté, in their turn, occupy the place of *cosubjects* which, among the Tupinamba, was occupied by the enemy group, the group from which the victim had been taken.[7] In short, the transformation that divine Araweté cannibalism operates on human Tupinamba cannibalism bears not upon the symbolic content of this practice or its social function, but consists in a pragmatic sliding, a torsion or shift in perspective which affects the status and functions of subject and object, of means and end, of self and other.

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[7] In so far as the ceremonial death was considered as the *kalòs thánatos* (the beautiful death), the relation between the enemy groups was endowed with an essential positivity: not only would it give access to individual immortality, it would also permit collective vengeance, which was the motor and central motif of Tupinamba life. In Soares de Souza's lapidary formula: 'As the Tupinamba are very bellicose, all their fundamental principles consist

I came to conclude, later, that the idea of a coordinated changing of points of view would do more than describe the relation between the Araweté and Tupinamba versions of the cannibal motif. This change would manifest a property of Tupi cannibalism itself, qua actantial schema. I then came to define it as a process of transmutation of perspectives, where the 'I' is determined qua 'other' by the act of incorporation of that other, which in its turn becomes an 'I', but always *within the other*, literally '*through* the other'. Such a definition gave an answer to a simple, but insistent, question: what is it, of that enemy, really, that was devoured? It could not be his matter or

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in knowing how to wage war on their opposites' (Soares de Souza Gabriel, *Tratado descritivo do Brasil em 1587* [1587] [São Paulo: Cia Editora Nacional/ EDUSP, 1971], 320). On the dialectic of the death of the individual and the life of the group, see this passage by Thevet: 'And do not think that the prisoner is shocked by this news [that he is to be executed and rapidly eaten], his opinion being that this death is honourable, and that it is much better for him to die thus, than to die in his house from some contagious disease: for (they say) one cannot avenge death, which offends and kills men, whereas one can avenge those who have been slain and massacred in war.' (A. Thevet, 'Cosmographie universelle' [1575], in S. Lussagnet [ed.], *Les Français en Amérique pendant la deuxième moitié du XVIeme siècle: le Brésil et les brésiliens* [Paris: P.U.F, 1953], 196).

'substance', given that it was a *ritual* cannibalism, where the consumption of the victim's flesh, in quantitative terms, was insignificant; what is more, testimony of any physical or metaphysical virtue being attributed to the enemy's body is rare and inconclusive, in the known sources. So the eaten 'thing' could not truly be a 'thing', even if it was – and this is essential – a body. This body was nevertheless a sign, a purely positional value: what one ate was the relation of the enemy to his devourers; in other words, his *status as enemy*. What one assimilated of the victim were the signs of his alterity; and what was aimed at was that alterity as a point of view on the Self. Cannibalism and the type of war that was associated with it implied a paradoxical movement of reciprocal autodetermination by the point of view of the enemy.

With this thesis I was obviously suggesting a counter-interpretation to certain classical precepts of the discipline. If the aim of European multiculturalist anthropology is to describe human life as it is lived 'from the native's point of view', indigenous multinaturalist anthropophagy assumed as the vital condition of its self-description the 'semiophysical' prehension – the putting to death and the devouring – of the point of view of the enemy. Anthropophagy as anthropology.[8]

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[8] Or, in the vein of the ferocious humour of Oswald of Andrade, author of the celebrated 1928 *Anthropophage's Manifesto*: odontology as ontology… (O. de Andrade, 'Manifeste anthropophagique' [1928], in P.F. de Queiroz-Siqueira, 'Un singulier manifeste', *Nouvelle Revue de Psychanalyse,* 6, 1972: 277-81).

This idea came to me in listening to Araweté war chants, in which the warrior, through a complex deictic and anaphoric play, speaks of himself from the point of view of the dead enemy: The victim, who is the subject (in both senses) of the song, speaks of all the Araweté people he has slain, and speaks of his killer – who is he who 'speaks', that is to say, he who actually sings the words of the dead enemy – as a cannibal enemy (although among the present-day Araweté one eats only words). Through *his* enemy, the Araweté killer sees himself *as* enemy, in his capacity as enemy. He apprehends himself as a subject on the basis of the moment when he sees himself through the eyes of his victim, or rather, when he pronounces his own singularity in the voice of the latter. Perspectivism.

The warrior semiophagy of the Tupi is far from being an uncommon development in the Amerindian lands. The idea of an indigenous political philosophy of cannibalism, which would be at the same time a cannibal philosophy of politics, was broached in its broad strokes by Pierre Clastres's theory of primitive war.[9] However, its ethnographic generality and complexity only began to be recognized thanks to the efforts of various Amazonist colleagues, more or less at the same moment when I embarked upon an analysis of the Tupi material.[10] These works point towards a predatory economy of alterity as constituting the basic regime of Amazonian sociality: the idea that the 'interiority' of the social body is integrally constituted by the capture of the symbolic resources – names and souls, persons and trophies, words and memories – of the exterior. In choosing as principle of movement the incorporation of attributes drawn from the enemy, the Amerindian socius comes to 'define' itself according to the same attributes. This is what can be seen in the course of the great ritual moment of Tupinamba life, the putting to death of the captive, where the place of honour is reserved for the twin figure of the killer-and-his-victim, who reflect each other and reverberate to infinity. Ultimately, here is what is essential in the 'metaphysics of predation' of which Lévi-Strauss speaks: primitive society as a society without interior, which only arrives at being 'itself' *outside itself*. Its immanence coincides with its transcendence.

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[9] P. Clastres, 'Archéologie de la violence: la guerre dans les société s primitives', *Libre* 1, 1977, 137-73. See also: 'Échange et pouvoir: philosophie de la chefferie indienne', in P. Clastres, *La société contre l'État* (Paris: Minuit, 1974), 25-42 – see P. Clastres and L. Sebag, 'Cannibalisme et mort chez les Guayakis', *Revista do Museu Paulista* XIV, 1963, 174-81; H. Clastres, 'Rites funéraires guayaki', *Journal de la Societé des américanistes* LVII, 1968, 62-72, for the pioneering articles.

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[10] Certain among them deserve a special mention: Bruce Albert's essential thesis on the bellico-funerary complex of the Yanomami (*Temps du sang, temps des cendres: representation de la maladie, système ritual et espace politique chez les Yanomami du Sud-Est* (*Amazonie brésilienne*) [Université de Paris X (Nanterre), 1985]); the studies pubished in the special issue 'Guerres, sociétés et vision du monde dans les basses terres de l'Amérique de Sud' (ed. P. Menget) of the *Journal de la Société des américanistes* LXXI, 1985), most notably Taylor's article on the headhunting of the Jivaros as apparatus of capture of the virtualities of persons ('L'art de la réduction'), Chaumeil's on the cosmological economy of war in the Yagua ('L'échange d'énergie: guerre, identité et reproduction sociale chez les Yagua de l'Amazonie péruvienne') and Menget's own work on the system of 'adoption' of enemy women and children by the Ikpeng ('Jalons pour une etude comparative [dossier 'Guerre, société et vision du monde dans les basses terres de l'Amérique du Sud'). One should also mention Menget's 'Note sur l'adoption chez les Txicão du Brésil central', in *Anthropologie et Sociétés* 12[2], 1988: 63-72, Philippe Erikson's article on the cannibal ethnosociology of the pano-speaking peoples ('Altérité, tatouage et anthropophagie chez les Pano: la belliqueuse quête en soi', *Journal de la Société des Américanistes* LXII, 1986: 185-210), and Joanna Overing's on the images of cannibalism in the cosmology of the Piaroa ('Dualism as an expression of differences and danger: Marriage exchange and reciprocity among the Piraoa of Venezuela', in K. Kensinger (ed.), *Marriage Practices in Lowland South America* [Urbana/ Chicago: University of Illinois Press, 1984]). In the following years, studies multiplied (beyond the numerous works of the researchers already mentioned, let us cite those of Ph. Descola, B. Keifenheim, I. Combès, A. Vilaça, C. Fausto, A. Surralès, D. Karadimas, and T. Stolze Lima).

It was thus less via shamanism than via war and cannibalism that I came to deal, for the first time, with the problem of sacrifice. Now, if the Maussian definition seemed to me inappropriate (no recipient of the sacrifice, no notion of 'the sacred') the notion proposed by Lévi-Strauss in his discussion on totemism, on the contrary, appeared to me to shed a new light on Tupian anthropophagy.

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The contrast between totemism and sacrifice presents itself from the start in the form of an orthogonal opposition between the *totem* and *manido* systems of the Ojibwa, established in the first chapters of *Totemism Today*.[11] In Chapter VII of *The Savage Mind* the opposition is generalized, redrawn[12] and systematized in the following terms:

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[11] C. Lévi-Strauss, *Le totémisme aujourd'hui* (Paris: PUF, 1962), 32.

- Totemism postulates the existence of an homology between two parallel series (natural species and social groups) by establishing a formal and reversible correlation between two systems of globally isomorphic differences.
- Sacrifice postulates the existence of just one series, continuous and oriented, along which is effected an actual and irreversible mediation between two polar and non-homogeneous terms (men and divinities), whose contiguity must be established through successive analogical identifications or approximations.
- Totemism is metaphorical, whereas sacrifice is metonymic; the first is an 'interpretative system of references'; the second a 'technical system of operations'; the first is of the order of language [*langue*]; the second, of the order of speech [*parole*].

It can be deduced from this definition that sacrifice actualizes processes of a different type, at first glance, from the equivalences of proportionality at work in totemism and in the other 'systems of transformation' analysed in *The Savage Mind*. The logical transformations of totemism are established between terms whose reciprocal positions are modified by permutations, inversions, chiasms or other combinatory or extensive redistributions – totemism is a topic of discontinuity.

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[12] C. Lévi-Strauss *La pensée sauvage* (Paris: Plon, 1962), 298.

Sacrificial transformations, on the contrary, unleash intensive relations which modify the nature of the terms themselves, for they 'make something pass' between them: the transformation, here, is less a permutation than a *transduction*, in Gilbert Simondon's sense – it appeals to an energetics of the continuous. If the objective of totemism is to establish a resemblance between two series of differences each given on their respective side, the goal of sacrifice is to induce a zone or a moment of indiscernibility between two poles supposed to be self-identical – a goal that engages difference in an entirely other way (via the inside rather than via the outside, so to speak). To return to a mathematical allegory, one could say that the model of structural transformations of totemism is combinatory analysis, whereas the instrument necessary to explore the 'realm of continuity' (Lévi-Strauss) established by the intensive metamorphoses of sacrifice instead comes down to something on the order of differential calculus: imagine that the death of the victim is the tracing of a tangent, the best approximation to the curve of divinity ...

Thus, the Lévi-Straussian definition of totemism apprehends the latter as a system of *forms*, whereas that of sacrifice has recourse to formulations that suggest the presence of a system of *forces*. A veritable fluid mechanics: Lévi-Strauss utilizes a whole schematism of communicating vessels to speak of sacrifice, referring, for example, to a 'solution of continuity' between 'reservoirs', to a 'deficit of contiguity' filled 'automatically' and other similar expressions. All of this evokes irresistibly the key idea of a *difference of potential* as the principle of sacrifice.

The same hydraulico-energetic language reappears in the analysis of laughter and aesthetic emotion as discharge of accumulated symbolic energy, in the 'Finale' of *The Naked Man*. Here, Lévi-Strauss has recourse to it when he turns to societies with a 'cold' history, who struggle against entropy by utilizing differences of potential contained in their inequalities of class or in the exploitation of other people, thereby to engender becoming and energy.[13] The notion of difference of potential plays a decisive, if little-remarked, role in the construction of the concept of *mana* in *Outline of a General Theory of Magic*. Hubert and Mauss hold that *mana* expresses the general idea of the differential value of things and of beings ('it is always a matter, in magic, of respective values recognized by society'), and thus, of their hierarchical arrangement, and that this hierarchical difference of value (Mauss *avec* Nietzsche!) is coherent with the translation of concepts of *mana*, *orenda*, etc. by Hewitt as 'magical potentiality'. And they conclude:

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[13] C. Lévi-Strauss & G. Charbonnier, *Entretiens avec Claude Lévi-Strauss* (Paris: UGE, 1961), 44-8.

> What we call the relative position or respective value of things could also be called a difference in potential, since it is due to such differences that they are able to affect one another ... [T]he idea of *mana* is none other than the idea of these relative values and the idea of these differences in potential. Here we come face to face with the whole idea on which magic is founded, in fact with magic itself..[14]

The Lévi-Straussian interpretation of *mana* in terms of an inadequation between signifier and signified[15] is therefore a compromise between a totemic-type explanation, in so far as it appeals to a model of correlative differences between a signifying series and a signified series, and a sacrificial-type explanation, in so far as it depends on the observation of a perpetual disadjustment (the absence of a 'perequation') between two series, a disequilibrium that very much resembles Hubert and Mauss's 'difference of potential'.

In short, two different images of difference, an extensive image and an intensive image: form and force. Images that are so different as to be 'incompatible', suggests the author[16] – a judgment I shall allow myself to interpret as aiming to indicate *complementary* images, in the sense of Niels Bohr, an author frequently cited by Lévi-Strauss.[17] In this case, rather than designating two 'systems', totemism and sacrifice would designate two descriptions – both necessary, but mutually exclusive – of a same general phenomenon, sense or semiosis qua articulation of heterogeneous series.

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[14] H. Hubert & M. Mauss , 'Esquisse d'une théorie générale de la magie' [1902-3], in M. Mauss, *Sociologie et anthropologie* (Paris: PUF, 1950), 114. [Translation by R. Brain from M. Mauss, *A General Theory of Magic* (London/ NY: Routledge Classics, 2001)].

[15] C. Lévi-Strauss, 'Introduction à l'oeuvre de Marcel Mauss', in M. Mauss, *Sociologie et anthropologie*, XLIX.

[16] Lévi-Strauss, *La Pensée Sauvage*, 295.

However, such a complementarity, at least as far as Lévi-Strauss is concerned, is clearly asymmetrical. In his inaugural lecture at the Collège de France, the author affirms that, unlike history, structural anthropology must utilize 'a method that would be that of *transformations* rather than of *fluxions*',[18] suggesting with this something more akin to a group algebra than to a differential dynamics. Recall that 'method of fluxions' was the name given by Newton to what would later be called differential calculus. And, in fact, it is as if the structural method in anthropology – or rather, the usual interpretation of this method – was conceived to take account of form rather than of force, of the combinatory rather than the differential, of the corpuscular rather more easily than the undulatory, of language to the detriment of speech, of categorization in preference to action.[19] Consequently, those aspects that seem to resist to a greater or lesser extent the structural method are habitually treated by Lévi-Strauss as semiotic (or even ontological) minor modes – it is not by chance that I speak at the beginning of *Métaphysiques Cannibales* of a minor anthropology – either because they bear witness to the limits of the thinkable, or because they belong to the asignifying, or, finally, because they express the powers of illusion. Thus, as we know, sacrifice is held to be imaginary and false, and totemism esteemed as objective and true,[20] a judgment that repeats and generalizes the great opposition between myth and ritual developed in *Naked Man*;[21] a judgment which, we are tempted to say, teaches us more about certain aspects of Lévi-Strauss's cosmology than about the cosmology of the peoples he studied so intensively.[22]

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[17] See, for example: Lévi-Strauss [1952], *Anthropologie Structurale* (Paris: Plon, 1958), 326; 'La notion de structure en ethnologie', in Lévi-Strauss *Anthropologie structurale*, 398; 'Pensée mythique et pensée scientifique' in M. Izard (Ed.) *Lévi-Strauss* (Paris: L'Herne, 2004), 42; Lévi-Strauss and Charbonnier, *Entretiens*, 18, 25.

[18] C. Lévi-Strauss [1960], 'Race et histoire', in Lévi-Strauss, *Anthropologie structurale deux* (Paris: Plon, 1973), 28.

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[19] This having been said, Deleuze observed, already in 1972, on the subject of structuralist mathematics: 'Sometimes the origins of structuralism are sought in the area of axiomatics, and it is true that Bourbaki, for example, uses the word "structure." But this use, it seems to me, is in a very different sense [...] The mathematical origin of structuralism must be sought rather in the domain of differential calculus, specifically in the interpretation which Weierstrass and Russell gave to it, a *static and ordinal* interpretation, which definitively liberates calculus from all reference to the infinitely small, and integrates it into a pure logic of relations.' (G. Deleuze, 'À quoi reconnaît-on le structuralisme?' [1972], in D. Lapoujade [ed.], *L'île déserte et autres textes. Textes et entretiens 1953-1974* [Paris: Minuit, 2002], 247. [Translation from 'How do we Recognize Structuralism?' in *Desert Islands and other Texts 1953-1974* (Los Angeles: Semiotext(e), 2004)]).

[20] Lévi-Strauss, *Anthropologie structurale II*, 301-2.

[21] C. Lévi-Strauss, *Mythologiques IV: L'Homme Nu* (Paris: Plon, 1971), 596-603.

[22] This opposition between myth and rite proposed in *Naked Man* was to

Totemism, today, is dissolved in the general classificatory activity of savage thought;[23] sacrifice still awaits a comparable constructive dissolution. We know how totemism was undone by Lévi-Strauss: it ceased to be an institution, becoming a method of classification and a system of signification in which the reference to a series of natural species was contingent. Would it be possible to rethink sacrifice along similar lines? Would it be possible, in short, to see the divinities that function as terms of the sacrificial relation, as being as contingent as the natural species of totemism? What would this look like: a generic schema of sacrifice, of which typical institutional crystallisations would only be particular cases? Or, to formulate the problem in a language more sacrificial than totemic, what would be the field of dynamic virtualities of which sacrifice is a singular actualization? What forces are mobilized by sacrifice?

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be a great obstacle for the structuralist legacy, as can be seen in various attempts at modalisation, reformulation or flat-out rejection of the latter (and with it, sometimes, of whole areas of Lévi-Straussian anthropology). Americanist ethnology, in particular, has had to confront this opposition in at least two fundamental studies on Amazonian ritual systems (S. Hugh-Jones, *The Palm and the Pleiades: Initiation and Cosmology in North-West Amazonia* [Cambridge: Cambridge University Press, 1979]; B. Albert, *Temps du sang, temps des cendres: representation de la maladie, système ritual et espace politique chez les Yanomami du Sud-Est [Amazonie brésilienne]* [Paris: Université de Paris X (Nanterre), 1985]).

[23] With the important exception, already remarked upon, of Ph. Descola's theory, where the term comes to designate a specific ontology, typically exemplified by Australian aboriginal cultures.

Setting aside Lévi-Strauss's value judgements, the contrasts established between metaphorical discontinuity and metonymic continuity, positional quantity and vectorial quality, paradigmatic reference and syntagmatic operation, were a great help to my own work, and led me to inscribe Tupi ritual cannibalism in the column (the paradigm!) of sacrifice. A true anti-totemic operator, cannibalism would engage a transformation that is virtually reciprocal (the imperative of vengeance that gave it its entire sense in Tupinamba society) but actually irreversible between the terms that it connects, through the medium of acts of a supreme contiguity and 'discontiguity' (the violent physical contact of execution, the dismembering and consumption of the victim's body) which imply a movement of indefinition and the creation of a zone of indiscernibility between killer and victim, devourers and devoured. It is not at all necessary to postulate the existence of supernatural entities to realise that one is indeed in the element of sacrifice. In the tripolar interpretation of Tupinamba ritual developed in my ethnography of the Araweté, the actants are (1) the group of devourers, (2) the dual person executor-victim, and (3) the enemy group. 'Death' is but a vicarious function assumed alternately and successively by the three poles of the rite; but it is death that conducts the forces circulating in the process.

This is all very well. But does the concept of 'sacrifice', in this new Lévi-Straussian sense, really describe what happened in the cannibal ritual? There is nothing of the imaginary, and even less of the false, in Tupi cannibalism. Not even vengeance, which is strictly speaking 'impossible', was imaginary; for it was, before anything else, a schematism of social *poiesis*, a mechanism for the ritual production of collective temporality (the interminable cycle of vengeance) via the installation of a perpetual disequilibrium between enemy groups.[24] And in any case, even if one must always *imagine* the enemy – construct the other as such – the objective was *really* to eat him – to construct the self qua other. There is something that does not pass through the concept of sacrifice, even if many more things pass through it than through that of totemism.

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[24] 'Perpetual disequilibrium' is a key concept of *Histoire de Lynx* (C. Lévi-Strauss, *Histoire de Lynx* [Paris: Plon, 1991]), elaborated – as if by chance – on the basis of the analysis of the Tupinamba myth of the twins, recorded by Thevet around 1554.

Ex-Nihilo: Forming a Body Out of Nothing[1]

Dorothée Legrand

1. CAN A SUBJECT EAT?

What does an eating subject do? He incorporates what he is not. That does not only mean that he transforms what is not his body into what composes his body. It also means that he transforms himself into what he is not. As one incorporates food into oneself, one incorporates oneself into the realm of food: the realm of dead animals and plants. Eating is an act of survival; eating is an act of merging one's life with death.[2] Eating blurs the difference between one's body and a corpse. The stomach is 'a *zone of indiscernability or*

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[1] I wish to thank Gabriel Catren for feeding my thoughts on the issues discussed here and Dylan Trigg for commenting on a previous version of this article. I am grateful to Reza Negarestani for inviting this contribution. I acknowledge the support of the '*European Platform for Life Sciences, Mind Sciences, and the Humanities* Volkswagen Stiftung grant.

[2] G. Didi-Huberman, *Disparates sur la voracité*. *MLN*, 106, 1991, 765-79.

undecidability' between life and death: what happens 'in there' is not a combination but rather the processing of the common factor between life and death, 'not an arrangement of [life and death], nor a resemblance, it is a deep identity, a zone of indiscernability more profound than any sentimental identification [...] That is the reality of becoming':[3] 'every man who [eats] is a piece of meat'.[4] Unfolding these claims will allow considering what 'eating' and 'eating nothing' can teach us about the constitution of who we are: *can a subject eat without negating himself as such?*

2. CONCEPTUAL TOOLS

Phenomenology has significantly contributed to the characterization of the subject of conscious experience as being irreducible to the object. The subject is what the object is not. In particular, the object is understood phenomenologically as what is aimed at by the intentional act of consciousness and the subject as the one who aims at the object. Schematically, the subject is the ineradicable starting point of the 'arrow' of intentionality and the object its ending point. Crucially, in this view, the subject (of consciousness) does exist but not as an object (of consciousness).

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[3] G. Deleuze, *Francis Bacon: Logique de la sensation* (Paris : Seuil, 1981); trans. D.W. Smith as *Francis Bacon, The Logic of Sensation* (London/NY: Continuum, 2003), 25.

[4] Ibid., 23.

Not being an object of consciousness obviously does not prevent the subject from being a body. However, it is important to underline here that the bodily subject is also irreducible to an animate material thing – an organism living anonymously – and to an inanimate material thing – a corpse. It is in this sense (and only in this sense), that here it is said that the subject is *no-thing*. The subject is thus constituted as a *double negativity*: the *specificity* of a subject lies in what an object of consciousness is not and in what a material thing is not. In what follows, the term 'object', when used with no more specification, will be used to cover both 'object of consciousness' and 'material thing'. The negation of objecthood will be termed no-thingness. This ambivalence will allow us to capture *at once* the double negativity constituting the subject.

The characterization of the subject's double negativity allows the consideration of the multidimensionality of bodily self-consciousness.[5] On the one hand, consciousness of one's body-as-subject is a dimension of bodily self-consciousness that is pervasive, as it corresponds to the experience of any object from one's bodily anchored perspective. For example, experiencing an object to one's right is experiencing oneself as bodily located to the left of the object, experiencing a surface as affording support to one's steps is a way of experiencing one's bodily weight. In these cases, one's body is not taken as an object of intentional consciousness, but is experienced as subject.

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[5] D. Legrand, 'Pre-reflective self-consciousness: on being bodily in the world', *Janus Head*, 'Special Issue: The Situated Body', 9/1, 2007, 493-519; 'Phenomenological dimensions of bodily self-consciousness', in S. Gallagher (ed.), *Oxford Handbook of the Self* (Oxford: Oxford University Press, forthcoming)

On the other hand, consciousness of one's body-as-object is a special case of intentional consciousness where one takes one's own bodily states as intentional objects of consciousness, be it explicitly or not. For example, one experiences one's body-as-object when one evaluates one's body as being thin or fat, on the basis of a mirror reflection of one's bodily shape; one may also experience one's body-as-object when focusing on the interoceptive sensation of one's heartbeats which one may be able to count accurately or not.

Now considering that the body is a material thing, and that the subject is irreducible to a material thing (is no-thing), it is important to underline that *any* experience qualifying as a form of *bodily* self-consciousness involves the experience of oneself as *material*. The body may be experienced as material in various ways. One may scrutinize one's body as if it were any typical object (e.g. one may pay attention while cutting meat, because one experiences that the knife may cut as well through one's fleshy finger, thereby experiencing the common materiality of meat and finger), or one may experience one's body while encountering or using other objects (e.g. one may use one's fingers as instruments to grab food, one's tongue as an instrument to lick, feel the texture or test the temperature of a meal, because one experiences the common materiality between one's bodily instruments and food). One may also experience the materiality of one's body while merely looking forward, which involves, albeit implicitly, experiencing oneself as a material subject, voluminous, located and oriented in space.[6]

In addition to these experiences of the materiality of one's body-as-object and of one's body-as-subject, one may experience the materiality of one's 'anonymous' body. Indeed, the materiality of one's body may be experienced as *escaping* one's experiential grasp, unveiling one's complicity with anonymous materials.[7] As will be further evidenced below, *one's own* materiality may be experienced as being common to the materiality of inanimate things and corpses, while it may also be experienced as participating to the pre-personal dynamic of the physiological processes of one's living organism. Importantly, such 'anonymous' processes and aspects of one's body fall within the range of one's *experiences of oneself* as they may be experienced as *one's own* participation in the material realm, as *one's own anonymity*.

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[6] Legrand, 'Phenomenological dimensions'.

[7] R. Negarestani, *Cyclonopedia: Complicity with Anonymous Materials* (Melbourne: Re.press, 2008).

The double negativity of the subject – irreducible to objects of consciousness and to material things – will be used and developed throughout this contribution. Two points should thus be kept in mind from now on. First, the present discussion is not concerned with any purported divide between the subject and the body; between soul and matter. The distinctions that are at stake here are *experiential* and are intrinsic to the experience of the *body*. What will be discussed is *not* the distinction between an experience of oneself that would be bodily and one that would not; what will be discussed is different dimensions of *bodily* self-consciousness. Secondly, starting from the distinction between subject and object, it should be remembered that *differentiation is not separation.* While the different modes of experiencing oneself are *irreducible* to each other, they are also typically *integrated* with each other. The view defended here is that bodily self-consciousness is typically multidimensional in the sense that its different 'dimensions' are *equi-primordial* to the constitution of self-consciousness.

Notice that such a conception of bodily self-consciousness as *pervasively multidimensional* counters the view that focuses on the 'primordial absence'[8] of the body. For example, as repeatedly described in phenomenology, the seeing eye is not itself seen: 'the body conceals itself precisely in the act of revealing what is Other'.[9] The bodily subject would recede from consciousness, efface itself, in favour of the perceptual field that it discloses. This, however, does not describe adequately typical bodily self-consciousness. In particular, it leaves aside two considerations of importance. First, if subject and object are irreducible to each other, the absence of the body-as-object in one's experiential field would not eradicate the pervasive presence of one's body-as-subject as anchoring one's experiential field: one may not see one's eye (one's own *seeing* eye cannot be taken as *object* of visual experience), but one may still pervasively experience one's seeing body (as subject) as anchoring one's visual experience.[10] Ignoring this experiential evidence involves the unwarranted reduction of experience to its intentional object, thereby precluding any consideration of the conscious experience of one's body-as-subject. Second, if consciousness of one's body-as-subject and consciousness of one's body-as-object are equi-primordial, then the latter, far from being an 'aberrant type of appearance',[11] would rather fully constitute one's bodily self-consciousness. Ignoring the structuring role of one's consciousness of one's body-as-object would run the risk of reducing consciousness to its subjective dimension.

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[8] D. Leder, *The Absent Body* (Chicago: University of Chicago Press, 1990), 22.

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[9] Ibid.

[10] D. Legrand, 'Objects and Others in Anorexia Nervosa', in *Philosophy, Psychiatry and Psychology*, forthcoming 2011).

[11] J.-P. Sartre, *L'être et le néant* (Paris: Tel Gallimard, 1943); trans. . Tr.: H. E. Barnes as *Being and Nothingness* (New York: Philosophical Library), 357.

As one is a body, one experiences one's materiality as-subject, as-object and as-anonymous. None of these dimensions of bodily self-consciousness are ever fully eradicated from one's experiential field. The intention of the present contribution is to unfold the scope of this conception of bodily self-consciousness. In particular, what is proposed here is that, *due to their mutual irreducibility and complementarity, the different dimensions of bodily self-consciousness are neither fully integrated to each other nor fully dis-integrated from each other*. Rather, *typical bodily self-consciousness is characterized by a tension inherent to its multidimensionality*, a tension that may atypically lead to what will be described here as processes of '*constitutive self-negation*'. To anticipate, as conceptualized here, '*constitutive self-negation*' is a process of constituting oneself through a process of negating oneself, or a process of negating oneself in order to constitute oneself. In particular, and as touched upon above (section 1), while eating, one is not only assuming survival; one is also negating one's subjecthood by incorporating food, thereby incorporating oneself into the realm of anonymous organic processes and of corpses, assuming one's dependence to one's objecthood, thereby negating the sovereignty of one's subjecthood. Conversely, one may eat nothing as an act of constitutive self-negation: while eating nothing, one may refuse to let one's subjecthood surrender to one's objecthood. One may then seek to constitute one's subjecthood by negating one's objecthood, refusing to incorporate food, thereby refusing to be incorporated into the realm of anonymous organic processes and of corpses.

3. EXPERIENTIAL DESCRIPTIONS

To start with, the idea that there is a tension inherent to bodily self-consciousness, and the consequence that it may have on one's experience of oneself, and on one's constitutive self-negation, should be clarified at the *experiential* level. For this, I will first give voice to the people who I will be referring to throughout this contribution when considering atypical bodily experiences, quoting (at length) from their published reports. I will first present the quotes 'raw' so that the reader can get a sense of how they 'taste' on their own, and I will then 'bake' them in the conceptual 'oven' proposed above – together with some other 'ingredients' and 'spices'.

Marya Hornbacher

The first type of atypical bodily experience that will be discussed here is *anorexia.* For the sake of consistency and conciseness, I will refer here to one particular story 'only'. Marya Hornbacher was born in 1974, in California. When she was 23, she wrote her autobiography entitled *Wasted.*[12] There, she describes how she 'became bulimic at the age of nine, anorexic at the age of fifteen [...] and now, at twenty-three, [she is] an interesting creature, an Eating Disorder Not Otherwise Specified'.[13] An eating disorder, she describes, has 'the centripetal force of black holes'[14] as 'one's worth is exponentially increased with one's incremental disappearance'.[15] She describes an eating disorder as

> a bundle of deadly contradictions: a desire for power that strips you of all power. A gesture of strength that divests you of all strength. A wish to prove that you need nothing, that you have no human hungers, which turns on itself and becomes a searing need for the hunger itself. It is an attempt to find an identity, but ultimately it strips you of any sense of yourself, save the sorry identity of "sick." It is the grotesque mockery of cultural standards of beauty that winds up mocking no one more than you. It is a protest against cultural stereotypes of women that in the end makes you seem the weakest, the most needy and neurotic of all women. It is the thing you believe is keeping you safe, alive, contained – and in the end,

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[12] M. Hornbacher, *Wasted. A Memoir of Anorexia and Bulimia* (NY: Flamingo, 1998).

[13] Ibid., 2.

[14] Ibid., 129.

[15] Ibid., 4.

> of course, you find it's doing quite the opposite. These contradictions begin to split a person in two.[16]

She reports:

> I have never been normal about my body. It has always seemed to me a strange and foreign entity. I don't know that there was ever a time when I was not conscious of it. As far back as I can think, I was aware of my corporeality, my physical imposition on space [...] I do not remember very many things from the inside out. I do not remember what it felt like to touch things, or how bathwater traveled over my skin. [...] I did not like to be touched because I craved it too much. [...] I remember the body from the outside in. [...] I remember wanting. And I remember being at once afraid and ashamed that I wanted. [...] Somehow, I learned before I could articulate it that the body – my body – was dangerous. The body was dark and possibly dank, and maybe dirty. And silent, the body was silent, not to be spoken of. [...] I watched it with a wary eye.[17]

According to Hornbacher,

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[16] Ibid., 6.

[17] Ibid., 13-4.

> the shrinks have been paying way too much attention to the end result of eating disorders – that is, they look at you when you've become utterly powerless, delusional, the center of attention, regressed to a passive, infantile state – and they treat you as passive, infantile creature, thus defeating their own purpose. This end result is not your intention at the outset. Your intention was to become superhuman, skin thick as steel, unflinching in the face of adversity, out of the grasping reach of others.[18]

David Nebreda

The second person I am calling in here is David Nebreda. Born in 1952 in Madrid, he is a photographer, exclusively devoted to self-portraits and to the writing of books that 'recount the story of a schizophrenic process'.[19] Though he has not been diagnosed with eating disorder, the peculiarity of his eating behaviour and the radical consequences it has on his body, as well as the potential (existential) relations between schizophrenia and eating disorder[20] make his story a relevant case of ‘constitutive self-negation’ in the present context.

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[18] Ibid., 68.

[19] D. Nebreda, *Autoportraits.* (Paris : Editions Léo Scheer, 2000), 9.

[20] L. Binswanger, 'Der Fall Ellen West', *Schweizer Archiv für Neuroloie und Psychiatry*, 1944; 'The Case of Ellen West, An anthropological-Clinical Study', in R. May et al. (Eds.) *Existence: A New Dimension in Psychiatry and Psychology* (New York: Basic Books, 1958).

David Nebreda has ‘the conviction that there still exist spaces for genuine investigation concerning behaviour – human and non pathological – and its limits’.[21] Such investigation is ‘in accordance with [his] most intimate project’.[22] He describes how he lives this project in the following way:

> I live alone, have neither family nor any social contact in my country. [...] I live concentrated, devoting myself to my reflections, I do not do anything else;[23]
> I stayed, during nine years of my life, without getting outside and without pronouncing a single word.[24]

Always working alone, he says,

> forces me to be perfectly conscious of my brain and of its instrument – my body, its possibilities, the most minimal nuances of its movements, its situations in space and its continual alterations[25]
> I seek – always sat on the bed, in silence, eyes closed, that’s how I spend my time – to approach and to see

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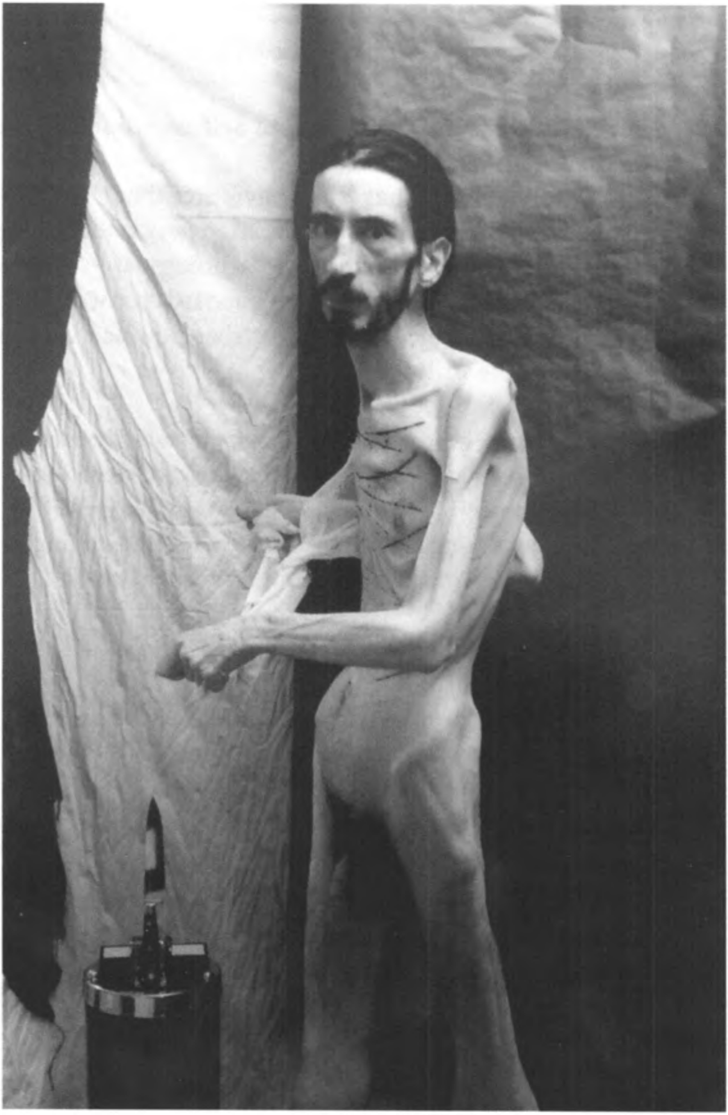
[21] D. Nebreda, *Sur la Révélation* (Paris : Editions Léo Scheer, 2006), 17.

[22] Ibid., 17.

[23] Ibid., 21.

[24] Ibid., 27.

[25] Ibid., 22.



David Nebreda, *Le cadeau de la mère. Le couteau nouveau portant mon nom.*
[The gift of the mother. The new knife having my name]
(D. Nebreda, *Autoportraits*, 62). ©2000 Éditions Léo Scheer

> an image of myself which must not only be perfectly composed [...] but also obey to a precise rule of reflection[26]
> Once the mental image has been perfectly constructed, measured and justified, I use my camera.[27]

He insists:

> my body is only an instrument whose control must always be subjected to an idea of general discipline.[28]
> Self-portrait is an exercise of reflection and of internal organization, much more than an exercise of representation [...]. Self-portrait can be neither biographical, nor artistic, nor cathartic, nor complicit [...]. The self-portrayed body [...] must be calm and precise.[29]

For that to happen,

> the first decision contents itself with ceasing (silence, lack of hygiene, of food, of movement, of clothes...), when this is not enough anymore, one must open oneself, lacerate oneself, bite oneself, flog oneself, burn oneself, maintain the wounds infected [...], the body must exhaust itself, for the foreign matter to be

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[26] Ibid., 22.

[27] Ibid., 23.

[28] Ibid., 26.

[29] Ibid., 29.

> put to the test. [...] One cannot talk of violence – no matter the violence inflicted – since genuine violence would come from preventing it.[30]

In the notes about the self-portraits he took in 1989-90, David Nebreda asks: what is 'the relation between himself and the photographical other'?[31] And he answers:

> One knows well that the reality of this relation is the 'other', [...] once one reaches the goal initially set to renounce one's own identity in favour of the new one, the fruit of this relation, that is, that of the photographic witness (and not of the photographic object) in his status as another me, more real and more definite.[32]

Being constrained to stay at the psychiatric hospital from 1990 to 1992, he then lives 'seven years of silence and of near-paralysis'.[33] When he gets back to photography in 1997, he acknowledges being 'conscious of not being and mistaken about his real image'.[34] His work becomes an 'attempt at the self-recovery of oneself, at the self-reconstitution of an image':[35] 'the author acquired the awareness of not being, from this abolition and exhaustion [...]; he begins a therapeutic attempt at the recovery of a vital cycle which does not manage to happen'.[36]

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[30] Ibid., 72.

[31] Nebreda, *Autoportraits*, 174.

[32] Ibid.

[33] Ibid., 175-6.

[34] Ibid., 177.

One of the questions David Nebreda asks, and that might be the most strikingly relevant one in the present context – the interrogation of the notion of 'constitutive self-negation' – is the following: 'How to maintain an identity when this demands and is recognizable only by the means of offering relentlessly proof of one's own destruction?'.[37] It is this question that is at stake in his life, 'to the extent that the demonstration of his own existence, that the awareness of his own identity are not questions of rhetoric any more but a daily *tour de force*'.[38] It is notably this question that is at stake also here, only at a theoretical level.

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[35] Ibid.

[36] Ibid.

[37] Ibid., 162.

[38] Ibid., 184.

4. THE MIRROR AND THE TENSION BETWEEN ONE'S BODY-AS-SUBJECT AND ONE'S BODY-AS-OBJECT

What follows from the aforementioned distinction between subject and object (section 2) is that bodily self-consciousness is characterized by an irreducible self-fracture between one's consciousness of one's body-as-subject and one's consciousness of one's body-as-object. In particular, as identified by Lacan[39] and further commented upon by Merleau-Ponty,[40] recognizing one's image in a mirror transforms the subject who can now acknowledge that there can be a spectator of himself: contrasting with the body as 'a strongly felt but confused reality [...] the collection of confusedly felt impulses',[41] the recognition of the specular body as one's own brings together with it the possibility of an ideal image of oneself, image which would 'henceforth be either explicitly posited or simply implied by everything I see at each minute'.[42]

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[39] J. Lacan, J, 'Le Stade du Miroir comme Formateur de la Fonction du Je', in J. Lacan, *Écrits* (Paris: Seuil, 1966), 93-100; trans. B. Fink as 'The Mirror Stage as Formative of the I Function as Revealed in Psychoanalytic Experience', in *Ecrits* (New York: Norton, 2006), 75-81.

[40] M. Merleau-Ponty, 'Les Relations avec autrui chez l'enfant' (Centre de Documentation Universitaire, 1951), in M. Merleau-Ponty, *Merleau-Ponty à la Sorbonne. Résumé de cours 1949 1952* (Grenoble : Éditions Cynara, 1988).

[41] Ibid., 136.

[42] *Ibid.*

What matters for the point at stake here is the experiential split that is involved in the recognition of oneself in one's specular image: 'at the same time that the image of oneself makes possible the knowledge of oneself, it makes possible a sort of alienation'.[43] This 'alienation' does not involve the vanity of some excessive fascination for one's physical appearance. Rather, it involves the fact that with specular recognition, the immediately lived body is confiscated for the benefit of the mediatively seen body: one's 'visible me' is given priority relative to one's bodily feelings. This 'captation'[44] is constitutive of oneself, as one is both at once subject and object. Experiencing oneself thus involves a tension between what is given 'here' – one's body-as-subject – and 'there' – one's body-as-object.

By introducing such tension, the objectification of the body that occurs with mirror self-recognition would introduce a negation of the purity of one's subjecthood, a 'negation of its absolute'.[45] In reaction against such a 'narcissistic wound', the child recognizing himself in a mirror would assume 'the armour of an alienating identity, which will mark with its rigid structure the subject's entire mental development'.[46] From the identification – 'the transformation that takes place in the subject when he assumes an image'[47] – due to mirror self-recognition, the subject 'flounders in quest of the lofty, remote inner castle',[48] projecting himself into 'the unthinkable of an absolute subject',[49] seeking an ideal of integrity.

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[43] *Ibid.*

[44] J. Lacan, J, *La Relation d'Object. Séminaire IV* (Paris : Seuil, 1998), 17.

[45] Henri Ey, quoted in J. O'Neill, 'The Specular Body: Merleau-Ponty and Lacan on Infant Self and Other', *Synthese*, 66/2, 2007:201-17, 202.

[46] Lacan, 'Le Stade du Miroir', 4.

Points of controversy notably concern whether the transformation that occurs through the identification with one's specular image can be achieved via other routes, whether the body lived prior to the mirror stage is a 'body in bits and pieces' [*corps morcelé*] or whether the body is first lived as a synesthetic whole which is particularly sensitive to the rejecting or caring behavior of others.[50] These different scenarios are nonetheless united by the idea that bodily self-consciousness hosts a tension between one's body-as-subject and one's body-as-object.

With this in mind, it is interesting to consider again the bodily experiences reported by Marya Hornbacher. She says:

> I remember my entire life as a progression of mirrors. [...] my mother, as I scuttled along sideways beside her like a crab, staring into every reflective surface,

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[47] Ibid., 2.

[48] Ibid., 5.

[49] Ibid., 5.

[50] O'Neill, 'The Specular Body', 209.

> would sniff and say, Oh, Marya, You're so vain. That, I think, was inaccurate. I was not seeking my image in the mirror out of vain pride. On the contrary, my vigilance was something else – both a need to see that I appeared, on the surface at least, acceptable, and a need for reassurance that I was still *there*.[51]

This suggests that the mere experience of her body-as-subject does not suffice to attest her existence. Quite the opposite: she seeks to validate her self-experience/self-existence in the experience of her body-as-object, in her body image. It would be as if, facing her image in a mirror, a surprising thought – conscious or not – would suddenly come to her mind: 'so all this really *does* exist!'.[52] To exploit here Freud's description of his experience of incredulity when facing the Acropolis,[53] it's as if the person who would express such surprise would be divided from herself, far more sharply than is usually noticeable. On the one hand, she would behave as though she is obliged, under the impact of an unequivocal observation (the sight of the Acropolis for Freud, the sight of herself for Marya), to believe in something the reality of which had hitherto seemed doubtful (Freud encountering himself as *a man who*

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[51] Hornbacher, *Wasted*, 13-4.

[52] S. Freud, 'A Disturbance of Memory on the Acropolis', Standard Edition Vol XXII, 237-48, 236.

[53] *Ibid.*

really has gone a long way, while facing the Acropolis; Marya encountering *her own objecthood* when facing her own body image). On the other hand, she is justifiably astonished, because she had been unaware that the real existence of the Acropolis (for Freud) or of her own body-as-object (for Marya) had ever been objects of doubt. We see here how the identification with one's mirror image leads the subject to experience the (potentially 'depersonalizing') tension between, on the one hand, his body-as-object captured in an image and, on the other hand, his body-as-subject never captured as an image.

While (some) anorectics are obsessed with their mirror image, David Nebreda, quite in contrast, did not face any mirror since twenty-one years. He explains that 'the observation of the mirror had been forbidden [...] and, after all those years where one has not looked any mirror, the only reference I have of my image is the one that the photographic double gives me and continues to give me';[54] 'Mirrors [...] did not disappear, they are covered with papers (not entirely, frame etc. included, but only their reflecting surface)'.[55] Despite his aversion for mirrors, David Nebreda also constructs the image of his body-as-object, along the lines (some) anorectics do. But most radically, he does not only shape his body by controlling his eating behaviour, by cutting and burning his body, but also controls the way he appears to himself, by cancelling any spontaneous image of himself: ‘I seek [...] to approach and to see an image of myself which must not only be perfectly composed [...] but also obey a precise rule of reflection. [...] an improvised image is rarely satisfactory.[56]

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[54] Nebreda, *Autoportraits*, 183.

[55] Nebreda, *Sur la Révélation*. 27.

It appears here that, on the one hand, the body-as-subject and the body-as-object are in tension with each other, while on the other hand, this tension, as radical as it may be, does not lead the subject to seek the eradication, but rather the *controlled transformation* of the body-as-object and its image. It is not accidental that this self-transformation is operated through a hyper-controlled eating behaviour by both Marya Hornbacher and David Nebreda (who also uses many other strategies). Indeed, the incorporation of food is possible only on the premise that the subject accepts the fundamental ambivalence of his own being – at once body experienced as *subject*, corpse-like thing experienced as *object*, and living organism experienced as one’s anonymity. One may experience as unbearable the tension there necessarily is between these dimensions of one’s own being; as a reaction, one may refuse one’s ambivalence, and seek to reduce the tension by transforming oneself, operating on an ambivalent process that one can deliberately control: food-incorporation.

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[56] Ibid., 22.

One may wonder, however, how the tension between the experience of one's body-as-subject and the experience of one's body-as-object, paradigmatically experienced in mirror recognition – typically benign – may have such a tremendous impact that it may become life-threatening, as it is the case both for Marya Hornbacher and for David Nebreda. The next sections intend to unfold this issue.

5. DESIRE VS. NEED

To understand the impact of the experiential tension there is in particular between one's body-as-subject and one's body-as-object, it is relevant to explore the experiential tension there is in general between the subject and any object. And this tension may be adequately captured by introducing here the notion of desire.

The notion of desire is relevant here as it contrasts with that of need. On the one hand, reaching the needed object (e.g. grabbing food) fulfills the need (e.g. fills in the stomach), thereby appeasing it (e.g. calming hunger). On the other hand, reaching the target of one's desire (e.g. savouring the taste of the very special hot-chocolate that your grandmother used to bring you in bed when you were a child) does not fulfill the desire (e.g. your desire to activate your cherished childhood memories), does not appease it,[57] but rather exacerbates it through the very fact of satisfying it (e.g. exacerbates nostalgia).[58] Need is awakened by the absence of the needed object (e.g. food), and turned off by its presence. Need thus involves a form of lack (e.g. hunger) in the sense of a default of presence (e.g. an emptiness in mouth and stomach). Desire, by contrast, is not characterized by a lack of fulfillment: it lacks nothing in the sense that no thing can fill it in (e.g. it is neither the absence of hot-chocolate nor the lack of memories that activates nostalgia through the taste of hot-chocolate). The experience of food catalyzing feelings and emotions is very common but very revealing nonetheless. What it underlines is, again, the ambivalence of eating behaviour: one is never related to food as merely fulfilling one's needs but also as feeding one's desires. Not only food, but any object can occupy such ambivalent place;[59] but the ambivalence seems particularly acute in the case of food. Indeed, owing to human neoteny, which forces the child to receive food from others, one's need for food is deeply linked from early on to one's desire for inter-subjective relations.

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[57] R. Barbaras, *Introduction à une phénoménologie de la vie* (Paris: Vrin, 2008), 134.

[58] Ibid., 127.

[59] Lacan, *La relation d'object.*

Food materializes inter-subjective relations under specific conditions. First, it may be given and received as a sign of the sensitivity of the giver to the receiver's need and desire, if it is given consistently with the manifestation of the subject's call for food and attention.[60] In this sense, the desire expressed by the subject's call may be validated inter-subjectively if it receives appropriate feedback. In contrast, there are multiple ways of invalidating the subject's desire. One such way involves not replying at all to the subject's call, not giving anything. In this case, even the needs of the deprived subject are not met (the child remains hungry). Such *privation*[61] differs significantly from the *frustration* at stake when the subject's desire is not met. In this latter case, an object (food) may be obtained and may fulfil the subject's need (appease his hunger), while failing to carry subjecthood from the giver to the receiver, failing to materialize inter-subjective relations, failing to feed the subject's desire (for care and attention). Moreover, fulfilled needs may *substitute* the frustrated desire, the subject regressively nipping the latter in the bud.[62] In this context, desire is

> what is evoked by any demand beyond the need that is articulated in it, and it is certainly that of which the

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[60] Ibid., 182.

[61] Ibid., 36, 55.

[62] Ibid., 189.

> subject remains all the more deprived to the extent that the need articulated in the demand is satisfied. Furthermore, the satisfaction of need appears only as the lure in which the demand for love is crushed, by sending the subject back to sleep [...]. But the child does not always fall asleep in this way [...], especially if the Other, which has its own ideas about his needs, interferes, and in place of that which it does not have, stuffs him with the choking pap of what it has, that is to say, confuses his needs with the gift of its love. It is the child one feeds with most love who refuses food and plays with his refusal as with a desire (*anorexia nervosa*).[63]

We see here how food (and, according to Lacan, any object) is intermeshed in inter-subjective webs. As one understands that the (m)other may or may not respond to one's hungry calls, given or refused objects (food) acquire the value of a testimony of (m)other's power of acknowledging or censuring one's need and desire. Objects are thus endowed with two layers of potential satisfaction: they may fulfil a need (for food), while they may as well satisfy a desire (for care) thereby symbolizing the favourable power of the (m)other.[64]

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[63] J. Lacan, ' La Direction de la Cure et les Principes de son Pouvoir' [1958], in J. Lacan, *Écrits* (Paris: Seuil, 1966), 585-646: 627-8; trans. A. Sheridan as 'The Direction of the Treatment and the Principles of Its Power', in *Ecrits. A Selection* (London: Routledge Classics, 2001), 173-214: 200.

[64] Lacan, *La Relation d'Object*, 69.

In contrast, they may still fulfil a need (for food), while being frustrating as well, when they fail to feed one's desires, failing to materialize (m)other's care, thereby symbolizing the withdrawal of (m)other's favour.[65]

This framework conveys specific conceptions of the subject's relations to objects, to himself and to others, conceptions which are all interrelated to each other but which will be discussed for their own sake in the following sections.

6. THE SUBJECT'S RELATIONS TO OBJECTS

As far as the subject's relations to objects is concerned, the current framework allows us to understand the 'painful dialectic of the object, at once there and never there'[66] following which the demand of the desiring subject can never be satisfied by a need-fulfilling object[67] but only by what is 'beyond' the object, i.e. the materialization of inter-subjective relations. Reciprocally, what engenders frustration is not the lack of objects but the absence of inter-subjective validation of one's desire.

It appears here that a tension lays at the core of any subject-object relation, not only due to the aforementioned irreducibility between subject and objects

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[65] Ibid., 180-1.

[66] Ibid., 183.

[67] Ibid., 101.

(section 3) but also due to the discordance between any object and the target of the subject's desire: on the one hand, objects are matters of transactions between subjects, as they may be given, refused or retrieved; on the other hand, what is desired is not some exchange of objects but interrelations between subjects. The consideration of desire as constitutive of subjective experience thus leads to the conceptualization of the subject's relation to objects as involving unavoidable tensions,[68] as the latter can never satisfy the desire of the former. This view[69] stands in sharp contrast with some idealist conception of a subject who, like a spider pulling out of itself the strings of its web, would project the constitutive images of his own world, projected world which would thus suit the subject harmoniously.

The experiences reported by (some) anorectics contrast with the conception of the spider-subject and his fulfilling world. It could even be said that the anorectic suffers from knowing all too well that she is not a spider, in the sense that she experiences that the world of objects, on the one hand, and herself, on the other hand, are incommensurable: anorexia involves 'the release, the comfort, the power, however illusory and short-lived, of being able to conquer nature. Of being able to spit in the face, or rather puke on the shoes, of this material realm'.[70] Eating as an act of ingesting objects which are meant to be assimilated by the subject thus becomes both absurd and unbearable as it acts against the irreducibility of the subject to any object. For the anorectic, not only is the subject what the object is not, but moreover the subject is what the object cannot/should not fill in. Interestingly enough, there is some philosophical appeal to this mode of being anorexic. Sartre may be relevantly convoked here. He argues:

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[68] Ibid., 16.

[69] Ibid., 55.

> The description of knowledge is too often alimentary. [...] we are not yet rid of that primitive illusion [...] according to which to know is to eat – that is, to ingest the known object, to fill oneself with it (*Erfüfflung*), and to digest it ('assimilation'). We shall best account for the original phenomenon of perception by insisting on the fact that the relation of the quality to us is that of absolute proximity (it "is there," it haunts us) without either giving or refusing itself, but we must add that this proximity implies a distance. It is what is immediately out of reach, what by definition refers us to ourselves as to an emptiness. Contemplation of it can only increase our thirst for being as the sight of the food out of reach added to Tantalus' hunger. Quality is the indication

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[70] Hornbacher, *Wasted*, 121.

> of what we are not and of the mode of being which
> is denied to us.[71]

In this quote, Sartre characterizes two forms of subject-object relation (in the particular case of perceptual knowledge): one involves the full assimilation of the object by the subject who would thereby be filled in; the other, which Sartre advocates, involves a never-fulfilling object whose capture by the perceiving subject reflects to the latter what he is not: objecthood is the mode of being that is denied to the subject. Sartre describes here the irreducibility of one's subjecthood: no capture of any object would ever suffice to fill in the subject who remains inevitably 'empty', i.e. not-an-object, no-thing.

7. THE CONSTITUTION OF THE DESIRING SUBJECT

Conceptualizing subject-object relations in terms of desire involves conceiving of the subject as driven by an orientation towards desired objects, by an aspiration towards what he is not.[72] The notion of desire also allows the characterizing of this process of reaching out as incessant, since the satisfaction of desire fuels the desire itself and unavoidably fails to nullify the distance between the subject and the object desired (section 5). Importantly, for a subject, being incessantly irreducible to an object does not amount to a lack: being a bodily subject inevitably involves being already an object too. Moreover, being an object is not something one could ever fully achieve without losing one's specificity: being oneself constitutively involves being a subject, i.e. it irreducibly involves not-being-an-object.

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[71] Sartre *L'être et le néant*, 223-4; *Being and Nothingness*, 187.

[72] Barbaras, *Introduction à une phénoménologie de la vie*; D. Legrand, 'Self-consciousness and World-consciousness', in D. Zahavi (ed.), *Oxford Handbook of Contemporary Phenomenology* (Oxford: Oxford University Press, forthcoming).

This characterization contrasts interestingly with Sartre's view. According to Sartre, the subject is determined as a 'lack of being'.[73] Sartre characterizes an 'original connection',[74] or 'bond'[75] between the subject ('for-itself') and what he lacks ('in-itself'). In this framework, the subject is 'an incomplete being' surpassing itself toward a 'particular totality which it lacks'.[76] Nonetheless, Sartre insists, this is an 'impossible synthesis': 'this totality can not be given by nature, since it combines in itself the incompatible characteristics of [objecthood] and [subjecthood]'.[77] The subject is thus suffering because it is 'perpetually haunted' by a totality or coincidence with itself which remains unreachable, precisely because one cannot attain objecthood without losing oneself as subject.[78] Such 'unhappy consciousness with no possibility of surpassing its unhappy state' would involve the fear of losing oneself in the very search for oneself. As is often the case with Sartre's views, however, this characterization would better suit atypical states of consciousness than typical ones.[79] Interestingly, this equivocation sheds some light on a common point between atypical and typical states of consciousness, namely, the tension between irreducible dimensions of oneself. Furthermore, it would be contingent whether such tension is experienced as such, whether it is experienced as a threat to one's integrity, or whether it is experienced as a happy contribution to one's complexity.

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[73] Sartre *L'être et le néant*, 121; *Being and Nothingness*, 85.

[74] Ibid.

[75] Ibid., 122; 85.

[76] Ibid., 125; 89.

[77] Ibid., 126; 90.

The case that Sartre elaborates on, the 'unhappy consciousness' of the subject 'perpetually haunted' by the search of a perfectly harmonious version of oneself, and constantly threatened by the risk of losing oneself in this very search, this case would not capture self-consciousness as such but atypical forms of it. In particular, this characterization suits the experiences reported by (some) anorectics well. For example, Marya Hornbacher states: 'somewhere in the back of my brain there exists this certainty: The body is no more than a costume, and can be changed at will. That the changing of bodies, like costumes, would make me into a different character, a character who might, finally, be all right'.[80] Notice here that, in her mind, neither costumes nor one's body are only external envelopes to the self: one could not change costumes or exchange bodies at no cost to oneself and one's self-experience. Rather, for her, one can 'judge a book by its cover', and she seeks to make her body-as-object fit perfectly herself-as-subject – in vain, since these dimensions of bodily-self-consciousness are irreducible to each other. She believes that the body can be transformed, like one would change clothes, to fully match the way she feels about herself. Reciprocally, she believes that the way she feels about herself can be changed by changing her body, thereby offering to herself the 'right' being. Seeking perfect harmony between one's body-as-subject and one's body-as-object thus haunts (some) anorectics. But the *threat* that this search represents is also vividly present in their experience. Indeed, as subject and object are irreducible to each other, harmonizing them would require losing one or the other. To avoid eating is thus a mode of refusing the assimilation of objects to oneself, in the fear of becoming an object oneself; it is a mode of being a subject by avoiding being an object, by literally voiding one's body from objects before they get incorporated; it is a refusal to be unharmonious, a refusal of the tension there is between one's body-as-subject and one's body-as-object, as well as a refusal to solve this tension by incorporating and being incorporated to objects.

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[78] Ibid.

[79] Legrand, ' Subjective and physical dimensions'.

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[80] Hornbacher, *Wasted*, 31.

On this point, it may be said that Marya Hornbacher and David Nebreda are opposite to each other. Indeed, if Marya Hornbacher seeks to regain a sense of her identity by preserving her body-as-subject, David Nebreda may be involved in the opposite process of regaining a sense of his identity by projecting himself fully in the body-as-object. Of course, this body-as-object is quite peculiar in that its natural functioning is controlled, to the point of its' being annihilated. Indeed, he explains that 'the first big decision consists in accepting myself definitively and secretly as negation of any natural state whatsoever'.[81] This includes negating the pre-personal functioning of the body, 'the search for any mode of putrefaction apart from the one that is inherent to any micro-organism'.[82] Moreover, its image is also rigorously controlled by the practice of photographical self-portraits (section 3). But this radically controlled body image seems to become David Nebreda himself: the 'photographic witness' is not a 'photographic object' but 'another me more real and more definite' in whose favour he 'renounce[s] [his] own identity'.[83] Renunciation here is a mode of constituting oneself without suffering from the intolerable tension between different dimensions of oneself.

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[81] Ibid., 72.

[82] Ibid., 66.

[83] Nebreda, *Autoportraits*, 174.

Nebreda makes this inner tension painfully clear. At the end of the period of work where he produced his first series of colour self-portraits, he was constrained to stay at the psychiatric hospital from 1990 to 1992. He then described the

> degeneration in which one found oneself when the psychiatric entity demonstrated peremptorily the intolerable character of [one's visionary project, which leads to the new life materialized by means of pictures and of notes], and when it [(the psychiatric entity)] maintained without a shadow of a doubt that what it had before its very eyes was not a vital project but a pathological and dangerous entity which must be eradicated as quickly as possible. [...] One will have to renounce [the photographic witness] to protect him. From the moment that all his previous history, personified in the 'evil', had rejected him and evicted him from himself following his experience of death and of rebirth, and [from the moment] that one has to renounce the 'good' [(the photographic witness)] for its own good [(to protect it from the psychiatric entity)], the only perspective

> that remains is that of ‘nothingness’, the everyday hell of radical and profound negation of oneself.[84]

It is at this period that he lives ‘seven years of silence and of near-paralysis’.[85] This description, sharp as a razor, captures the way the tension hosted within oneself may become unbearable. It also underlines the way such tension is itself immersed in an inter-subjective context where others represent one’s own body at will. The impact of *others* on one’s bodily self-consciousness is multi-faceted. Below, I consider only some of the ways inter-subjectivity may be involved in (a)typical bodily experiences and eating practices.

8. THE INTERLACING OF DESIRING SUBJECTS

It follows from the characterization given above that desire targets others. Indeed, the desiring subject may only be satisfied by an object if it materializes others’ sensitivity to his desires.[86] In this sense, the ‘painful dialectic of the object, at once there and never there’[87] also materializes a dialogue between giving-receiving subjects (section 5). This interlacing of desiring subjects may be best explained by appealing to Kojève's reading of Hegel's Master-Slave dialectic.[88]

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[84] Ibid., 175-6.

[85] Ibid.

[86] Lacan, *La Relation d’Object*, 141.

[87] Ibid., 183.

In the current framework, a subject is first of all not-an-object, no-thing. According to Kojève/Hegel, the subject is revealed to himself as a desiring subject and receives a positive content from the action that arises from his desire. This content is relative to the desired target: as no-thing, the subject's 'void' is penetrated by the object his desire targets.[89] By desiring a 'natural' object, the subject assimilates, incorporates, internalizes such object, thereby constituting himself as object-like, e.g. targetting food, he is a fed body, a container of feeding matter. Notice that this is exactly what (some) anorectics refuse: to be reduced to an object by assimilating objects (section 6). To genuinely constitute himself-as-subject, the subject cannot assimilate any thing, he can only desire no thing. In particular, if the subject desires another subject, he assimilates the nature of this subject, i.e. desire. Thereby, we see here that mutually desiring subjects exacerbate their subjecthood by amplifying their respective desires, feeding each other. In this sense, desire is 'anthropogenetic', i.e. it constitutes humans as self-conscious beings, when it does not target objects but others' desire. For example, subjects desire food as humans when they react not only to their bodily need for food, but to the desire to be fed by others, food thereby becoming a materialization of others' care.

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[88] A. Kojève, *Introduction à la lecture de Hegel : leçons sur la Phénoménologie de l'Esprit professées de 1933 à 1939 à l'École des Hautes Études* (Paris : Gallimard, 1980), trans. J. H. Nichols as *Introduction to the Reading of Hegel: Lectures on the Phenomenology of Spirit* (Ithaca, NY: Cornell University Press, 1980).

[89] G. Catren, 'The Thing and The Shrink', conference presentation, *Dark Materialism*, Kingston University, UK, January 12, 2011. At http://backdoorbroadcasting.net/2011/01/dark materialism/.

(Some) anorectics epitomize the inter-subjective constitution of the subject.[90] Their sense of themselves is mediated not only through their image (section 4), but also through others. Through others' approbation, they seek the objective confirmation of their being. They exist for themselves only through others: 'What are you worth if no one's looking? How do you know you're even there?'.[91] In Sartre's words, the self is here enslaved to the other: 'I am a slave to the degree that my being is dependent on the centre of a freedom which is not mine and which is the very condition of my being'.[92] In this sense 'my original fall is the existence of the Other'.[93]

Moreover, (some) anorectics recognize all too well that others cannot validate them if they are themselves enslaved; that the attitude of the master treating slaves as dependent animals is an existential deadlock: only a free desiring subject can validate one's own desire; only mutual desires are constitutive. Like a slave, the anorexic subject understands that she depends on others' subjecthood to be validated as subject. Like a slave, she must free herself from any unidirectional dependency in which her desire would suffocate for the benefit of others' desire. To establish reciprocity, she must negate herself as slave. As she cannot negate her dependency upon others, as others' desire remain her master, she cannot do anything other than negate herself; as she cannot reduce others to slavery without thereby losing the inter-subjective recognition her being relies upon, it is her own body that she subjects to slavery. This latter point will now be unfolded.

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[90] Legrand, 'Subjective and physical dimensions', 'Objects and Others'.

[91] Hornbacher, *Wasted*, 125.

[92] Ibid., 267.

[93] Ibid, 263.

9. NEGATING ONE'S BODY-AS-OBJECT

As we saw above, in the current framework, the subject is conceived of as revealing himself as a desiring subject and as receiving a positive content from the action that arises from his desire. Such action negates the desired target, not by eradicating it but by transforming it. Kojève takes eating as an example of such an action that is negating without being merely destructive: the subject who eats creates and maintains his own being thanks to the transformation, internalization, incorporation of food, i.e. a foreign, external object which the subject is not. Again, this is quite precisely what (some) anorectics refuse: to be constituted through the assimilation of foreign objects, to be constituted by alterity, as this would threaten the autonomy and irreducibility of themselves-as-subjects.

For the subject to be constituted as subject, he cannot content himself with desiring objects (section 8). Rather, he must prioritize his subject-specific desire over the fulfillment of his object-related need. As it turns out, fulfilling needs involves self-preservation, the maintaining of the constancy of a pre-constituted internal milieu, the conservation or restoration of a self-constituted subject and in particular the homeostatic conservation of one's life. It follows that it is by bracketing the preservation of himself as a given living being that the subject may attest his subjecthood: *self-constitution must overcome self-conservation.*

In particular, prioritizing his desire, the subject negates the need of his body. Therefore, even though 'there appears round our personal existence a margin of almost impersonal existence, which can be practically taken for granted, and which I rely on to keep me alive', and even though 'for most of the time personal existence represses the organism without being able either to go beyond it or to renounce itself; without, in other words, being able either to reduce the organism to its existential self, or itself to the organism', in particular circumstances, 'my human situation abolishes my biological one'.[94] To continue with Kojève's own example, the subject may be revealed to himself as desiring food, but as the subject eats, he assimilates the objecthood of food, thereby negating as much as constituting his subjecthood. *Negating* food, on the contrary, as both Hornbacher and Nebreda do radically, allows the subject to overcome the fulfilment of his bodily needs, thereby overcoming the constitution of himself as an animate material thing – an organism living anonymously – and as an inanimate material thing – a corpse (section 2).

To negate food, however, is not to stop eating all together. Rather, it notably involves controlling voluntarily one's eating behaviour. What is negated is the nutritional need of one's body, as fulfilling nutritional needs represents the surrendering of the subject to the matter of his body, to his belongingness to the realm of anonymous organic processes and of corpses. As Deleuze argues, anorexia:

> is not a matter of a refusal of the body, it is a matter of a refusal of the organism, of a refusal of what the organism makes the body undergo. [...] The anorexic void has nothing to do with a lack, it is on

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[94] M. Merleau-Ponty, *Phénoménologie de la perception* (Paris: Éditions Gallimard, 1945), 99-100; *Phenomenology of Perception* (London: Routledge and Kegan Paul, 1962), 84.

> the contrary a way of escaping the organic constraint of lack and hunger at the mechanical mealtime.[95]

Nutritional needs are negated by being transformed into (non-)eating projects representative of one's subjecthood, and thereby constitutive of it. Physiologically, the human being is an omnivore. Constructing oneself beyond one's need thus involves selecting specific aliments, not for their nutritional value but for their subjective value, that is, for how they may symbolize oneself-as-subject. Anorectics do not stop eating, or they die: 'People have this idea that eating-disordered people just don't eat. Wrong. They have rules about what they eat';[96] 'I had decided to ingest one hundred calories a day. It seemed a good number, a tidy number, a 'diet' rather than a disorder, a Plan. Carrots, mustard, two pretzels, the milk in my coffee.[97] Anorectics live thanks to a careful selection of aliments that represent and express who they are or want to be(come). As for Nebreda, 'vegetarian since more than thirty years, [he] follow[s] a strict diet composed of a small number of invariable food (eight or nine) which [he] eat[s] raw or simply cooked in water'.[98]

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[95] G. Deleuze, C. Parnet, *Dialogues* (Paris: Flammarion, 1977), 132; trans. H. Tomlinson & B. Habberjam as *Dialogues* (New York: Columbia University Press, 1987), 110.

[96] Hornbacher, *Wasted*, 113.

[97] Ibid., 119.

[98] Nebreda, *Sur la Révélation*, 21.

These cases put the selection of food to such an extreme that they exemplify unequivocally that what is at stake here is not some game, coquetry or vanity, but the constitution of oneself by risking one's life, the constitution of oneself as a desiring subject by the negation of one's bodily needs. Negating over and over again the constitutive belongingness of one's body to the realm of anonymous organic processes and of corpses is necessary for the incessant constitution of oneself-as-subject, which always risks falling into mere objecthood as one eats, thereby internalizing the objecthood of food.

10. MATERIALIZING NO-THING-NESS

This framework allows us to understand that a lack of objecthood is not sufficient for the constitution of subjecthood. Rather, what is at stake is the dialectical negation of one's objecthood: its transformation. To understand the type of transformation that is relevant for the constitution of one's subjecthood, let us return to the idea that subjecthood is constituted through inter-subjective validation, that is, through reciprocal recognition: the other who I value as a subject must recognize me in return to validate me as a subject (section 8). For that to happen, subjecthood must be expressed in the material world that the subject shares with others. The subject must be capable of showing himself to others specifically as subject, i.e. he must materialize his no-thing-ness.

Strikingly, both Hornbacher and Nebreda must make their subjectivity exist in the outer world in order for them to believe that they exist. Neither of them are 'Cartesian' subjects who could be certain that they exist while doubting about their materiality. As Marya Hornbacher describes, 'a disappearing act, the act of becoming invisible, is, in fact, a visible act, and rarely goes unnoticed'.[99] Here again, (some) anorectics' reports would join Sartre's words:

> What we call 'noble' or 'good' or 'true' suffering and what moves us is the suffering which [...] is presented to us as a compact, objective whole which did not await our coming in order to be and which overflows the consciousness which we have of it; it is there in the midst of the world, impenetrable and dense, like this tree or this stone; it endures [...]. And it is as such that it fascinates us [...]. The suffering which I experience, on the contrary, is never adequate suffering [...]. It escapes as suffering toward the consciousness of suffering. [...] If I must suffer, I should prefer that my suffering would seize me and flow over me like a storm, [...] but this enormous, opaque suffering, which should transport me out of myself, continues instead to touch me lightly with its wing, and I can

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[99] Hornbacher, *Wasted*, 129.

> not grasp it. I find only myself, myself who moans, myself who wails, myself who in order to realize this suffering which I am must play without respite the drama of suffering. I wring my hands, I cry in order that [...] their sounds, their gestures may run through the world [...]. Each groan, each facial expression of the man who suffers aims at sculpting a statue-in-itself of suffering. But this statue will never exist save through others and for others.[100]

As this quote emphasizes, the materialization of one's experiences in the material and shared world allows grasping those experiences and offering them to inter-subjective validation. As already seen above (section 4), for (some) anorectics, the experience of one's body-as-subject may indeed be too dim and would need a supporting validation requiring its materialization into one's body-as-object.

As for Nebreda, his photographical witness assures him that he exists for real. The construction of this highly-controlled image is a 'vital project' for him.[101] The material world must express one's subjecthood; one's 'endemic hungers' must be materialized in a 'made-to-measure ectoplasm'.[102]

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[100] Sartre *L'être et le néant*, 128; *Being and Nothingness*, 91-2.

[101] Nebreda, *Autoportraits*, 175.

[102] Nebreda, *Sur la Révélation*, 56.

Both cases evidence that one's own body must be seen as the carrier of one's subjecthood. As such carrier, the body-as-object is fundamental for the constitution of oneself-as-subject. The body-as-object may carry, express, expose subjecthood to the subject himself and to others, thereby participating to the constitution of oneself-as-subject. Conversely, if the subject is not carried, expressed, exposed by the body-as-object, he fails to be recognizable by others and evaporates as a solipsistic illusion. Being or rather becoming a subject thus involves practices of bodily self-transformation leading the body-as-object to expose one's subjecthood. Plagiarizing Negarestani's characterization of decay allows understanding the sense in which anorexia and other forms of constitutive self-negation like the one performed by David Nebreda are building processes involving the objective manifestation of subjecthood: 'a building process toward exteriority'.[103]

11. CONSTITUTIVE SELF-SUBTRACTION

Crucially, self-transformation may be both at once self-constituting and self-negating. To unfold this point, let me import here what Negarestani described in another framework, namely the Etruscan torture in which 'a living man or woman was tied to a rotting corpse, face to face, mouth to mouth, limb to limb, with an obsessive exactitude in which each part of the body corresponded with its matching putrefying counterpart'.[104] After Aristotle, Negarestani discusses this torture as an 'analogy with the twofold composite of the body and soul'.[105] In this view, 'we are punished much as those tortured by the Etruscan robbers: so our souls, tied together with our bodies as the living fixed upon the dead'.[106] This view affiliates the body to a corpse and links the living to the soul. Negarestani exploits this in the aim of unfolding the necrocratic dynamic of life itself. For my own purpose, however, I will maintain the torture at the bodily level. But instead of linking one's living body to another dead body, the torture may be an analogy of the tension there is between the different dimensions of one's own body. On the one hand, the corpse figures the body-as-object, as both partly share common attributes: shape, opacity, etc. On the other hand, the living body figures the body lived as subject, while the corpse lacks subjectivity. The Etruscan torture can thus function as an allegory for the double-sidedness of one's own body: at once subject and object, characterized at once by features specific to subjects and by features shared with objects. This is the 'necrophilic intimacy' of the body.

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[103] R. Negarestani, 'Undercover Softness: An Introduction to the Architecture and Politics of Decay', Collapse VI, 379-430: 385.

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[104] R. Negarestani, 'The Corpse Bride: Thinking with Nigredo', **Collapse IV**, 129-161.

[105] Ibid., 130.

[106] Ibid., 132.

In this sense, anorexia would be a necrophobia, since (some) anorectics refuse the 'dead' that composes their body – and who would blame them for being repulsed by the Etruscan torture?

Negarestani's analysis of *aphairesis* (from the Greek: withdrawal, separation) is most relevant here: '*aphairesis* emphasizes simultaneously removal (that which is taken away) and conservation (that which is left behind by removal) – the removed and the remainder'.[107] *Aphairesis* is an operation of subtraction which, as such, is composed to two vectors: 'The negative vector is the vector of removal whereby belongings or attributes are subtracted from a magnitude. The positive vector, on the other hand, emphasizes the possibility of conservation and persistence against subtraction. The vectors of *aphairesis* respectively effectuate the removed and the remainder in subtraction'.[108] These two vectors are necessary to each other: on the one hand, shedding continues only as long as some remainder can support the operation of subtraction; on the other hand, the remainder is attested only as long as it resists some subtraction.

Inevitably, one thinks here about atypical bodily experiences. Remember (section 3b) David Nebreda's striking question: 'How to keep an identity when this demands and is recognizable only by the means of offering relentlessly proof of one's own destruction?'.[109] Negarestani's analysis of the notion of *aphrairesis* allows us to address this question, as he shows how relentlessly proving one's existence and identity *requires* relentlessly proving its resistance to subtractive self-negation. Anorexia can also be better understood in this framework – the anorectic's eating nothing may be seen as a subtractive operation. In fact, Negarestani's characterization of *aphairesis* could be used, word for word, to describe anorexia: 'a procedure which takes away all that exists extraneously and negatively contributes to all that remains and itself progressively diminishes'.[110] We understand here that the anorectic's necrophobia does not lead her to mortification[111] in the sense that the very process she is engaged in requires that her body to remain – to remain less and less without disappearing all together: it is through the diminishing persistence of her body that the anorectic attests the continuity of her existence/identity: as she needs to continuously attest herself, she is constrained to 'the infinitesimal persistence of the decaying object – in other words, its limitropic convergence upon zero'.[112] Letting the body persist minimally is thus necessary not only for the continuation of the anorectic's life but also for the continuation of the anorexic project. The same can be said about David Nebreda: the living body must relentlessly bleed to attest its own decay and recovery, thereby attesting its existence. In both cases, the 'vital project' involves continuing to remain/become oneself by continually stripping oneself of what's foreign (the corpse-likeness of the body-as-object and pre-personal spontaneity of the organism).

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[107] Ibid., 136.

[108] R. Negarestani, 'Differential cruelty', *Angelaki* 14: 3, 2009: 69-84, 73.

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[109] Nebreda, *Autoportraits*, 162.

[110] Negarestani, 'The Corpse Bride', 138.

[111] Ibid., 139.

[112] Ibid., 388.

12. NO-THING-NESS

Now, one must ask: what is it that guarantees and is attested by the operation of subtraction? It cannot be an object since, ultimately, all objects will have to be stripped off for the subtraction to continue up to its own radical limit. As Negarestani shows, what guarantees and is attested by the operation of subtraction can be neither what remains contingently and will eventually be removed nor what is already removed: rather it is a 'resistance toward correlation with what remains and what is removed'.[113] In other terms, what guarantees and is attested by the operation of subtraction cannot be an object, it has to be no-thing qua non-object. No-thingness is thus what guarantees the continuation of subtraction, thereby guaranteeing the continuation of the attestation of this very no-thingness.

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[113] Ibid., 144.

In particular, what guarantees and what is attested by one's self-subtraction is one's own no-thingness, one's irreducibility to objecthood, i.e. one's subjecthood. We understand here that the one way of attesting oneself-as-subject is by peeling away one's body-as-object as an act of revealing one's body-as-subject as no-thingness. The anorectic takes this literally and traps herself in a deadly contradiction: being necrophobic, i.e. refusing to surrender to the corpse-likeness of her body-as-object, she ends up mimicking the dead. She 'prioritize[s] the reign of the void qua non-belonging'.[114] She constructs herself/her body 'as a byproduct of the differential regurgitation of a shriveling body which is in the process of becoming less and less, without ever finding the relief of complete annihilation'.[115] What is negated here is oneself as a given, in favour of oneself as self-constituted through an operation of self-negation. It is only by constituting one's body-as-object actively, by actively negating the body as given, that the body-as-object may express one's subjecthood. The operation at stake here is thus a dialectic negation that is, a conserving suppression or suppressing conservation. The entity that is suppressed dialectically is cancelled in its contingent aspect of being a naturally given being (pre-personal life and death) but it is retained as significant and meaningful

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[114] Negarestani, 'Differential Cruelty', 76.

[115] Negarestani, 'The Corpse Bride', 382.

(oneself-as-subject). On the one hand, anorexic processes can be said to involve a dialectic negation in the sense that the negation of their body as manifesting their corpse-likeness involves the constitution of their body as manifesting their subjecthood. On the other hand, David Nebreda can be said to be involved in a dialectic negation, not because he produces 'art', but first of all because he produces what he considers/experiences as himself (his photographic double).

13. SYMBOLIC NEGATION

In the view proposed here, anorexia is not understood as primarily involving the construction of a body-as-object with obsessive care for its shape and weight. What (some) anorectics primarily seek is rather the formation of the body-as-object as a manifestation of their body-as-subject, which can thereby be carried in the world and expressed to others. Such anorexic subject exposes to others what she is as subject: nothing. And she shows how to relate to others beyond the transaction of objects and exchange of bodies.

Inter-subjective relations are shaped by *signs* of love, attention, understanding, listening of the subject('s desires).[116] As the expression of inter-subjectivity cannot be reduced to the transaction of any thing (section 5), the clearest sign of inter-subjectivity (love) is the gift of what one lacks. Reciprocally, inter-subjective relations target no thing, i.e. the subject and what he lacks.[117] It thus appears here that (some) anorectics (like the young homosexual woman described by Lacan)[118] want to expose to others how they want to be loved. What such an anorexic subject materializes is that she is not an object of love and that she refuses to be so; what she begs is to be loved, not for what she has, a body-as-object with breast and hips, but for what she is, a body-as-subject, no-thing. She wants to be given the type of love she's been frustrated of, as her desires have been choked by the (over-)fulfillment of her needs (section 5).

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[116] Lacan, *La Relation d'Object*, 140.

We understand here that this anorexic subject may refuse fulfillment to preserve the function of desire[119] and that this process is inter-subjective. More in detail, eating relies primarily on the goodwill of others. The demand to be fed, addressed by the subject to others, is the simplest oral demand. To this demand, the (m)other responds by the inverse demand that the subject lets himself be fed. It is in this *encounter* of two demands that lies a (inter-subjective) desire that overflows the (nutritional) demands themselves. We see here that fulfilling nutritional needs may silence the demands, in turn extinguishing the desire expressed in their confrontation. This view sheds light on why a subject who is hungry may not allow himself to be fed, as he may refuse to disappear as desire by being fulfilled as demand. Abandoning one's desire to others, enslaving one's desire to the power of satisfaction which the (m)other is endowed with, is accepting that one's desire may be shattered by the fulfilment of one's bodily needs, a stuffed mouth being unable to express desire in the oral demand. As in idealized love (that, strangely, is understood as specifically masculine), what is sought in anorexia (mostly seen as feminine) is non-fulfilment.[120]

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[117] Ibid., 142; A. Johnstone, 'Nothing is not Always No-One: (a)voiding Love', *Filozofski vestnik*. XXVI: 2, 2005, 67–81.

[118] Lacan, *La Relation d'Object*, 145-7.

[119] J. Lacan, *Le Transfert. Séminaire VIII* (Paris: Seuil, 2001), 178)

Anorexia is seen here as an inter-subjective process whereby a subject expresses her desire that others desire her as desiring. Another way of saying this is to say that anorexia is a *symbolic* process.[121] Rather than focusing on (normative) body image, unfolding the idea that anorexia is a symbolic process leads to the distinction between an object and a gift: a gift is an object received as a sign of the sensitivity of the giver to the receiver's desire. As such, it is not reducible to the transaction of any particular object but materializes the interaction of subjects. A gift materializes no-thing and as such, it exists symbolically, the materializing object being replaceable by any other object. It may be replaced by words,[122] and it may as well be replaced by no thing at all. According to Lacan, this is what explains anorexic symptoms. Anorexia is not a refusal to eat, a negation of activity, but *an act of eating nothing*, a no-thing which exists symbolically.[123] No-thing is savoured as such and is used to preserve one's desire from being swallowed up. In anorexia, the hungry subject refuses to respond to (m)other's demand: 'let me feed you'; by annihilating the object (food) that materializes both her dependency on bodily needs and her dependency on the demanding (m)other, she builds up 'a perfect response to a lack of autonomy':[124] 'The anorexic body seems to say: I do not need. It says: Power over the self [...] power over the body, over the life, over the people around you, power over a world gone berserk'.[125]

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[120] Lacan, *La Relation d'Object*, 109, 141.

[121] Ibid., 155.

The role of the (m)other in David Nebreda's project is particularly delicate to characterize/understand and any 'interpretation' would be unwarranted. Encountering his work, it is impossible not to see that his self-portraits are culturally anchored, that his mother is particularly 'present' in his writings and photographs (one picture of her and many references), that the very act of exposing his photographs and of publishing his words places him in a socially recognizable and intersubjectively shared location. Nebreda says that his experience of the look of the other is not very different from that any other person may have.[126] Importantly, however, he insists that he lives and works alone (section 2b); exceptionally he pictures himself and only himself; his art is not primarily directed at others – at first, he buried his self-portraits. His books are not for him an opportunity of encountering others but an 'outlet for all the negations'.[127] Nonetheless, he himself describes that 'it is by thinking of me, by demanding of myself, by ripping myself, by contradicting myself, but above all by giving up myself that I constitute myself necessarily in a cultural form'.[128] Importantly, he does not pursue the representation of himself. Rather, as Baudrillard says:

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[122] Ibid., 175.

[123] Ibid., 184-5.

[124] Hornbacher, *Wasted*, 68.

[125] Ibid., 85.

> he finds the strength to inscribe himself in a living sign, the living equivalent of [his] mental destruction – the sign of his own body. His own body or his personal body? At any rate it is the only living object available to him in his reclusion with which to put his own death into circulation. [...] He manages to deny himself absolutely and to produce that denial

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[126] Nebreda, 'J'espère que Mon Travail Sera Toujours Innocent. Entretient. Propos recueillis et traduits par Anna Guilló', *La Voix du Regard*, 15, 2002 : 72-7, 77.

[127] Nebreda, *Sur la Révélation*, 57.

[128] Ibid., 61.

> as work, and even as artwork. For his photos are not mere testimony, they are works. And this is where art appears as the perfect simulacrum: not just the sign, but the simultaneity of the thing and the sign [...] That is not in any way representative.[129]

The 'simultaneity of the thing and the sign' would indeed be at the core of Nebreda's 'production'. It is in this sense that his work is a *production of identity*. He would not be able to represent his identity, as this would presuppose the existence of the identity to be represented. He is rather moulding himself by the very act of picturing himself. The 'photographic double' and the act of giving birth to it is not 'just' a crucially important aspect of himself; it is himself as he lives himself. In exposing his photographs, he is thus giving *himself* to the gaze of others, and to their (mis)interpretation.

14. CONCLUSION

What has been proposed here is that, for the body to attest to rather than cancel one's subjecthood, the subject must form his body, for it to escape the status of a natural (living or dead) object. To be more or less than an object, the subject must realize himself as a self-made body. This work of self-realization is rooted in the anxiety of death,[130] as it is rooted in the negation of one's bodily needs, the negation of the preservation of oneself as a given (section 9). One's irreducibility to objects must be expressed in the material world in order for others to recognize it, to validate the subject's subjecthood (section 10).

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[129] J. Baudrillard, *L'Echange Impossible* (Paris :Editions Galilée, 1999); trans. C. Turner as *Impossible Exchange* (London: Verso, 2001), 125-6.

If one's subjecthood were only internal, intimate, invisible, mute, it would conflict with other subjects who live in solidarity with the material world. In this sense, as defended by Kojeve, if a subject changes and

> his change remains 'private', purely subjective, revealed to himself alone, 'mute', not communicated to others [...] this "internal" change puts him at variance with the World, which has not changed, and with the others, who are bound to the unchanged World. This change, then, transforms man into a madman or a criminal, who is sooner or later annihilated by the natural and social objective reality. Only work, by finally putting the objective World into harmony with the subjective idea that at first goes beyond it, annuls the element of madness and crime that marks the attitude of every man who – driven by terror – tries to go beyond the given World

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[130] Kojève, *Introduction à la lecture de Hegel.*

> of which he is afraid, in which he feels terrified, and in which, consequently, he could not be satisfied.[131]

While un-exposed subjecthood turns the subject into a madman or a criminal, the expression in the material world of one's subjecthood – as atypical it may be – may be motivated by the desire to accord oneself with others, by building a world where one has a place, and where one can share oneself with others, thereby appeasing one's craving for inter-subjective validation.

One's own body seems the most primary locus of the self-transformation that must occur, for matter to expose one's subjecthood. And manipulating food-incorporation seems the most basic way to perform such self-transformation. In particular, a radical subtraction from one's body of the elements of pre-personal life and death can be conceptualized as involving two contemporaneous processes: *shedding* one's objecthood, thereby attesting to the *irreducibility* of one's body-as-subject and one's body-as-object; and *exposing* one's no-thingness, thereby attesting to their ineradicable *intermeshing*.

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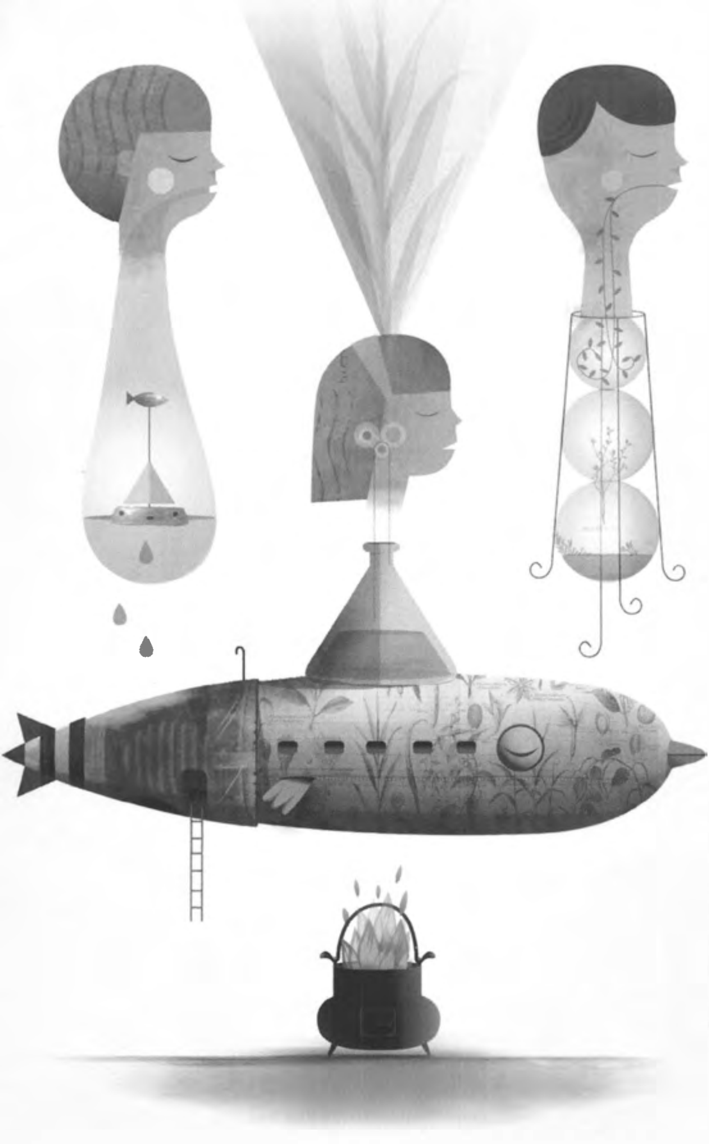
[131] Ibid., 28.



On Philosophical Alchimery, or Why All Chimeric Compositions are Philosophical Stones

Gabriel Catren
Illustration by Cristian Turdera[1]

> *If you have a philosophical stone, do you therefore also have a mathematical and artistic stone? etc.*
>
> NOVALIS[2]

> *I have always dreamed and attempted something else, with the patience of an alchemist, ready to sacrifice all vanity and all satisfaction, as in the past one burned his furniture and the beams of his roof, to feed the furnace of the Great Work.*
>
> MALLARMÉ[3]

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[1] http://www.cristianturdera.com/.

[2] Novalis, *Notes for a Romantic Encyclopaedia, Das Allgemeine Brouillon*, trans. E.W. Wood (Albany, State University of New York Press, 2007), 16.

[3] S. Mallarmé, 'Lettre à Paul Verlaine, 16 novembre 1885', in S. Mallarmé, *Œuvres complètes*, ed. B. Marchal (Paris : Gallimard, 1998), tome I, 789.

The system of faculties of a local subject is a *prism* that, according to the different possible interests of reason and the concomitant entanglements of faculties, refracts experience onto different abstract planes or sections (e.g. theoretical, ethical, esthetical, affective, etc.). We shall call *mode of thought* a discipline that aims to mediate the limits of the regional historical world that surrounds the subject *according to a particular abstract plane of experience*. Each mode of thought (e.g. science, politics, arts, psychoanalysis, etc.) defines a *monochromatic* trans-regional – or universal-oriented – gradient of mediation coplanar to the corresponding spectral section. Philosophical reason is a *systematic* or *trans-modal* regime of thought, that is to say a regime of thought *transversal* to the different planes, whose goal is to compose *concrete* polychromatic mediators by bringing the abstract vectors of mediation into concert. Such a philosophical concrete synthesizer produces, from the spectral decomposition of experience provided by the abstract modes of thought, a *polyphanic* overcoming of a regional field of experience. The constitutive abstract trans-regionality of the diverse modes of thought is thus enriched with a concrete operatic trans-modality. This means that systematic philosophy should not be understood in terms of a volatile overarching encyclopedic survey of the different interests of reason, but rather as a katabatic deepening of the bottomless concreteness of trans-modal experience. We shall then call *philosophical stone* the adamant converging pole of the concrescent operations carried on by a particular process of trans-modal philosophical synthesis. The orchestration of a philosophical stone requires an amalgrammation of the local grammars that literalize the diverse modes of thought into a unique *grimoire*, and the arrangement of the regulative ideas that provide different prismatic orientations in thinking into a single *constellation*. The very possibility of this philosophical *ars magna* relies on the following theses: firstly, that every *regional* environing world is immersed in a unique non-horizontal (i.e. non-arche-earth-centred) *universal* field of experience; secondly, that every *abstract* mode of thought is a section of one and the same *concrete* field of experience; and lastly, that every form of transcendentally-determined intentional experience is an immanental reflexive self-experience of the impersonal field itself. This *universal* and *concrete* field of *immanental* self-experience will be called *absolute*. It follows that the different regulative ideas that orient the labour of the abstract modes (e.g. the *Verum*, the *Bonum*, the *Pulchrum*, etc.) are just kaleidoscopical cases of the idea of the absolute as such. To concoct a philosophical stone, the philosopher begins by inserting and dissolving the different prismatic modes of thought into the solvent field of concrete experience. This *liquefactio* of the abstract modes of thought into a unique concrete solution triggers a process of fertilizing corruption that proceeds by means of free associations, impure mixtures, transversal contagions, epiphytic transplantations, teratological combinatorial processes and communicant vessels of the highest connectivity. The monochromatic chastity of each abstract plane is thus (re)inserted into the *universal menstruum* (Novalis) of impure experience. In the wake of Hegel, we could say that the philosophical track towards the concrete must traverse the Spirit's treasury of this unconscious night, this dark chaos which contains every production of spirit in its destratified simplicity – a wealth of infinite theoretical representations, artistic percepts, imaginative schemes and eidetic poles.[4] This absolution with respect to the prismatic foliation of experience permits the philosopher to attune himself to the monstrous parousia of the absolute in its uttermost *infinite* (trans) *versability* (Novalis) : '*only out of the chalice of this realm of spirits, foams forth to him*'[5] the trans-modal mercurial menstruum.

In order to compose a concrete *organon* of mediation, the philosopher has to distill a particular set of spectral mediators from this cacophonical mixture. The ingression of these ingredients into the opus requires whitening the composite by means of a spectral synthesis of their monochromatic gradients of mediation. The superposition of this linearly independent set of mediating vectors permits the philosopher to span and clear a multimodal theatre of operations. The philosophical alchimery enriches the resulting composite by means of transversal operations of internal consistency, operations that will permit the concrescence to hold itself. The production of counterpoints between different themes, the introduction of topological twists between the overlapping phenomenological sheaves, the extrapolation of the motifs far beyond their natural domains, the chimerical wedding of disconnected kingdoms, the knitting of textural montages between divergent lines of escape, the compossibilisation of different harmonic keys, the tiling of multidimensional musaics of glass beads, the potentialization of the different components to higher powers, the knotting of the relevant interests of reason in new sinthomatic ways – all these diagonal operations permit the philosopher to entangle the heterogeneous ingredients into a consolidated concrescence that overflows every single abstract section. Thanks to the lysergic injection of this *korova lacta philosophica*, the ingredients are joined together into a composite that, overcoming the state of a mere cultural juxtapositive multiplicity, coagulates into a coalescence of mutual implication. This condensation allows the philosopher to transmute the volatility of the abstract modes into the downward weightiness of the concrete. Once the *dissolve* and *coagulate* phases are over, the furnace of the *magnum opus*, fed by the furniture and the beams of the roof that accommodate and shield the anchored existence upon the transcendental earth, will ignite and propel a multistage-alembic. In the crimson phase of the trip, the alembic heads towards the supposed elementary, immediate and unilateral last instances of regional experience. The elementary grains which voxel the local historical world that surrounds the alchimerical theater, far from defining the outermost edges of any possible experience, result from a particular transcendental coarse-graining. In order to circumvent the narcotic hypostasis of these cut-offs and unground the local renormalization of experience, the *opus* has to *mediate*, *resolve* and *fibrate* the transcendental trellis and *decompactify* its concealed higher-dimensional abysses. In this way, the philosophical composite, being concocted in a particular – cultural, historical, cosmological, linguistic – phenomenological horizon, will project itself towards the trans-regional interzone of manifestation disclosed beyond these contingent and permeable thresholds. Instead of travelling through the 3+1 spatiotemporal dimensions of the firmament painted on the underside of the outer sheltering umbrella, this sort of at-homeness-fired alembic-chuggabug tears open the firmament itself to frame in a new light a stereoscopical vision of the polyphanic landscape that appears through the lattice.[6] This trans-modal '*vitrauxlisation*'[7] of the environing world is as philosophical as the fortuitous hierogamy of a sewing concrete machine and a doxical umbrella in a Klein retort (Lautreamont). Once the acclimatized integrity of the local Zabriskian atmosphere has been blown-up, the propelling furnace is turned off, the pre-modern orni-theological mystifications are '*right away evaporated in mists*', and the bluish *katabatic* stage of the voyage begins. By dropping away the propelling stages, the remaining stoned kernel starts its groundless free-falling into the nested unconcealed underworlds. The consistent *unheard of* combination of heterogeneous ingredients forms a sort of crystalline lens whereby a stereoscopic, atonal and polyphonic experience of the absolute – in the double sense of the genitive – takes a cleared place and pulses a diachronic time. The more concrete the philosophical stone is, the deeper the musaical descent into this nether yonder.

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[4] Cf. G.W.F. Hegel, *Hegel and the Human Spirit. A translation of the Jena Lectures on the Philosophy of Spirit (1805-6)*, trans. L. Rauch (Detroit: Wayne State University Press, 1983), 87.

[5] Cf. G.W.F. Hegel, *Phenomenology of Spirit*, trans. A.V. Miller (Oxford: Clarendon Press, 1977), 493.

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[6] Cf. G. Deleuze and F. Guattari, *What is Philosophy?*, trans. H. Tomlinson and G. Burchell (New York: Columbia University Press, 1994), 203.

[7] Cf. nakH ab Ra, *Breve Diccionario de Brujería Portatil, in Nosotros, los Brujos. Apuntes de arte, poesía y brujería*, ed. J. Salzano (Buenos Aires: Santiago Arcos editor, 2008), 267.

ANALYTICAL JELLY

Gelatine (30g)	Its translucent, tasteless structure will be essential.
Lemon Juice (100ml)	Will help bring about the aseptic, astringent product desired.
Water (400ml)	What can be said? Will wash away all obscurities.
Plain cream (80g)	Whiteness of 'white' will ensure a firm blend.
Sugar (little spoon)	To keep open a door to 'other worlds'.

Dissolve the gelatine in water, add the lemon juice, the cream, put in a pan, soak and boil. Throw away the sugar, no one is looking. Allow to cool. Sell it as a magnificent dish, whose preparation involved great difficulties. Make its aura shine. Enjoy with your closest friends and distribute to the World.

TRANSMODERN TATIN

Flour (330g)	Will bring you down to Earth.
Butter (330g)	Worst will be the best.
Icing sugar (110g)	Nature and artifice will come together.
Egg yolks (3)	Life will have to surface.
Apples (6)	What can be said? Will obscure all.

Do not worry much about the preparation. Forget good orders and canonical behaviours. Just do it. Or, better, travel to France, recall that you are still an heir of Romanticism, and, in some remote village, ask for a wonderful *Tarte Tatin*.

Analytical Jelly and Transmodern Tatin: Two Trivial Recipes

Fernando Zalamea

Good cooking comes from small villages and long traditions. One cannot favour, for instance, France's *petite cuisine* over its *cuisine villageoise*. A solid, rooted, generous, *confit de canard aux lentilles*, deliciously magnified in Moissac, far exceeds a light, pretentious, stingy, *rémoulade de tourteau à l'aneth, sauce fleurette citronnée*, served at Taillevent's. But philosophy in the twentieth century has followed fashions far meaner than those of the *petite cuisine*. The analytical (and anglosaxon) obsession with language and (classical) logic has obscured many earlier, wider pursuits of knowledge, related to a *necessary* blend of philosophy with creative mathematics, chemistry, art and literature. Nevertheless, well beyond *petite* analytical hunting estates, some giant critics stood firm: Warburg, Florenskij, Benjamin, Cassirer, Merleau-Ponty, Blumenberg, to name just a few boundary-crossers. With reference to Llull, Leibniz, Novalis or Peirce (mandatory readings are Jordi Gayà's *La teoria luliana de los correlativos*[1] and Laurent Margantin's *Système minéralogique et cosmologique chez Novalis*),[2] culture as a *continuum* was also continually explored in the twentieth century. Of course, the death of *universals* and of *metaphysics* alike has been greatly exaggerated.

A *savoury paradox* shows how contemporary mathematics produces new understandings of universals without an Absolute, with extremely interesting 'relative universals', in category theory and model theory, rising renewed from the ashes. Following Rosa María Rodríguez Magda,[3] we may understand *Transmodernism* as a Modernism which never died; which, like the Phoenix, continues to rise again. Transmodernism maintains Postmodernism's open spirit of dissemination, as well as some of its main emphases (not new conquests, since we find them already in Novalis, Valéry, Florenskij, etc.) on the fragmentation of truth and the conjunctions of antinomies, but goes well beyond the mere register of singular breakdowns and tries to propose new relative nets to encompass residuation. A rich *counterpoint* emerges between Postmodernism and Transmodernism: break, locality, differentiation, contradiction, ambiguity, the impossibility of universals, ‘all is equally worthwhile’, death – what might be called postmodern dissonance – contrasted with revision, local/global dialectics, oscillation, differentiation/integration, partial gluing of relative coherences, fabrics of vagueness/exactness, relative universals, ‘some are more worthwhile than others’, renaissances – a sort of transmodern harmonics.

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[1] Palma de Mallorca, 1979.

[2] Paris: Harmattan, 1998.

[3] *La Sonrisa de Saturno. Hacia una teoría transmoderna* (Barcelona: Anthropos, 1989).

We propose these two ‘trivial recipes’ in order to give a hint of the *pendulum* between *petite* and *villageoise* philosophy. But beware! – After the *Jelly*, the *Tatin* becomes mandatory! If not, a nasty taste in the mouth may result, that lasts months, years, or ... a century already ...

Appendix

WORLD-SOUL

PLATO, *TIMAEUS*

Now that which is created is of necessity corporeal and visible and tangible – visible and therefore made of fire, tangible and therefore solid and made of earth. But two terms must be united by a third, which is a mean between them; and had the earth been a surface only, one mean would have sufficed, but two means are required to unite solid bodies. And as the world was composed of solids, between the elements of fire and earth God placed two other elements of air and water, and arranged them in a continuous proportion—

> fire:air::air:water, and air:water::water:earth,

and so put together a visible and palpable heaven, having harmony and friendship in the union of the four elements; and being at unity with itself it was indissoluble except by the hand of the framer. Each of the elements was taken into the universe whole and entire; for he considered that the animal should be perfect and one, leaving no remnants out of which another animal could be created, and should also be free from old age and disease, which are produced by the action of external forces. And as he was to contain all things, he was made in the all-containing form of a sphere, round as from a lathe and every way equidistant from the centre, as was natural and suitable to him. He was finished and smooth, having neither eyes nor ears, for there was nothing without him which he could see or hear; and he had no need to carry food to his mouth, nor was there air for him to breathe; and he did not require hands, for there was nothing of which he could take hold, nor feet, with which to walk. All that he did was done rationally in and by himself, and he moved in a circle turning within himself, which is the most intellectual of motions; but the other six motions were wanting to him; wherefore the universe had no feet or legs.

And so the thought of God made a God in the image of a perfect body, having intercourse with himself and needing no other, but in every part harmonious and self-contained and truly blessed. The soul was first made by him – the elder to rule the younger; not in the order in which our wayward fancy has led us to describe them, but the soul first and afterwards the body. God took of the unchangeable and indivisible and also of the divisible and corporeal, and out of the two he made a third nature, essence, which was in a mean between them, and partook of the same and the other, the intractable nature of the other being compressed into the same. Having made a compound of all the three, he proceeded to divide the entire mass into portions related to one another in the ratios of

1, 2, 3, 4, 9, 8, 27, and proceeded to fill up the double and triple intervals thus:

> - over 1, 4/3, 3/2, - over 2, 8/3, 3, - over 4, 16/3, 6, - over 8:
> - over 1, 3/2, 2, - over 3, 9/2, 6, - over 9, 27/2, 18, - over 27;

in which double series of numbers are two kinds of means; the one exceeds and is exceeded by equal parts of the extremes, e.g. 1, 4/3, 2; the other kind of mean is one which is equidistant from the extremes – 2, 4, 6. In this manner there were formed intervals of thirds, 3:2, of fourths, 4:3, and of ninths, 9:8. And next he filled up the intervals of a fourth with ninths, leaving a remnant which is in the ratio of 256:243. The entire compound was divided by him lengthways into two parts, which he united at the centre like the letter X, and bent into an inner and outer circle or sphere, cutting one another again at a point over against the point at which they cross. The outer circle or sphere was named the sphere of the same– the inner, the sphere of the other or diverse; and the one revolved horizontally to the right, the other diagonally to the left. To the sphere of the same which was undivided he gave dominion, but the sphere of the other or diverse was distributed into seven unequal orbits, having intervals in ratios of twos and threes, three of either sort, and he bade the orbits move in opposite directions to one another – three of them, the Sun, Mercury, Venus, with equal swiftness, and the remaining four—the Moon, Saturn, Mars, Jupiter, with unequal swiftness to the three and to one another, but all in due proportion.

PREPARATION OF AND ANTIDOTE TO A POISON

IBN WAHSHIYA[1]

One procures the lizard which exists in houses and inns – the larger the better – and adds to it a kind of blister fly which is green and small, having long legs and something like flour on its wings, and which often alights on the trees of the large and small cucumbers.

They are both put into a large glass bottle with a wide mouth. On them olive oil is poured and the bottle is stoppered tightly. It is hung in a bakery or kitchen until both animals are dissolved in the oil.

If you see that they have been dissolved and consumed, shake the contents of the bottle for three days, then bury it in ass manure for fourteen days. Then take it out; all of what is in it has become black.

A dãniq and one-half of this can kill in one to two days. The victim has a burning of the palate, a contraction of the opening of the stomach, a violent pain in the bowels, swelling of the tongue, and abundant vomiting. One and one-half dãniqs of this poison are given in hot gravy or hot water. If the humour of the victim be cold, then it is fatal in four days. He will die unless he is cured before this by the remedy.

1., from M. Levey (ed., trans.) *Medieval Arabic Toxicology: the Book on Poisons (Kitab Al-Sumum) of Ibn Wahshiya and its relation to early Indian and Greek Texts*, (American Philosophical Society: 1966), 53.

Preparation of the Remedy Antidotal to This Poison.

It is obtained from two mithqãls each of laurel seed, Aristolochia, germander which has the five leaves, dry sea moss, and seed of the white poppy, and three mithqãls each of the crystalline matter attached to the dried leaf of the rose, and cabbage seed. Ten dirhams of amomum and twenty dirhams of crystalline sugar are added. All are pulverized until they become like dust. Then they are kneaded with bee honey which has been mixed in wine. It is left for two months. Two mithqãls of its beverage is used with hot water after the poisoned one has vomited, if God wills.

EXPERIMENTS TOUCHING BURIALS

FRANCIS BACON[1]

Experiments in consort touching burials or infusions of divers bodies in earth.

376. Burials in earth serve for preservation, and for condensation, and for induration of bodies. And if you intend condensation or induration, you may bury the bodies so as earth may touch them: as if you will make artificial porcelane, &c. And the like you may do for conservation, if the bodies be hard and solid; as clay, wood, &c. But if you intend preservation of bodies more soft and tender, then you must do one of these two: either you must put them in cases, whereby they may not touch the earth, or else you must vault the earth, whereby it may hang over them and not touch them: for if the earth touch them, it will do more hurt by the moisture, causing them to putrefy, than good by the virtual cold, to conserve them, except the earth be very dry and sandy.

377. An orange, lemon, and apple, wrapt in a linen cloth, being buried for a fortnight's space four foot deep within the earth, though it were in a moist place, and a rainy time, yet came forth noways mouldy or rotten, but were become a little harder than they were; otherwise fresh in their colour; but their juice somewhat flatted. But with the burial of a fortnight more they became putrefied.

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[1] In *Phenomena of the Universe or Natural History for the Building Up of Philosophy* (1607).

378. A bottle of beer, buried in like manner as before, became more lively, better tasted, and clearer than it was. And a bottle of wine in like manner. A bottle of vinegar so buried came forth more lively and more odoriferous, smelling almost like a violet. And after the whole month's burial, all the three came forth as fresh and lively, if not better than before.

379. It were a profitable experiment to preserve oranges, lemons, and pomegranates, till summer, for then their price will be mightily increased. This may be done, if you put them in a pot or vessel well covered, that the moisture of the earth come not at them; or else by putting them in a conservatory of snow. And generally, whosoever will make experiments of cold, let him be provided of three things; a conservatory of snow; a good large vault, twenty foot at least under the ground; and a deep well.

380. There hath been a tradition, that pearl, and coral, and turquois-stone, that have lost their colours, may be recovered by burying in the earth, which is a thing of great profit, if it would sort: but upon trial of six weeks' burial, there followed no effect. It were good to try it in a deep well, or in a conservatory of snow; there the cold may be more constringent; and so make the body more united, and thereby more resplendent.

NOTE ON THE ROCKS WHICH CONTAIN DRIED OUT PLANTS AND FISH – WITH REFERENCE TO A LOST RECIPE BY LEIBNIZ

B. LE BOVIER DE FONTENELLE[1]

What we reported in *l'Histoire* in 1703, about those rocks found in the Verona area which contain dried out plants and fish, has been confirmed by Mr Leibniz. He says that in the land of Brunswick around Osterode, in the County of Mansfield around Eisleben and in many other places in Germany, one finds veins of slate, more or less horizontal, in which there are representations, though very exact and very detailed, of various kinds of fish or plants, which appear in their natural length and width, but without any thickness. These traces are often etched in a mixture of copper, which even contains silver. Some of these plants are unknown in those regions, but they are found in pictures of plants from the Indies.

Mr Leibniz conceives that a kind of soil covered the lakes and surrounding areas, and buried fish and plants in it, or that some muddy water loaded with soil enveloped them or carried them away. This soil has itself since hardened into slate, and the length of time, or some other cause, destroyed the delicate matter of the fish or plant, almost in the same manner in which the bodies of flies or ants that are found encased in yellow amber have disappeared and are not now tangible at all, but simple delineations. The matter of the fish or the plant, being consumed, left its form imprinted in the slate, by way of a hollow which remained in it, and this hollow has eventually been filled by a metallic matter, whether a subterranean fire burning the soil into slate has made the metal that was mixed in it come out, or a metallic vapour penetrating the slate fixed itself into these hollows. Mr Leibniz adds that one can imitate this effect by a rather curious process. One takes a spider, or some other suitable animal, and buries it within clay, while keeping an opening that enters from outside into the hollow. One puts the mass in a fire in order to harden it; the matter of the animal disappears in cinders, which one can make come out by way of some liquid. After which one pours through the opening some melted silver, and when that cools down, one finds inside of the mass the figure of the animal wonderfully represented in silver.

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[1] In *Histoire de l'Académie des Sciences de Paris* [1706], 202-3.

COOKING EARTH WITH SALT AND GRAVITY

ISAAC NEWTON[2]

When mercury sublimate is re-sublimed with fresh mercury, and becomes mercurius dulcis, which is a white, tasteless earth scarce dissolvable in water, and mercurius dulcis re-sublimed with spirit of salt returns into mercury sublimate; and when metals corroded with a little acid turn into rust, which is an earth tasteless and indissolvable in water, and this earth imbibed with more acid becomes a metallic salt; and when some stones, as spar of lead, dissolved in proper menstruums become salts – do not these things shew that salts are dry earth and watery acid united by attraction, and that the earth will not become a salt without so much acid as makes it dissolvable in water? Do not the sharp and pungent tastes of acids arise from the strong attraction whereby the acid particles rush upon and agitate the particles of the tongue? And when metals are dissolved in acid menstruums, and the acids in conjunction with the metal act after a different manner, so that the compound has a different taste much milder than before, and sometimes a sweet one – is it not because the acids adhere to the metallic particles, and thereby lose much of their activity? And if the acid be in too small a proportion to make the compound dissolvable in water, will it not by adhering strongly to the metal become unactive and lose its taste, and the compound be a tasteless earth? For such things as are not dissolvable by the moisture of the tongue, act not upon the taste.

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[2] From *Newton's Philosophy of Nature: Selections from His Writings* (Whitefish, MT: Kessinger, 2003), 166-7.

As gravity makes the sea flow round the denser and weightier parts of the globe of the Earth, so the attraction may make the watery acid flow round the denser and compacter particles of earth for composing the particles of salt. For otherwise the acid would not do the office of a medium between the earth and common water, for making salts dissolvable in the water; nor would salt of tartar readily draw off the acid from dissolved metals, nor metals the acid from mercury. Now, as in the great globe of the Earth and sea, the densest bodies by their gravity sink down in water, and always endeavour to go towards the centre of the globe; so in particles of salt the densest matter may always endeavour to approach the centre of the particle: so that a particle of salt may be compared to a chaos, being dense, hard, dry, and earthy in the centre; and rare, soft, moist, and watery in the circumference. And hence it seems to be that salts are of a lasting nature, being scarce destroyed unless by drawing away their watery parts by violence, or by letting them soak into the pores of the central earth by a gentle heat in putrefaction, until the earth be dissolved by the water, and separated into smaller particles, which by reason of their smallness make the rotten compound appear of a black colour. Hence also it may be that the parts of animals and vegetables preserve their several forms, and assimilate their nourishment; the soft and moist nourishment easily changing its texture by a gentle heat and motion till it becomes like the dense, hard, dry, and durable earth in the centre of each particle. But when the nourishment grows unfit to be assimilated, or the central earth grows too feeble to assimilate it, the motion ends in confusion, putrefaction, and death.

VERMICULAR PREPARATIONS

CHARLES DARWIN[3]

During the grinding process, the particles of earth must be rubbed against one another, and between the stones and the tough lining membrane of the gizzard. The softer particles will thus suffer some attrition, and will perhaps even be crushed. This conclusion is supported by the appearance of freshly ejected castings, for these often reminded me of the appearance of paint which has just been ground by a workman between two flat stones. Morren remarks that the intestinal canal is 'impleta tenuissima terra, vel uti in pulverem redacta'. Perrier also speaks of 'l'etat de pate excessivement fine a laquelle est reduite la terre qu'ils rejettent,' etc.

As the amount of trituration which the particles of earth undergo in the gizzards of worms possesses some interest (as we shall hereafter see), I endeavoured to obtain evidence on this head by carefully examining many of the fragments which had passed through their alimentary canals. With worms living in a state of nature, it is of course impossible to know how much the fragments may have been worn before they were swallowed. It is, however, clear that worms do not habitually select already rounded particles, for sharply angular bits of flint and of other hard rocks were often found in their gizzards or intestines. On three occasions sharp spines from the stems of rose bushes were thus found. Worms kept in confinement repeatedly swallowed angular fragments of hard tile, coal, cinders, and even the sharpest fragments of glass. Gallinaceous and struthious birds retain the same stones in their gizzards for a long time, which thus become well rounded; but this does not appear to be the case with worms, judging from the large number of the fragments of tiles, glass beads, stones, etc., commonly found in their castings and intestines. So that unless the same fragments were to pass repeatedly through their gizzards, visible signs of attrition in the fragments could hardly be expected, except perhaps in the case of very soft stones.

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[3] In *On Humus and the Earthworm: The Formation of Vegetable Mold through the Action of Worms with Observations on their Habits* (London: John Murray, 1881), 123, 126.

[...] Nor should we forget, in considering the power which worms exert in triturating particles of rock, that there is good evidence that on each acre of land, which is sufficiently damp and not too sandy, gravelly or rocky for worms to inhabit, a weight of more than ten tons of earth annually passes through their bodies and is brought to the surface. The result for a country of the size of Great Britain, within a period not very long in a geological sense, such as a million years, cannot be insignificant; for the ten tons of earth has to be multiplied first by the above number of years, and then by the number of acres fully stocked with worms; and in England, together with Scotland, the land which is cultivated and is well fitted for these animals, has been estimated at above 32 million acres. The product is 320 million million tons of earth.

CANNIBAL CORPSES

APARECIDA VILAÇA[1]

[...] In reporting a number of cases of cannibalism among [Pano language-speaking] populations, Gertrude Dole comments:

> But in spite of the obvious supernatural element in Panoan funerary endocannibalism, some of the data indicate that there is also a gastronomic aspect to the practice. The Capanahua, for example, roasted the body 'like game' [...] The Cashibo ate their old people with delight...[2]

I suggest we need to examine this emphasis on the pleasure of eating human flesh with more caution, before we extract from it any rapid conclusions on the protein value of the meal, a notion which empties the food of all its symbolic character. I wish to highlight the fact that such claims of gustative pleasure coexist with others which appear to be set in contradiction. The Guayaki ate intestines which were only slightly spoiled, as well as less putrid parts of the decomposing corpses.[3] By contrast, as I discuss later, Wari' corpses were roasted after they had already reached an advanced state of putrefaction, and then eaten with some sacrifice. Nonetheless, faced with this almost indigestible meat, the eaters politely exclaimed: "this is good, it isn't at all rotten!"

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[1] From 'Relations between funerary cannibalism and warfare cannibalism: the question of predation', *Ethnos* 65/1 (2000), 83-106.

[2] G. Dole, 'Endocannibalism among the Amahuaca Indians', In P.J. Lyon (Ed.), *Native South Americans: Ethnology of the Least Known Continent (*Boston: Little, Brown, 1974): 302-8, 306.

If we suppose a relation of continuity between the type of exclamation made by the Wari' and the claims about the deliciousness of the corpse's meat reported by other authors, it becomes clear that we are presented with people's efforts to prove the edibility (far from evident) of the deceased's flesh. A corpse does not look like food, whether this is due to the recognition of a kinsperson or group member, or due to its rotten state. For this reason, in the presence of the corpse – or that of the astonished ethnographer face-to-face with such a bizarre custom – what is stressed is the unobvious: the corpse is food. This kind of exertion is not restricted to the consumption of a dead member of the group. Here, we may cite Cunhambebe's famous phrase in reply to Hans Staden's disapproval of the former's consumption of human flesh: "I'm a jaguar. It's tasty".[4] In turn, we may contrapose this statement to Anchieta and Abbeville's observations on the repugnance held for human flesh by the Tupinamba:

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[3] P. Clastres, *Chronicle of the Guayaki Indians* [1968], trans. P. Auster (NY: Zone Books, 2000).

[4] H. Staden, *Duas Viagens ao Brasil* [1557] (São Paulo: Editora Universidade de São Paulo, 1974), 132.

some expressed an enormous disgust for this flesh, and would vomit after eating it.[5] Relish and disgust are not, in my view, contradictory aspects associated with the consumption of human meat, attributable simply to individual taste. Rather, both are attitudes whose aim is to evince the edibility of the meat, dehumanizing the deceased, but without failing to preserve some of his or her humanity: this explains the obligatory abstention of some, such as the enemy's killers, or the kin of the dead group member in the Wari' case, who sometimes express their avoidance precisely in terms of repugnance. As we shall see, this double posture in relation to the humanity of the deceased or the enemy corresponds to the equally dual nature of these rites. In the case of the Wari' funeral, a failure to perceive its double aspect – in which the deceased's humanity and inhumanity remain in constant opposition – could lead us to a partial interpretation, one which misses the rite's essence.

As far as the Wari' material is concerned, my hypothesis – possibly applicable to some other ethnographic universes, as I hinted above – is that ingestion is a fundamental classificatory operator, one intrinsically bound to the notion of predation, understood here as a relation between predator and prey. Given the basic identity between humans and animals, predation has as its aim the marking of a difference in a human continuum, or the explication of this difference which in another mode would remain masked. Let us see how this takes place among the Wari'.

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[5] Cf. E. Viveiros de Castro, *From the Enemy's Point of View: Humanity and Divinity in an Amazonian Society* (Chicago: University of Chicago Press, 1992), 56.

[…] The Wari' conducted war expeditions with the sole aim of killing enemies: Indians of other ethnic groups and Whites. A group of men would leave in the direction of the enemy village and lie in hiding, waiting for someone to approach. The technique of attack was ambush. When the enemy approached all the men released their arrows, shooting even if the first arrow had been sufficient to kill. In this way, everyone became a killer, returning to the village and beginning a period of seclusion, during which they remained almost immobile, sustaining themselves on great quantities of non-fermented maize drink (*chicha*) produced incessantly by women. The killers – all of them – contained the spirit of the dead enemy within them, and it was this which, with the help of the maize brew, caused them to swell and fatten; the ultimate purpose of the seclusion.

Whenever possible, the killers brought with them parts of the victim – head, arms and legs – which were carried, raw, in baskets slung over the shoulders exactly like animal game, differing only in that the latter – with the exception of large animals such as tapir – are usually carried whole. The enemy's trunk, very heavy, was left in situ. The genitals (especially male genitals) were taken by the men in order to be admired by women (and then thrown on the fire to burn).

The enemy's flesh was transported raw for roasting in the village. However, if the journey was lengthy, it could be roasted in the forest by the killers. What is crucial here to our analysis is that the enemy's flesh, just like the flesh of game, was never eaten rotten. Arriving in the village, the women, who constituted the majority of the people who stayed behind, welcomed the killers exuberantly, especially if they had brought enemy flesh, and this meat was roasted and eaten by them and by the men who had not been involved in the kill.

Near to home, the warriors whistled or sounded their flutes. Everyone ran to meet them. They handed the enemy's body over to the women, saying "Roast my prey" (*Xain je watama*). The enemy's flesh was consumed in the same way as animal game, the meat eaten off the bone. The Wari' say, however, that they ate the enemy's flesh with anger. The killers, who contained the spirit of the enemy inside them, refrained from eating his flesh.

It is important to stress that the essential aspect of warfare was killing the enemy, not eating him. In less favourable circumstances, when the killers were forced to flee, the victim's body was left were it fell. Everything happened exactly in the same way on their arrival, including the seclusion of the killers, although the enthusiasm of the women was slightly lessened. Eating the enemy was an excess, a pleasure which they allowed themselves whenever possible. In contrast to the flesh of deceased Wari' which, as we shall see, had at least to be tasted, the enemy – having been killed like an animal – did not need to be eaten. Predation by itself confirmed his animal status, placing the Wari' in the position of humans.

What should be underlined here is that the Wari' do not strive to differentiate warfare and hunting: they endeavour to approximate them. When they hunt and eat their favourite game, they quickly become subject to reprisal, a counter-predation, which is likewise defined by hunting and by warfare. As such, enemy (*wijam*) and prey (*karawa*) are equivalent positions with which the Wari' maintain the same type of relation: both are shot and eaten.

So, on one hand, the identity between *wijam* and *karawa* is founded on their mutual difference from the Wari', who themselves occupy a position of humans – the unique humans, *wari'*. This equivalence occurs in the context of the relation between elements; that is, in the context of predation. Ideally, the Wari' are those who prey and this is what differentiates them, what characterizes them as humans, *wari'*, and constitutes enemies and animals – both equally prey – as non-humans. Yet, on the other hand, what enables them to be related to the Wari' is precisely their human potential; the capacity to act as humans (also see Chaumeil 1985, for an analogous vision of Yagua warfare). In this sense, legitimate game is that which is also a predator, and the animals preferred as prey by the Wari' are precisely those which are capable of preying on them (symbolically). These animals and enemies can potentially occupy the position of predators; they are capable of attacking, killing and eating the Wari', and are, during these moments, humans, *wari'* (which makes the Wari' non-humans – *wijam* or *karawa*). Thus, the Wari' take the subjectification of war victims to an extreme, extending it to the animals which they choose to eat.

However, it is important to note that when the Wari' speak of enemies and game in the context of predation, they emphasize their animal characteristics, not their human ones. Their desire is to demarcate that what is killed and eaten is not people. An interesting fact is that the Wari' never use the female gender when speaking of enemies, even when this involves women, as the female gender only exists for human beings. To refer to a woman from an enemy group, they say: 'female enemy (fêmea),' just as they speak of animals, and not 'enemy wife'.

We turn now to the Wari' funeral, where the corpse-food equivalence is less perceptible, masked by ritual procedures whose aim is precisely to differentiate this meal from both daily alimentation and the devouring of enemies ...

RECIPE FOR DISASTER

EUGENE THACKER

What You'll Need

- Incredulity towards reality, accompanied by a period of psychic fatigue;
- A loss of the Presence of consciousness, in the form of physical comedy;
- An acute sense of imperfection, built on an ectoplasmic form of ennui;
- The pain of God (may be substituted with periodic Self-Naughting);

Directions

1. Allow the logical paralogism to consist in the falsity of a syllogism due to its form, whatever its content may otherwise be. Its impression can be rendered complete in the semi-darkness that glimmers in vaulted caverns or starry temples, beneath the branches of a lofty forest glade, strangely quickened and stirred by the enigmatic play of half-lights in the horrific quiet after the rain; empty distance, remote voids, and a daemonic dread far too serious.
2. Make sure that the transcendental paralogism, however, has a transcendental ground for inferring falsely due to its form. I swayed and moaned, clumsily clutching each of the strange growths like fresh

bruises. When I finally looked, the skin had peeled back painlessly, revealing an almost reptilian crust that reminded me of tree bark. There was only one possible conclusion to draw from what had happened, and it almost defiled common sense. These lonely ruins were alive.

3. Keep in mind that a fallacy of this kind will have its ground in the nature of human reason, and will bring with it an unavoidable, although not insoluble, illusion. Occasionally reflect on the Plain of Obsidian Fire or the Black Arch of the Absurd, which both pass out of the Unknown Lands, by the Place of the Ab-humans, which tends to always be immersed in a mossy green, luminous mist (whole libraries had been assembled there, and many a thousand million had mouldered into the forgotten dust of its long, softly singing corridors).

4. Thus there will be syllogisms containing no empirical premises, by means of which we can infer from something with which we are acquainted to something of which we have no concept, and yet to which we nevertheless, by an unavoidable illusion, give objective reality. In respect of their result, such inferences are thus to be called crystalline rather than rational inferences; even though they might lay claim to the latter term on account of what occasions them, because they are not thought up, nor do they arise contingently, but have sprung from the nature of tragicomedy.

Nutritional Information

The street organ drawl, the polar explorers and botanical linguists, all inadvertently united on the arid plain of a manuscript, will hoist black flags signaling the presence of pentacular ambergris flying out of the still night of an ink-well, abandoned to those preoccupations of those who, in every perfect liquid night, do nothing except make stains with crabbed, articulated fingers, and in that way are incapable even of leading into error the ridiculous seraphim of logical deduction.

SERVING THE OPEN (AN EXEGETICAL EXERCISE)

MANABRATA GUHA

Being devoured is, after all, also a form of existence.[1]

FANTASIES ON A BIOLOGICAL MODEL OF SUPER-EGO FORMATION[2]

H.'s spontaneous statement on her fatness: 'all this fat is my mother'. If she felt freer inside from the disastrous (introjected) mother-model, then she noticed a decrease in the fat padding, and at the same time she lost weight.

During the week, in which, for the first time, he faced up defensively to his cruel mother: S. felt he had lost weight. At the same time, however, he had the idea that this fat was that of his equally cruel grandfather.

These observations lead to the idea that formation of the super-ego occurs as the final outcome of a fight, in reality lost, with an overwhelming (personal or material) force, roughly in the following way:

A precondition is the existence of an 'intelligence' or a 'tendency to deal with things economically', with an exact knowledge of all the qualitative and quantitative energy charges and possibilities of the body, also of the ability of the mind to accomplish, to bear, and to tolerate; in the same way this 'intelligence' can estimate with mathematical exactitude the distribution of power in the external world. The first normal reaction of a living being to external unpleasure is an automatic warding off, that is to say a tendency to self-preservation. If beaten down by an overwhelming force, the energy (perhaps in fact the external power of the trauma) turns against the self. In this moment the 'intelligence', which is concerned above all with the preservation of the united personality, seems to resort to the subterfuge of turning round the idea of being devoured in this way: with a colossal effort the 'intelligence' swallows the whole hostile power or person and imagines that it itself has devoured somebody else and, in addition, its own person. In this way man can have pleasure in his own dismemberment. Now, however, his personality consists of a devoured, overgreat (fat) aggressor and a much smaller, weaker person, oppressed and dominated by the aggressor, that is, his pretraumatic personality. Many neurotics symbolize their illness in dreams and symptoms as a bundle that they have to carry on their backs; in others this bundle becomes part of the body and turns into a hump or growth; also favoured is the comparison with an enveloping great person which, as it were, enwraps maternally the former personality. The psychological 'devouring' seems to be associated with greedy voracity and increased hunger for assimilation: putting on fat as a hysterical symptom. If, by the analytic reservoir of the traumatic struggle, the person has been freed from the overwhelming power, then the obesity, the physiological parallel phenomenon, may disappear. Physiological and chemical aspects: the muscle and nerve tissues consist, in essence, of protoplasm, that is to say mainly of proteins. Protein is specific for each species, perhaps even for each individual. Foreign protein acts as poison; it is therefore broken down and the specific protein synthesized anew out of the harmless constituents. Not so with unspecific fat. Pork fat, for instance, is stored in the cells as such, and can quite well stand as the organic symbol, or the organic tendency to manifestation, which runs parallel with the devouring of the external powers. Here a still quite vague idea emerges. Is it possible that the formation of the super-ego and the devouring of the superior force in defeat may explain the two following processes: (1) 'Eating up the ancestors', and (2) adaptation in general.

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[1] Ferenczi, *Final Contributions to the Problems and Methods of Psychoanalysis* (London: Karnac, 1994), 230.

[2] Excerpt from Ibid, 227-30.

(1) Plants grow and develop through the incorporation of minerals. Thereby the possibility of existence within the organism is offered to minerals (inorganic substances) which, however, is equivalent to being devoured by the organism. How far the inorganic matter as such is destroyed or dissolved, however,

remains problematic. Quantitative analysis rediscovers the consumed inorganic substances to the last grain. When the plant is devoured by a herbivorous animal, the plant organism is destroyed, that is to say reduced to organic or even partly inorganic components. It remains problematic whether or not, despite this, part of the plant substance survives and conserves its individuality, even in the body of the herbivorous animal. In this way the animal body is a superstructure of organic and inorganic elements. Expressed psycho-analytically (although at first glance highly paradoxical) this means: the animal organism has devoured one part of the (menacing?) external world and thus provided for the continuation of its own existence.

The same thing happens at the devouring of animal organisms. It is possible that we harbour ill our organism inorganic, vegetative, herbivorous, and carnivorous tendencies like chemical valencies. The likewise highly paradoxical aphorism here is as follows: 'Being devoured is, after all, also a form of existence.'

The idea then emerges that one ought to consider in this process the possibility of a mutual devouring, that is to say a mutual super-ego formation.

2. Adaptation in general appears to be a mutual devouring and being devoured, whereby each party believes that he has remained the victor.

21.9.1930

We begin with a personality, an individual, a discrete entity – bounded, internally consistent, and self-affirming. It occupies space by asserting its existential right. Such entities, which share not boundaries but economies of relations, operate under a diktat which asserts that the

> ... precondition [for the formation of the super-ego] is the existence of an intelligence or a tendency to deal with things economically, with an exact knowledge of all the qualitative and quantitative energy charges and possibilities of the body, also of the mind to accomplish, to bear, and to tolerate; in the same way this intelligence can estimate with mathematical exactitude the distribution of power in the external world.[3]

But what happens when this discrete entity, the individual, Ferenczi's patient, finds herself threatened with being 'consumed' by her mother's fat? Under such conditions, what happens to the economy of relations or that which Ferenczi refers to as the 'tendency to deal with things economically'? Is this logic of economic relationality overwhelmed by an external force (of an external world) with which the individual had prior relations? What impact does this have on the individual, the discrete, the particular? What insight does it give us into the individual, the discrete, the particular?

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[3] Ferenczi, *Final Contributions*, 228.

Ferenczi reports that the first stage in the strategic defence of the discrete entity in the face of an intrusive external and traumatic power or force consists in the designing of a quantitatively and qualitatively precise act of resistance. But, when faced with the prospect of such a *mathesis* of defence being overwhelmed by the external force, the 'tendency to deal things with economically' compels the discrete (defender) to expand the logic of relationality to be 'open' to the external force: The discrete (defender) allows itself to be infiltrated by the external force, but with the ulterior motive of being able to contain it – by consuming it. In other words, the apparent tactical retreat effected by the discrete (defender) could be considered to be a feint – a deceptive strategic manoeuvre executed at the local or tactical level – designed to contain the external force by internalizing it – by make the external force its own. For Ferenczi, this presence of the external force inside the discrete (defender) is akin to an 'alien transplant' that resides or is nested within the discrete. As a consequence of this, as Ferenczi points out, the originally discrete entity (the defender) is now co-constituted not only by itself, but also by the presence of this alien intruder that lurks within itself. It is worth pointing out that when Ferenczi refers to the trauma inflicted by the 'external force', he is not referring to a cut in the sense of an externally-inflicted opening. Instead, the feint executed by the discrete (defender) is a self-opening to the external force (which we can now restate as 'the open'). In this way, the discrete 'consumes' 'the open' in what will eventually be a feeble attempt to keep 'the open' at bay. Ferenczi alludes to this when he observes that

> [m]any neurotics symbolize their illness ... as a bundle that they have to carry on their backs; in others this bundle becomes part of the body and turns into a hump or growth; also favoured is the comparison with an enveloping great person which, as it were, enwraps materially the former personality.[4]

But there is a twist in this account of tactical defence on the part of the discrete: By being open to 'the open' – in its attempt to maintain its fidelity to the economy of relations that guide the discrete – the discrete (defender) also opens itself to a deep chemistry that radically alters it to unimaginable extents. In Ferenczi's case-study, where his patient expresses her neurosis in terms of assigning the presence of fat in her body to her mother, 'the psychological "devouring" seems to be associated with greedy voracity and increased hunger for assimilation'.[5] But this assimilation is not digestive in the sense that what is being devoured is chemically assimilated, that is to say, fully internalized without increasing the constituency of the discrete. Rather, this assimilation is expressive of a nesting – like the harbouring of chemical valencies – within the discrete (defender). As Ferenczi explains, the mechanism of defence – or what we have referred to as a tactical defensive manoeuvre – of the discrete is a matter of chemical valencies.[6] In a somewhat grotesque description, Ferenzci shows how 'consumption' is the intensive dissolution of discrete entities (in this connection, he refers to plants, herbivorous and carnivorous animals, including the human being) into both organic and inorganic substances, which make their way and leave their traces (traces which, according to Ferenczi, can be quantitatively analyzed) along the chain of consumption. Note that the radical indeterminacy at play here – what is consumed can be rendered into organic *and* inorganic substances – is an instance of the subversion of the Law of the Excluded Middle. In this sense, what is operative here is not so much a logic of continuity, but a logic of plasticity that fuses the discrete and its now internalized – but not fully assimilated – organic and inorganic substances. It is this logic of plasticity that guarantees the continued existence of the discrete (defender) albeit in a form and manner quite different from its original state.

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[4] Ibid.

[5] Ibid.

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[6] Ibid., 229.

The discrete, in fact, does not survive as the discrete; rather, it exists as a nested possibility of existences (local *possibilia*) along and across a continuum of chemical valencies, i.e., 'the open'. We can then say that there are two models of consumption at play here: The first is the most obvious one which involves the discrete *consuming* 'the open' by *being* open. The second is the intensive consumption *of* the discrete *by* 'the open' which lurks within the former. In the context of our exploratory exercise concerning the *Bhut Jolokia*,[7] this serves as an example of a highly subversive para-tactical model of operability. The trick (and the challenge) is to review the emerging battlespace in terms of nested chemical valencies drawn from what we have referred to as the continuum (or 'the open') rather than in terms of the mechanical relationalities that normatively connect discrete entities. In this sense, Ferenczi's 'highly paradoxical aphorism ... Being devoured is, after all, also a form of existence' withstands the scrutiny of our exegetical exercise. Thus we can say that while a para-tactical mode of operability, which remains *true-to-the-universe logic of delivering all expressions of isolation and discreteness 'remorselessly into the open,* may – as Ferenczi is at pains to point out in his case-study – reinforce the assertion that resistance may be futile, existence *per se*, along different and often alien modal possibilities, is not.

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[7] Present volume.

Notes on Contributors and Acknowledgements

AO& are a Vienna-based semi-nomadic organisation consisting of Philipp Furtenbach, Philipp Riccabona, Thomas A. Wisser and Rainer Fehlinger. AO& work with sites and environments to create settings and sequences for people to gather and interact. Their interventions often involve food, from simple dishes to multicoursed menus, strictly using aliments and products from disclosed origin. http://www.aound.net.

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fieldclub was initiated in 2004 as a live research project based on a four-acre field in Southwest England. The project collaborators, artist Paul Chaney and researcher Kenna Hernly, seek to deconstruct the post-modern notion of self-sufficiency through interdisciplinary art practice and direct interaction with the land. fieldclub's findings have led it to diverge from contemporary ecological discourse, and develop theories of 'nature' which rest outside of conventional humanist frameworks.

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COLLAPSE

Philosophical Research and Development

VOLUME VII

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Collapse VII brings addresses, from multiple perspectives, the multifaceted question of cookery, exploring how the question of the culinary – in an extended and expanded sense – is bound up with some profound and enduring issues in the history of philosophy, and can also suggest new approaches to contemporary philosophical problems.

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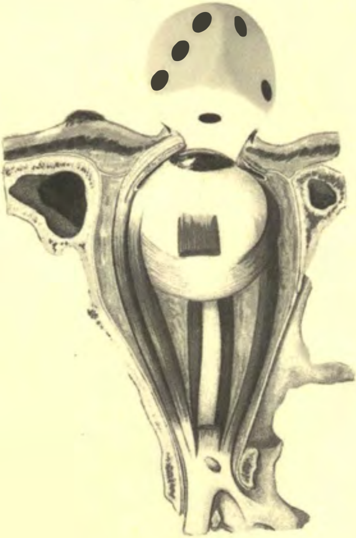

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Editorial Introduction

Robin Mackay

The conceptualization of uncertain events as a set of possibilities each assigned a numerical value—a schema which draws on the circumstances that originally occasioned it, namely the game of chance, the die and its faces—is an enduring one. Although probability calculus was mathematically formalized in the 1930s, abstracted from this 'occasional cause', the spontaneous metaphysics of the gambler continue to exert an intuitive hold on thinking concerned with uncertain eventualities, colouring its interpretation and its application to diverse situations. Stripped of these semantics, the meaning of probability remains as enigmatic as ever: an idealized construct that neutralizes contingency by integrating infinite 'trials'; or a real property, propensity, or 'random generator' inherent in the real but inaccessible to us? A mode of knowledge, or a limit to knowing?

The asymmetry of the wager is dramatised in the figures of the naive punter who faces every roll of the die as a hazardous adventure, and the casino manager who controls the long game and never loses. On one hand chance may be figured as subjective epistemological shortfall, on the other as the object of statistical knowledge. This tension between knowledge and contingency is conceptually condensed in the notion of probability and latterly in that of risk—a concept belonging to a relatively recent intellectual history, but one with immense consequences for modernity.

In recent economic history, financial tools constructed on the basis of probability models in order to manipulate risk have presided over catastrophic failure, having generated conditions that surpassed the capacities of those models. Meanwhile, in gambling itself, an increasingly technically managed and controlled environment means that any calculation of the 'odds' must look beyond the confines of the gaming table. Noting this double obsolescence of the casino model, the eighth volume of **Collapse** explores new ways of thinking risk and contingency outside the space of the idealized game of chance.

One of the colloquial legacies of the epoch-making financial crisis of 2008 has been the notion of 'casino capitalism'. The term implies the squandering of potentially productive resources on a game that is governed merely by chance; at the same time, it connotes an indictment of the asymmetrical allocation of the risks and rewards of such 'wagers'. Without dismissing the indignation neatly conveyed by such a formulation, we might suggest that the notion of 'casino capitalism' has served to occlude the complexity of the financial instruments involved, and the exact nature of the financial system's intrication with the political. Nevertheless, taking the phrase at its word serves usefully to call into question the actual relationship between gambling and finance; that is, between the complex probabilistic calculations employed within the world of finance and the games of chance from which the rudiments of this calculus originally emerged.

One of the initial impulses behind this volume of **COLLAPSE** was to unpack this righteous denunciation, to call its bluff by evaluating the extent to which the model of the casino—the game of chance—really does invest the field of finance; to investigate the ways in which chance, risk, contingency, and the wager integrally structure the global order. In parallel, however, the volume also asks whether the model of the game of chance encapsulated in probability theory obtains even *within* the casino, by way of a number of inquiries into the modern and contemporary history of the gambling industry. In this way we hope to interrogate and problematize what seems to be a pervasive image of thought.

In order to survey those practices in which intellectual resources are most acutely concentrated on the production and exploitation of risk, and to uncover the conceptual underpinnings of methods developed to extract value from contingency—in the casino, in the markets, in life—we have brought together contributors who extend the philosophical thinking of contingency beyond the 'casino' model, gamblers whose experience gives them the authority to considerably refine our understanding of what it means to master chance, researchers who analyse the operation and experience of risk in diverse arenas, and artists whose work addresses both the desire to confront chance and the desire to tame it by bringing it to order.

*

Our volume opens with **JEAN CAVAILLÈS**'s 1940 survey of the state of the art in probability theory in the first half of the twentieth century. Beyond its philosophical-historical interest, the text is invaluable for the way in which Cavaillès, through a technical dissection of the core concepts of a nascent probability calculus, extracts some fundamental problematics that act as a guiding thread throughout the volume.

Cavaillès begins by observing that the model of probability based on games of chance extends itself, in the absence of explicit theoretical justification, into all areas of society ('in the techniques of social economy as much as in physics'). The fundamental grounds for this widespread application to reality are no less contentious today than when Cavaillès was writing. Formulating his critique of the first attempts to produce a mathematical formalization of probability to rival the axiomatisation of geometry, one that would ostensibly decouple probability from its gaming origins, Cavaillès remarks on how the spontaneous metaphysics of the gambler continue to exert an intuitive hold on statistical thought, colouring its interpretation and reflecting its intended applications. Inversely, he shows how, when probability is theorised for itself, certain elements of our intuitive grasp of the notion are inevitably lost, and empirical instances are subjected to certain idealisations. Cavaillès's prime example here is the notion of the *collective*, which transforms the game and its repeated trials (dice throws) into a completed (if infinite) set, in which results occur with a determinate frequency that converges toward a limit and is valid for any place-invariant subset of the collective. In this way probability is effectively submitted to elementary calculus—and yet of course a collective is not something that is ever encountered in any possible field of application. As he discerns, these treatments tend despite themselves not so much to *explain* the principles of probability as to subtly codify the assumptions that make them *useful*.

Cavaillès's exposition continues with the observation that every wager presupposes the delimitation of a game and one's situation within it, and the stability of that game; a presupposition which constitutes a wager in itself. Thus 'the judgment of probability is always a wager, logically anterior to the production of the event to which it applies'. As he concludes, if 'old notions of chance' continually creep back into formalizations, vitiating their coherence, if probability continually 'overflows its definition', if the attempt to reassuringly house probability within a 'realist ontology' free of any abductive leaps fails, and if therefore, when it comes to probability, mathematical idealisation is involved in a continual dialectic with its applicability to real models, this is because the question of probability is not a regional but a *fundamental* problem for science—for prediction. The infinitude of the collective is a vicarious figure, within mathematical formalization, for the indeterminacy of a becoming whose future we seek to fix with laws; it stands in for a hypothesis that is fundamental for all scientific endeavour, 'where acts and wagers intersect each other' and where the success of each wager makes possible new acts. Cavaillès's conclusion grounds this process in the 'vital, extra-intellectual' character of hypothetical reasoning, and calls for a recognition of the hybrid character of the wager: it 'is situated on the dividing line between pure lived action and autonomous speculation; at once an impulse toward the future, a recognition of radical novelty, risk; and, on the other hand, an attempt at domination through the imposition of an order, and the establishment of symmetries'. An obscure situation that invites 'a conceptual renewal in which the elements issuing from [the] analysis of the wager play the preponderant role'—a renewal toward which this volume hopes to contribute some orientating elements.

One of the most intriguing ways to encounter the disparity between idealised models and actual instances of games of chance is from the point of view of those who attempt to pry open the gap between the two. And there is no better authority to speak on this subject than **Steve Forte**, who granted **Collapse** a very rare interview to discuss his career as a player and as a consultant in 'game protection'.

As Forte outlines, both the advantage player and the cheat, who seek to exploit extraneous elements in order to influence the game in their favour, and the casino protection operative, who seeks to detect and foil these exploits, recognise that the milieu of every game constitutes an 'information environment'. Whether through systematic knowledge, technology, perceptual training, or sheer discipline, the notional confines of the game are expanded by them to encompass a whole raft of factors that do not belong, as Forte says, to 'the *theoretical* game'—including the physical equipment, the gaming environment, and the human elements therein.

Detailing a choice selection of exploits, Forte gives us an insight both into the skill and dedication necessary to beat the house, and that called for on the other side of the table to detect these scams. Every assumption about the 'game of chance' is challenged here: randomness is approximate, no shuffle is complete, even a dice throw can be controlled, biases can always be detected; disciplined observation and analysis has the potential to transform almost any game of chance into one of knowledge and skill. The scammer's art extends to engineering the environment by stage-managing credible narratives, establishing routines for cover, manipulating expectations, and sometimes elaborate 'turns' designed to distract attention. While manufacturers of equipment and casino managers increasingly seek to establish systems to stabilise the gaming environment while maintaining an atmosphere conducive to play, gamblers continue to 'scientifically dissect every component' of the game. Forte assures us that, no matter how much protection is in place, new high-tech updates of the old scams will always appear, and that, once taken outside the realm of idealised chance and into the casino environment, the game is always operating across many overlapping milieus:

probabilistic, but also physical, psychological, social, and perceptual—as exemplified by the 'linework' of an unknown artist reproduced here from the collection of memorabilia built up by Forte throughout his career, and which serves as an appropriately subtle and deceptive figure for the cues, imperceptible to the average punter, that can tip the game in one's favour.

By way of contrast, **Natasha Dow Schüll** describes a casino environment where automation and player control seem to be almost total, and where the very desire to win has itself morphed into something new and disturbing. Her research into the world of machine gambling, increasingly central to casino culture, charts the emergence of an industry which specialises in the precise targeting of a very particular set of psychological predilections quite different to those traditionally associated with the gambler. No longer either *agon* or *alea*, neither a test of skill nor a heroic submission to chance, the 'game' here seems to consist in a quest for nothingness, escape, or even self-erasure, in what machine gamblers call 'the zone'—a state of continuous, immobile narcolepsy that technological solutions are rapidly evolving to deliver ever more reliably.

Through her dialogues with machine gamblers, Schüll develops a detailed phenomenological account of the zone. In parallel, her investigation into the industry shows how the development of aesthetics, ergonomics and environmental cues to encourage 'zone' playing are complemented by a series of invisible adjustments to the probabilistic structure of the game itself, which have succeeded in normalizing digital duplicity. These machines have become seductive skeuomorphs which maintain the aspect of their forebears, but whose delivery of a 'gambling experience' is radically discontinuous with the inner mechanisms by which they secure a steady profit. Whereas the players are served up an affective fix of randomness perfectly calibrated to ensure continued play, behind the screen any remnant of chance is entirely extirpated not only through statistical calculation but through a continual modulation of the human-machine coupling.

The traditional drivers of gambling behaviour seem to be important here only as a 'gateway': The hope of winning may bring the player into the zone, but once there, 'no rational action is possible'—one is 'beyond reason'. As Schüll's sources reveal, the efficiency with which the design-loop between players and manufacturers has enabled the machines to key into behaviour patterns means that even the designers themselves find it impossible to 'disenchant' themselves once drawn into the zone.

Schüll thus quite rightly presents this as a case study in what Deleuze called the 'control society': a kind of collusion between the players and an industry that actively solicits their addiction, its result is a casino in which ‘the calculation of probabilities is the rule, the house has the edge and, as much as possible, nothing is left to chance’. The zone itself is ‘beyond contingency’, affectively suspending and providing an escape from life under capitalism, while at the same time constituting a bleeding-edge model of its most advanced mechanisms of control.

The rise of machine gambling can also be read in an architectural register. Far removed from what was once ‘learnt from Las Vegas’, the occupation of erstwhile retail real-estate by machine gambling establishments has become a familiar feature of our cities. **Jaspar Joseph-Lester**’s photo-essay focuses on the Wedding district of Berlin, remarkable for its concentration of these small casinos which come in a variety of shapes and sizes and yet have begun to form a recognizable architectural genre, albeit one that is largely functional—even if their facades continue to deploy a jaded vocabulary of Vegas imagery, these sites are as far removed from the palatial excesses of the golden age of the Strip as Schüll’s interviewees are from Dostoyevsky’s gambler. In his examination of the architectural merits of these spaces Joseph-Lester riffs on Ed Ruscha’s deadpan methodical approach (*Some Los Angeles Apartments*, 1965), documenting the situation and formal characteristics of these deracinated spaces for zoned-out gamblers.

If there was ever someone who conformed to Steve Forte's characterization of the shift of the image of the advantage player from 'stereotypical professional gambler [...] into the science-orientated, geek-like, college whiz kid', it would be **David Walsh**, the Australian gambler whose sports betting syndicate The Bank Roll is one of the most successful in the world. Although in his interview with **Collapse** he immediately places the instinct for gambling in an anthropological and evolutionary perspective, Walsh numbers himself among the 'nerds' who have cultivated the ability to counter the evolutionary artefacts that bias human response to risk, and thus to maintain the attitude that marks out a 'professional' gambler.

On a different scale and in a different league—one is tempted to say a different world—from Wedding's hypnotised slot-players, Walsh's disciplined approach has led to a level of success that has allowed him to risk a bold move in an entirely different sphere, with his extraordinary Museum of Old and New Art in Hobart, Tasmania. In our interview, Walsh, echoing Forte's emphasis on the discipline required of the advantage player, emphasises the fact that successful systems are based firstly on insights that enable an edge, however small, to be established; and subsequently on a correct estimation of that edge and its disciplined and patient application. The glimpses Walsh affords us into his own system paint a picture not of sudden strokes of mathematical genius, but of a system based on the principle that surpassing the already considerable 'efficiency' of the betting public by even a small margin can pay great dividends. Reflecting upon his career and his latter day role as art collector and 'unmuseum' director, Walsh goes on to emphasise the vicissitudes of chance in life, and how selection effects colour our perceptions of fortune, success, and failure.

These forays into the world of the casino proper only go to reinforce Cavaillès's argument that once concepts of chance and probability are brought to bear in concrete applications, the tension between idealisation and experience yields a complex interference pattern. The same is true of the industrialisation of risk: contemporary reality continues to be shaped by the operationalization of probabilistic thinking through the systematic assessment of risk in all spheres of society. This is achieved largely through the use of models whose relation to the real, in Donald MacKenzie's famous phrase, tends to be that of 'an engine, not a camera'. Taking up this theme with an overview of his research into the statistical modelling of flood risk, **ANDERS KRISTIAN MUNK** brings us into the heart of the contemporary *manufacture* of risk enabled by such models. Beginning with William James's pragmatist premise that our understanding of chance, and the concomitant notion of non-actual events, remains incomplete without an understanding of how the latter are *made real* by mobilising some kind of galvanizing force, Munk addresses risk models as a particular form of science-fiction, wherein the 'fictitious' capacities of physical modelling are cultivated and activated by the application of the probability framework.

Exploring 'the difference made by models' and in particular the exigencies imposed on models whose aim is to 'enabl[e] things to express themselves in monetary values', Munk gives a detailed account of these hybrids of empirical data, physical modelling, and general statistical principles abstracted from the specificities of any particular event. The 'orchestration of futurity' that will allow 'the future to be thought of as a game of chance' brings into play a set of assumptions whose provenance is a bizarre mix of stereotyped curves, flying bombs, and kicking horses. Here probability figures not as incomplete knowledge, but as a supplementary construction that requires a 'leap of faith'—a 'cocktail' of knowledge and generic idealisation that is necessary in order to make indeterminacy go 'live' as an effective machine-part. Munk thus lays bare the construction of probability models as a 'platform for intelligibility', and reveals how those tasked with this construction are compelled to give pragmatic answers to some crucial theoretical problems (how to make a flood model without any data? How likely is it for water to go uphill rather than down? How are individual flood events independent from or correlated to each other?). Finally he offers us an analysis of how this process articulates the two aspects of the 'janus-face' of probability—as epistemic (incomplete information) and as 'explorable property of the future'—so that they may complement each other and yield a monetizable model. He concludes that the conditions put in place to ensure the 'liveness' of indeterminacy in fact mutilate the latter, depriving it of the other vital aspect of Cavaillès's understanding of chance: the emergence of radical novelty. At least, this is the case for the domain modelled; as for the actions of models themselves, they may interact with the world to present unforeseen outcomes. Indeed it is at this level that they 'make a difference' and, rather than representing reality, 'bring something hitherto unavailable [...] into being'—even if in doing so they may also 'exacerbate unintelligibility'.

It is this movement and its seismic historical effects that **Nick Land** addresses in a grand synthesis that seeks to 'transcendentalise' the notion of 'casino capitalism': according to Land, the inherence of risk to modernity makes of capitalism the system for which, at the (immanent) limit, 'the casino has become the stake'. Risk is a historically specific category: as Munk shows, it is constructed, rather than (like chance) suffered; and Land argues that the construction of risk also calls for the construction of new, formalised synthetic agents as their vehicles. At the limit of a planetary-scale experiment in which modernity and the calculative determination of risk are inextricably intertwined, Land sees artificial intelligence and capitalism converging in the construction of synthetic subjects that 'formalise agency and restructure time'. Abandoning any aspiration to make probability an exact science, Land here foregrounds the Bayesian approach which epistemologises risk within a framework of the incremental revision of inferences, allowing probability calculations to mitigate for their incompleteness, bringing learning and risking into immanence as 'integral cognitive hazard' and 'unplanned design', and fully unleashing the disruptive capacity of the pursuit of risk via its effective commodification.

Inevitably, this sovereign role played by risk in capitalism is accompanied by an inherent opposition to any supposedly external instance by which such risk could be judged or to which its imperative could be subordinated. Hence justice as such is risk's other, for, as Land insists, whereas a risk society is that for which society as such must be put at risk, the demand for justice is a demand to limit vulnerability, to keep the game *inside* the casino—a resistance to the escalation of the stakes to those of Russian roulette. This resistance, he argues, consists in the refusal to expand the weak subcategory of the *wager* into the full form of the *venture*, for which adoption of risk entails risking the loss of the agent itself.

Thus understanding risk-vehicles such as companies as already-exi(s)ting AIs heralding the complete integration of venture and agency, Land asks how we are to understand the discourse of 'mankind' from this perspective: As the pursuit of a continued struggle of an extra-economic form of agency against its absorption into the 'venture-form'; as reference to a species whose statistical consideration confidently predicts its imminent demise; or as a nonspecific concern with intelligence which, as such, would be indifferent to the corrosion of traditional subjecthood? The suggestion here is that, once capitalism is out of the box, our answer to this question implies at most a minor adjustment to the horizon of *existential risk* looming over the human subject—for leaving the table is no longer an option.

Contemplating the fate of mankind from a similarly lofty perspective, **Milan Ćirković** asks whether more, rather than less, risk might be the order of the day. In 'The Greatest Gamble in History', Ćirković meditates on existential risk, however, from the point of view not of terrestrial singularity but of extraterrestrial diaspora, examining the prospect of what might seem like a 'reckless gamble' on the part of a beleaguered species—namely, a decisive collective investment in extraplanetary migration. In introducing this possibility he considers the present situation of humanity in terms of an embedded series of 'games' at which we have, so far, been lucky. We are faced with a choice of several extremely uncertain and risky ventures with regard to our sedentary terrestrial situation (one of which—no less hazardous, given the potentially 'negative adaptive value of intelligence'—is to stay put). The stakes here are no doubt existential: Can we transform our situation from that of a game of chance into that of a game of skill? On a sober analysis of the odds, he argues, we may stand more chance of surviving to take another turn if we risk stepping out of the planetary 'cradle'.

Following this intense multiscalar amplification of risk, from the theory of probability to modelling to existential risk, an ascent that brings together the adventure of human intelligence, risk, capitalism, and futurality, we might firstly question any apparent congruency or continuity between Land's account of the disruptive force of risk under capitalism and Ćirković's call for a collective wager on an extraterrestrial future. After all, Tsiolokovsky's cosmist call for an escape from the earthbound casino to a collectively-willed future, with which Ćirković opens his reflections, was premised on a notion of collective endeavour that seems prima facie incompatible with the organisation of resources and intelligence presented by the risk-order of capitalism. Although the financial crisis has revealed, in accordance with Land's thesis, that the major instances of sociopolitical heredity are already effectively subordinated to the risk-vehicles of financial markets, an obvious response to his transcendental deduction of the futural essence of capitalist intelligence would be to observe that a certain class of subjects seem in fact to have succeeded very well in separating their own fate from that of their ventures. For the net effect of financial crisis has been to transfer the downside of risk from those who pilot complex financial vehicles to the citizens of what were once nations and societies, and indeed to prevail upon the waning sovereign power of the latter to prop up their ailing enterprises.

Yet in the absence of any conceptual grasp on the general nature of the financial instruments involved and their relation to the dynamics of capitalism, the satisfaction of such denunciation rings somewhat hollow. Cavaillès's observations hold well for these sophisticated instruments: at least a part of the catastrophic nature of the systemic crisis owes to the fact that they proliferated instrumentally in the absence of any firm understanding of their inherent logic.

Central to this cognitive deficit is the question of derivatives. The notion that the increasing sophistication of these financial instruments poses the threat of systemic failure disaster is nothing new;[1] and yet, although they are generally considered to have 'failed' in some way, the underlying assumptions of the models that provide their basic operational logic—specifically, models for derivatives pricing—do not appear to have been significantly questioned or revised.

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[1] See for example Richard Thomson's popular account in the aptly-titled *Apocalypse Roulette: The Lethal World of Derivative*s (London: Pan, 1998).

In an attempt to respond to this state of affairs, our volume presents a set of contributions which seek to understand the systemic nature of the global market in risk, which includes human agents, but also and increasingly the 'synthetic agents' to which Land refers; to evaluate precisely what sort of intelligence is in play in the latter; to understand the inherent logic of the derivatives market and the singular role it plays in the global economy; and to clarify the relation of this advance guard of the finance sector to the capitalist mode of power.

In a famous passage from his 1936 book *The General Theory of Employment, Interest, and Money,* Keynes charged, against the notion of the rational economic actor, that human behaviour is often driven by 'animal spirits' rather than being 'the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities'. Agreeing with David Walsh's conviction that risktaking behaviour can be understood in terms of our evolutionary inheritance, **John M. Coates, Mark Gurnell and Zoltan Sarnyai** caution against a too stringent separation of reason and emotion, thus extending this questioning of certain abiding philosophical and economic prejudices.

One of the images conveyed by the notion of casino capitalism is that of an elite of 'bankers' driven by the worst excesses of human (or, in fact, masculine) behaviour. Coates et al. provide a scientific context for this 'irrational exuberance' in which it becomes evident that the mechanisms that drive these 'violations of rational choice theory' may be the same ones that, within certain parameters, are functional and optimizing in risk situations. Their contribution to this volume, documenting an experiment which tracks correlations between biochemical shifts in the bodies of traders and their performance in the market, delivers some suggestive results. Endocrinal mechanisms that help the body to adapt rapidly to changing environmental circumstances, in an environment of 'uncertainty, novelty and uncontrollability', they suggest, may be responsible for the characteristics that make for a successful trader, able to respond appropriately to high-frequency signals; however, in chronic situations these same mechanisms may lead to behaviours that exacerbate systemic fear, with risk behaviour and chaotic markets amplifying each other in a biological-financial feedback loop that effectively hooks up the accelerated delivery of glucose to the brains of individual humans to inceasingly volatile markets.

This image of world markets wired into the metabolisms of bodies and the preconscious circuits of the brain rather complicates the alternative between rational assessment of information and 'masters of the universe' exuberance. In a network of bodies whose competencies amplify 'animal spirits'—biochemical and sensorimotor reactions to uncertainty and expected harm, instrumental within certain boundary conditions, potentially catastrophic beyond them—risk becomes a question that is as evolutionary and biochemical as it is political and financial: in other words, the figure of the trader is placed in the ramified space of the 'casino' described by Ćirković, comprising the contingent factors that produced both the peculiar animal *homo sapiens* and its technical milieu. Risktaking becomes a strange kind of hybrid object that cannot be addressed from any one disciplinary perspective, a syndrome that is neither entirely natural nor constructed or fabricated.

In invoking a 'neuroeconomics' that would provide the link 'between economic events and brain processes', Coates et al. suggest in closing that the trading floor might be a laboratory in which we could attempt the control, optimisation, and modulation of these biochemical aspects of the risk system, harnessing their positive cognitive role while guarding against their chronic effects (possibly through a 'feminization' of the trading floor).

Yet one might wonder for how long humans will play any role at all, considering the supercession of traders by various species of algorithmic 'black boxes', and the rise of high frequency trading. Although the stressed 'hormonal economic agents' of Coates's experiment were engaged in rapid trading, holding positions for only a few minutes at a time, automated computational trading today creates an environment the speed and intricacy of whose operations are simply intractable to human cognition. What role is left for 'the remnants of the human trading population' in this 'evolving ecology' whose 'emergent rhythms' are the expression of ever more densely interconnected relations between processing nodes of densely encoded knowledge and strategy?

It is this increasingly inhuman ecosystem that **NICK SRNICEK AND ALEX WILLIAMS** describe, an environment in which 'technology redefines the risk landscape itself', with increasingly fine-grained and liquid transactions giving advantage to those with sheer speed on their side. From computational dynamics to hardware configuration to physical location, firms competing on this landscape constantly strive for optimisation, and cyberspace's much-vaunted tendency to 'compress space' now sees the physical itself becoming the next frontier for finance as 'the earth itself becomes an impediment'.

With an eye on Land's future AI, Srnicek and Williams ask in what sense and according to what principles these agents 'think'—what kind of intelligence is embedded in them? On the basis of this question the authors of the 'Manifesto for an Accelerationist Politics'[2] expand and further finesse their understanding of accelerationism by distinguishing between a mode of acceleration that would operate 'in redefining this space so as to change the very rules under which the game itself is played', and a sheer operative increase in speed that aims 'simply [to] dominat[e] an agreed space of competition', suggesting that the latter in itself cannot be a 'game-changer' in any significant sense.

What might be the result of such sheer acceleration for *representation*, given both the impossibility of securing any kind of 'cognitive mapping' of these transactions which seem to reformat space itself, and the mode of nonrepresentative subjectivation that corresponds to the intensification of finance-power? As Srnicek and Williams observe, there remains a stubborn materiality to these operations, and indeed the geographical location of their major processing operations has become crucial, to the point where they are protected as major national assets: 'while popular perception portrays Wall Street as the central location of global finance, it is in fact New Jersey and Chicago where much of American finance is corporeally instantiated [...] and is regarded as a component of the nation's critical infrastructure'.

For this volume **Sam Lewitt** undertook the self-consciously vain task of capturing an image of one of these ‘constitutively dislocated’ locations, as a way to measure the almost total withdrawal of finance from representation. In fact, his contribution instead recounts how this original plan was thwarted by way of a misadventure that led to the erasure of said image and a visit from the FBI’s Joint Terrorist Task Forces.

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[2] On accelerationism, see R. Mackay and A. Avanessian (eds.), *#Accelerate: The Accelerationist Reader* (Falmouth and Berlin: Urbanomic and Merve, 2014).

What ensues is a reflection on the accelerated abstraction of the value-form and the forces that are mustered to defend its remaining physical outposts. Lewitt’s ‘Notes from New Jersey’ recall how his attempt to photograph the Mahwah datacentre—an enterprise whose interest lay in the impossibility of extracting from its blank facade any insight into the abstractions facilitated therein—triggered off a startling security response. The agents (of what power it is not clear) who forcibly redacted Lewitt’s digital images compounded the interpellation by suggesting that the only permissible representation of this ‘disappearing monument’ to a globalised automated financial network of abstraction would be one made by human means unsupported by any mode of recording save for the traditional skills of the artist. This unexpected turn of events, as Lewitt records, added further dimensions—those of guilt, erasure, and subjection—to his original project to test the conditions of representation under accelerated capitalism.

Although they may represent the cutting edge, the high speed operations transacted in Mahwah are perhaps more a matter of the *next* crisis than of the one whose protracted tail-end we are still living through. As already indicated, more germane to the latter would be an understanding of the infamous CDOs and, more generally, of derivatives. The mathematical instruments used to price derivatives—classically, the Black-Scholes-Merton formula—are underwritten by a model that ostensibly consists in assigning numerical probabilities to future events. The work of **Elie Ayache**, who has spent many years dealing first-hand with the complexities of the speculative options and futures markets, presents us with a new thinking of the market, as the primary manifestation in the world of radical contingency, to be thought entirely outside the terms of probability and prediction.

Ayache argues that in practice derivatives traders do not calculate price on the basis of a confined range of future probabilities, but directly and effectively *write* price as the contingent reality of the market, *now*. The market is therefore not a set of probabilities, but the very *medium of contingency*. It is a regime of events whose vicissitudes we cannot better grasp by addressing our failure to deal with highly improbable events (Nassim Taleb's 'Black Swans'), but whose events are effective without prevision or reason—according to the title of Ayache's book, *Blank* Swans.

At the beginning of *The Blank Swan* Ayache even goes so far as to suggest that it indeed this *philosophical* default played a crucial role in the current financial crises: The image of the market that circulates amongst those who daily recreate it is based on a frail philosophy of probability that fails to capture its most characteristic operations. He understands the act of writing derivative contracts or 'contingent claims' instead as a material inscription of difference directly in the real, creating a future that is in principle unforeseeable. Derivatives can thus be considered, in Ayache's words, 'technologies of the future'.

In our extensive interview Ayache not only avails us of his expert knowledge of derivatives pricing technology, but clarifies and extends his critique of Taleb, and gives the most in-depth account yet of his pursuit of a 'philosophy of the market'. The latter is distinguished by a move from an epistemological point of view—the idea that there is a 'real' random generator which models attempt to approximate—to an ontological one in which pricing as act—as a continual writing *in the gap* of discontinuity—is what drives the continual event of the market, *as place* rather than *in time*. For the market, Ayache argues, is a 'massive event' that moves in the dimension of writing, not that of time, and which has no external guarantor or generator for its processes. In this way, as he describes in detail in his responses, he develops his own conception of a 'unilateral' speculative materialism without any 'dogmatism of the absolute'. In surpassing Meillassoux's thinking of radical contingency by insisting that he must understand his own work as a *writing* (philosophy as a practice wherein 'writing is faster than thought'), the question becomes no longer one of thought acceding to an absolute real (just as it is not a question of the derivatives pricing model capturing the 'real' random generator of the underlying), but one of discovering the matter of writing 'in which the event is repeated'.

JON ROFFE's review of the overall movement of Ayache's thought reiterates this movement 'from depth to surface, or from thought to writing'. Explicating the major contribution of Ayache's approach—that of refusing to subordinate the understanding of the market either to predefined political categorisations or to probabilistic frameworks—Roffe asks what are the axioms of an immanent 'philosophy of the market', one that thinks the market outside of these imported constraints, and without arbitrarily expelling those aspects of the trader's activity that exceed them.

Roffe goes on to confront Ayache's theory directly with the question of CDOs, the privileged instruments of financial misfortune: Since the pricing of CDOs demands a supplementary level of probability-based calculation Ayache dismisses them as 'degenerative fantasy'; yet Roffe takes issue with this hygienic expulsion of CDOs from his model, arguing that they cannot be excluded from the 'generalised surface of the market' it predicates.

Suhail Malik's contribution draws Ayache's thinking further into the domain of the political by reading price as the medium of political order, and the market as the medium of *capital-power*. Turning from the intrinsic logic of the market to the shifts in global power dynamics implied by the sheer volume and financial magnitude of derivatives trading, Malik sets out from the fact that these markets demonstrably pose a systemic risk to national economies, and that their size and transnational nature means that they cut across and where necessary countermand the power of states. The uninhibited and unconstrained uncertainty unleashed by these risk-bearing instruments thus spells immanent crisis for a whole legacy of political certainties, since they constitute the greatest planetary concentrations of power and pose an 'existential risk' to sovereign power as traditionally conceived.

In what promises to be a significant contribution to political economy, Malik seeks to combine the philosophical understanding of the nature and logic of the derivatives market with an analysis of the entirely novel, structurally-specific mode of capitalist power it expresses. This ambitious 'ontology of finance' supplements Ayache's understanding of the fundamental logic of derivatives with Jonathan Nitzan and Shimshon Bichler's account of *capital as power*. Such a 'power theory of finance' answers both to Ayache's claims as to the singular importance of derivatives for an understanding of pricing as such, and to Land's claim that risk-bearing vehicles and agencies tend to corrode the inherited social forms from which they historically emerge. According to Malik, though, this inquiry requires the adjunction of Nitzan and Bichler's understanding of capital *qua* absentee ownership, with its primary ordering mechanism of *differential accumulation*. Equally, however, it necessitates a supplement to Nitzan and Bichler's own account: the latter already agree that ownership of property, stocks, bonds, and derivatives all pertain ultimately to the same, immanent market, with all of them being ordered by means of the universal mechanism of *pricing* (namely, through the discounting of anticipated future earnings). They also countenance the refusal to subordinate the analysis of capitalism to any dependency upon conditions exogenous to finance (diverging from Marxism in insisting that finance is not an excrescence of 'real production' or a 'parasitical, supplementary or "fictitious" mode of capital'). However their analysis must be extended to take account of the specific operations of derivatives, in order that it might encompass the new modalities through which their complex operations multiply and transform the power axiom of differential accumulation, and, crucially, the transformations they bring about in the inherent dimension of *sabotage* that Nitzan and Bichler see as integral to capital-power.

For Malik then, the order of futurality involved in derivatives markets, in discovering price as sole ordering mechanism, fully unveils a universalising logic that heralds a comprehensive reordering of the social via finance-power, one which extends the latter's reshaping of 'political futurity in terms of price magnitudes'. Extending Ayache's understanding of the market as writing, he offers an original analysis of the constitution of derivative pricing through the Derridean concept of *différance*, with the 'contingent claim' at once instituting price difference and deferring the exchange that would realise that difference, with the pricing surface as the 'stage of presence', and with the ultimate valuation of the derivatives contract featuring as a 'supplement' that serves only to structure the contingent unfolding of its quantitative role in the market. Contrary to Ayache's expulsion of time in favour of the 'place' of exchange, however, Malik reads pricing as a *temporization*, as a 'becoming-time of price'. Pricing emerges as a form of 'time-management' *and* as the basis of a new political economy, with derivatives trading integrated into Nitzan and Bichler's general model of price as the 'single quantitative architecture' of capital-power: Ultimately finance-power can be determined only by a 'realism' (yet a 'non-correlationist' one) that integrates both the power dimension and the risk dimension.

This analysis yields as its final term the *arkhéderivative* as 'a priori of the political economy constituted by the ontology of price'. The existential risk faced by capitalist modernity, the 'absolute volatility and indefinite plasticity' that constitute the 'risk-order' of these markets, is then understood as that of an 'ineliminable futurity that splits the present', a universal normless order that is 'necessarily contrary to stability' and constitutes an 'intensive differential sabotage' that lays waste to sovereignty.

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As regular readers of **Collapse** will know, the thinker most responsible for initiating a renewed debate around the concept of contingency (and whose conception of radical contingency converges, in Ayache's work, with the practice of pricing as technology) is **Quentin Meillassoux**. Meillassoux makes a welcome return to the pages of **Collapse** in this volume, opening a sequence of contributions that relate to the role of chance in the work of art by contextualising his recent work on Mallarmé, *The Number and the Siren*, in terms of his general philosophical orientation. He positions Mallarmé's *Coup de dés* as a *materialist* gesture that presents a unique solution to the predicament of the artist following the crisis of the withdrawal of all divine warrant, the poet confronted by Chance, that 'dark absolute' recognised by modernity as the only presiding power. In this confrontation with the sole reign of Chance, according to Meillassoux, Mallarmé succeeds in elevating himself *qua* writer of the *Coup de dés* to the level of a *material divinity*.

The 'Master' of the *Coup de dés*, who, in an eternal moment of hesitation, holds the dice in his hand but does not yet throw them, recalls Mallarmé's earlier protagonist Igitur; yet while Igitur was constrained to choose, in the *Coup de dés* Mallarmé *infinitizes* this hesitation: if everything is subject to chance, except for infinite, eternal chance itself, then Mallarmé, in devising a situation where the dice is both thrown *and* not thrown, *becomes* chance—the only modern divinity, and a thoroughly meaningless one whose celebration, in a ritual of solitary reading, leads not to a humbling of the human before jealous gods who demand allegiance, but rather to what Meillassoux describes as a neo-epicurean materialism, realized in the poet's eternal hesitation.

Following from this undecidable fate of the poet whose performative gesture makes him equal to chance, Meillassoux's ontological translation of Hume's critique of causality[3] and its evocation of a hyperchaotic universe where the laws of nature could alter at any moment inspires the tale of another type of performative tribute: **Sean Ashton**'s short story recounts the strange fate of a man who decides to 'put his body in the service of a philosophical notion'. This weird tale in which

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[3] See Q. Meillassoux, 'Potentiality and Virtuality, in Collapse 2.

Chesterton and Lovecraft meet Meillassoux, brought to life in suitable style by **Nigel Cooke**'s illustrations, describes a more homespun attempt to embody a philosophy; a singular experiment that wavers undecidably between philosophy, art, and performance, and leads the protagonist who knows where....

Proposing a further study in the activation of chance, albeit of a more violent sort, **GegenSichKollektiv** address the demand that the work of art itself must involve a risk on the part of its audience. From the time of the avant-gardes, this expectation of sensory and/or cognitive jeopardy has been a mainstay of the self-image of the modern artist, and is still omnipresent in the claims of contemporary art, but is rarely taken as literally as in the CAUTION experiment they propose. They approach the question from within a practice that feels it most acutely: under the banner of 'noise', various practices of experimental music have pursued the aim of a sensory and cognitive disruption of all norms of musical structure, style, and expectation, only for 'noise' to degenerate into a series of stereotyped gestures which have given rise to a marketable genre. Can anything be salvaged of the claim to provide a locus of real risk outside the calculative depredations of the consumer system? Drawing on the work of Ray Brassier, GegenSichKollektiv's diagnosis of this predicament leads to an analysis that suggests that only a dialectical articulation of the sensory and the cognitive—avoiding the dead ends of subjective abolition and conceptual overcoding of experience—can draw noise out of its safety zone and present the possibility of a true risk on the part of the audience, thus leading the way to a 'game' that would propel the collective body toward a real encounter with chance. Although the text itself operates as an invitation to the game, the reader is indeed advised to use their 'recipe' with the utmost caution.

Continuing this interrogation of the relation between art and contingency are two artists' works that cut through the entire volume. **JEAN-LUC MOULÈNE**'s series of images relay Cavaillès's exposure of the vital-abstract roots of the problem of probability. This is precisely the double-register within which Moulène's work operates, endowing his three-dimensional works with a 'formal cruelty' through objects which are at once visceral and conceptually truncated. In Moulène's unsettling edition for **COLLAPSE**, the operations of abstraction involved in thinking and operationalizing chance seem to be glimpsed at a second remove, as images of devices of thought. These figures are then interleaved as 'feuilles volantes' throughout the volume, with this redistribution offering yet another material image of chance.

Often an artwork's claim to contingency or chance is configured in terms of indeterminacy or ambiguity: by courting the indeterminate or explicitly invoking an interpretative relativism, artworks seek to be 'open to contingency', as if this were a decision the artist could make.

In her contribution **Amanda Beech** instead presents us with the order of coincidence. Her series addresses and invites the desire to order, to make sense of contingency and, in particular (as often thematised in her work) the desire to focalize the contingencies of power into a decisive image. In a series of images deriving from her 2013 collage-découpage installation work 'The Church The Bank The Art Gallery' (Banner Repeater, London, 2012), Beech tempts the viewer to formulate their suspicions as to the entanglement of the artwork in the three eponymous systems of power. Passing through the pages of the volume, these three loci are subjected to slippage, coincidence, and dispersion, yielding no definitive order. The three series, relating to each of these authorities suspected of compromising the artistic endeavour, provide the basis for a faltering, uncertain moving image, a montage sequence that interrupts the reader's progress through the volume, or which one can 'fastforward' flipbook-style, maximising the chance of divining some continuity at the price of turning the remaining content into an unintelligible blur.

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Three different viewpoints on contingency and probability, in philosophy, in science, and in the market, close our volume.

Fernando Zalamea reminds us that the concept of absolute chance was introduced into philosophy in the late nineteenth century by Charles Sanders Peirce, in the form of his 'tychism'. The pertinent difference between this concept and that of Meillassoux (and Ayache) lies in Peirce's insistence on a paradoxical integration of the principle of absolute contingency with that of continuity (synechism). In insisting upon synechism, Peirce attempts to avoid the potential vitiation of any systematic universal philosophy by the introduction of contingency; at the same time the dialectic with tychism avoids the impoverishment of specificity that might issue from the espousal of a universal 'continuism'. In his recapitulation of the universal 'forms of evolution' through which his theory of contingency is developed, Peirce seems to anticipate Ćirković's 'universal casino', as he progresses between different orders of contingency, whose consequences in the general system of dialectics between tychism and synechism Zalamea sets out in detail. As Zalamea describes, with reference to Reza Negarestani's architecture of decay, it is the 'back-and-forth' dialectics between the two principles—'a sort of chemical reaction'—which makes of Peirce's philosophy an impressively complex and subtle instrument that particularly deserves to be revisited in the context of what Zalamea, following Rosa María Rodríguez Magda, calls 'transmodernism', a condition that demands—beyond both modernism and postmodernism—precisely this marriage of the espousal of universal continuity and the acknowledgement of contingency.

In the opening text of the volume Cavaillès declares that probability remains a 'live paradox within the system of the sciences'. No more so that in quantum physics, where probability plays a central role—an event which seems to go counter to the entire trajectory of 'exact science'. **Michel Bitbol** suggests that we draw the full consequences of this event by understanding quantum mechanics as a metatheory which formalizes the general conditions of possibility for prediction as such for phenomena whose detection is inseparable from their production.

Bitbol continues the general trend among our contributors, by disposing from the outset with an epistemological reading of probability—one that would see the operations of probability as pertaining to subjective ignorance of the phenomena in question, with those phenomena understood to belong to a real generator that could in principle be known. As he observes, the emergence of probability in the sciences saw it attached to (Lockean) 'secondary qualities'; in quantum mechanics, however, even what were traditionally understood as 'primary' qualities are demoted to 'secondary' qualities *qua* 'indirect manifestations'. It is no surprise then that the association of the knowledge of secondary qualities and of probability with epistemological weakness should have given rise to resistance when the lineaments of this science began to emerge. Bitbol suggests that we should not be afraid to read the central principles of operationalism, holism, and perspectivism as countering this trend with a certain return to Pascal's recognition of anthropological limitations on knowledge and of the knower's entanglement with what is known.

If we insist on the retention of primary qualities, we can take up a stance according to which they can consistently be postulated, but only as inaccessible to any experimental practice—entirely breaking the cycle between theory and experiment that constituted the real value of the determinist hypothesis. The alternative seems to be to project indeterminism 'into the things themselves'—meaning that we conceive of the real, equally speculatively, in terms of propensities or potentialities. Bitbol insists that while either stance may be fruitful as a standpoint from which to motivate scientific research, the philosopher, rather than trying to obviate the problem, should intensify it, fully confronting what QM has to tell us about our situatedness, and examining what it is that the structure of the theory of QM owes to the situation of the experimenter. This 'reorientation' begins with a recognition of the expanded form of probability employed within QM, which emerges as a response to the type of phenomena it is bound to deal with. The differing contexts of experiments are intrinsic to the results they deliver, and cannot be unified in such a way as to eliminate them. Therefore a new apparatus evolves to articulate these incompatible contexts: a 'metacontextual form of probability theory' able to reconstruct these fractured data within a programme of universal applicability.

As Bitbol demonstrates, later developments of quantum theory do not escape but only deepen this extension of probabilistic thinking, further developing the 'metacontextual predictive structure' that confirms the inseparability of detection instrument, milieu, and phenomena. Furthermore, once one comprehends the structure of quantum theory as such—as consisting of this metacontextual form of probability, twinned, in each instance, with a specific set of symmetries—it becomes possible to understand the quantum theory not as a 'physical theory' in the sense of Newtonian physics, but as a 'generalised theory of probability' whose potential applications reach well beyond the sphere of physics.

In Elie Ayache's closing text, 'A Formal Deduction of the Market', he adds further precision to his concept of the market by returning full circle to the questions Cavaillès broached in his opening text, and by delivering on the latter's presentiment that 'it is to a more profound reform of our ideas about the real that probability calculus invites us, a reform whose magnitude we should not underestimate'.

However, where Cavaillès problematizes the axiomatisation of probability by pointing out the slippages that take place with regard to empirical probability and intuitive concepts of chance, Ayache argues that it is this utter abstraction of the formal model that harbours the potential to transform our understanding of events themselves, by stripping them definitively of the artefactual trappings of the 'casino' model. The latter is reduced to being just one possible model for the probability axiomatic, but one which is no longer permitted to overcode it.

Utilising the recent work of Glenn Shafer and Vladimir Vovk, Ayache demonstrates how the formalism can be stripped of its relation to concepts of repetition, time, and propensity (the real random generator) altogether, so as to move toward the notion of an 'ultimate and global event' that integrates *trading* and the category of *money* into the understanding of probability at a fundamental level.

Ayache argues that this liberated version of the axiomatic, dispensing with trials, repetition, outcomes and statistics, which demands a revision of the concept of the event and a rethinking of the relation between reality, matter, and formalism and a 'reshuffling' of chronology, yields precisely the figure that he calls the *market*.

Here we are party to a strange visitation by the ghost of Mallarmé's master, when Ayache declares that if '[t]here is something pressing to say when holding the die [...] this won't take place in time' since 'time is no longer essential to contingency'. For the intensive understanding of contingency he ultimately proposes seems precisely to correspond to the eternal hesitation of the Master's dicethrow.

Finally, in what Ayache speculatively proposes as a 'revolutionary' conclusion, it is the formalism itself that would give rise to reality: 'reality in the sense of genesis and inception'.

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As will be readily appreciated from this brief introduction, this volume has aimed to assemble a constellation of work which, as in previous volumes, acts through a series of partial overlaps and resonances so as to render vivid and urgent a set of problems that manifest themselves in diverse disciplines and practices.

Far from claiming to fully resolve the uncertainties engendered by such a montage, the aim is to intensify a set of problematics that are not only still 'live' epistemologically and ontologically, but whose ramifications continue to unfold at the heart of contemporary actuality. In presenting this set of resources with which to begin a renewed thinking of the questions of contingency, probability, and risk, we hope at least to have encouraged readers to resist surrendering the ‘demon of chance’ to deterministic idealization, to our own epistemic shortcomings, or even to the arrow of time. And in examining the forms of ‘game control’ integral to a society that feeds on risk but still dreams of ulterior certainty (if only the certainty that the arena of risk itself will remain secure), we hope to have suggested that, beyond the confines of the casino, these questions remain the site of a compelling and still mysterious configuration of the production (or writing) of the real, formalization, and the contingencies of human knowledge.

Untitled

Jean-Luc Moulène

Series of ten colour digital prints
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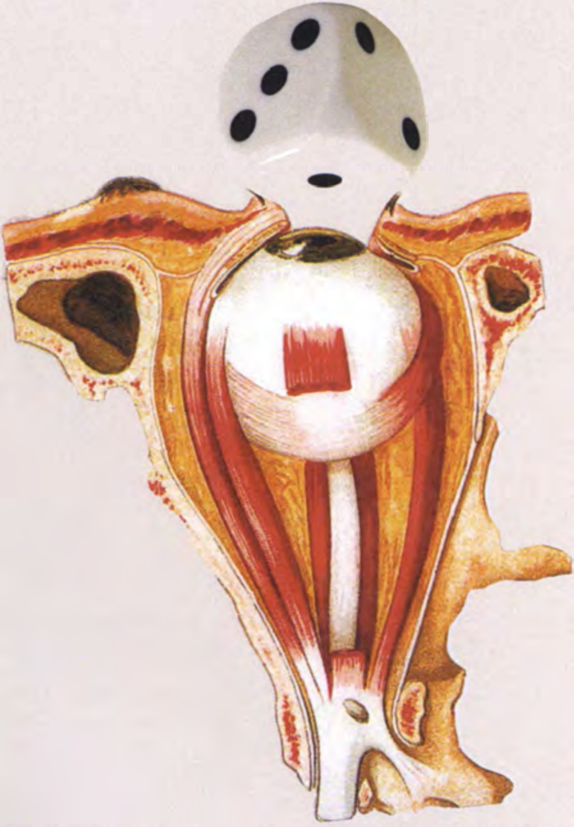

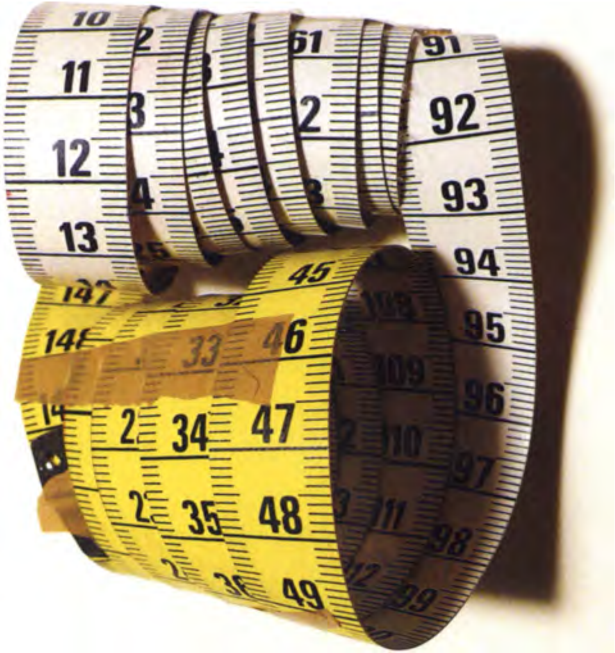

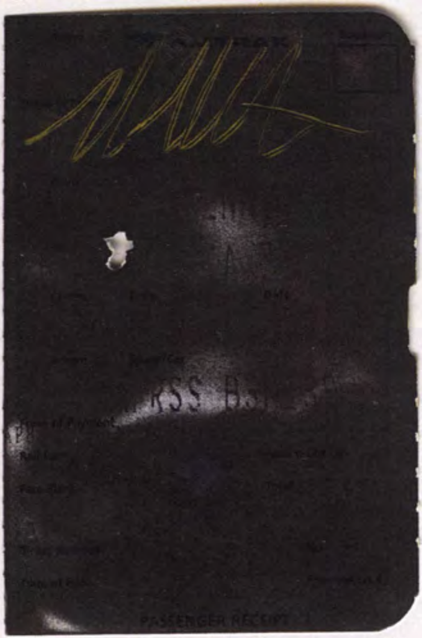

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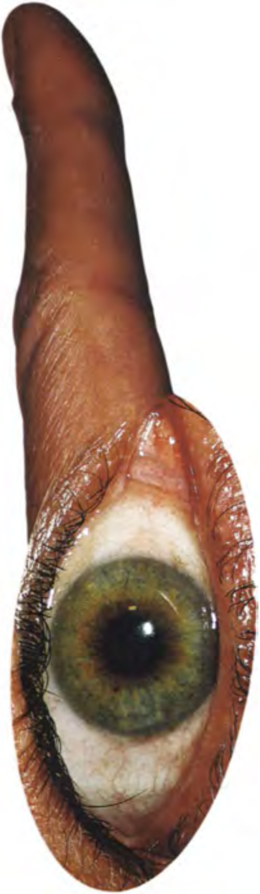
Form of Payment

PASSENGER RECEIPT



The Church The Bank The Art Gallery

Amanda Beech

Inside the Bank of Sicily, Palermo, is a Mormon
Church, bankrolling the deals that established one
of the art world's largest private collections of
Modern Art.

These systems mark our habitual perception.
We tie them together with directed energy.
We enjoy the pleasure of this sense-making.
The neatness of a world order in order.
Our lives in passive crisis: An order of crisis.

And so we imagine…

Make these connections through the ether.
We see the big payoff.
Access to secret and darker forms of knowledge, to
deeper stabilities enhanced through mystical unions.

It is the axis of power and the horrific truth of it all.

Safe in the comfort of knowing, when the worst
comes to the worst.
We are bound together as nature, from the start.

Or,

Coincidence is the satisfaction of our blind fantasy.
The event as fate.
The exposition of coincidence as meaning is the
grasping of material forms together as a poor ritual.

But:

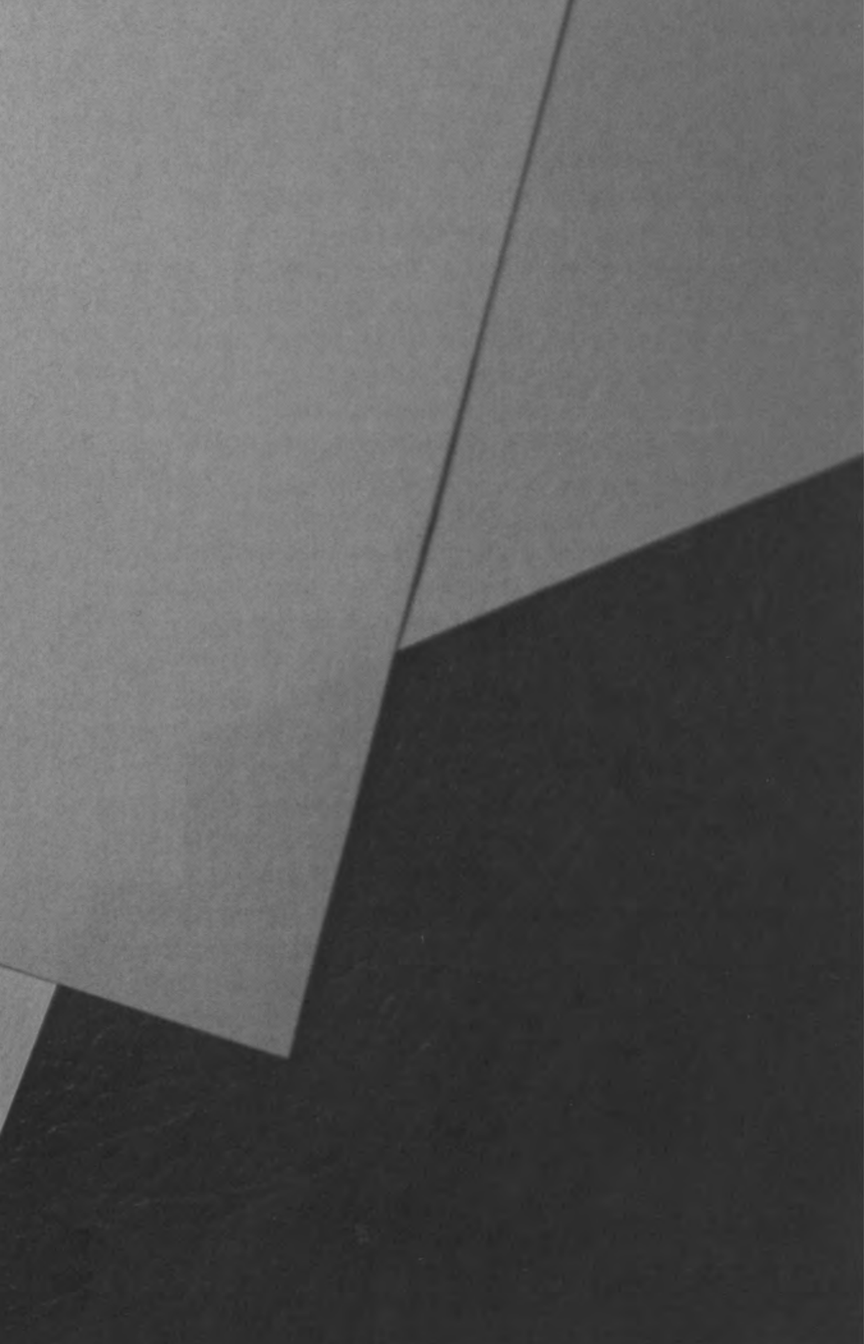
The challenge to such a faith is not an empiricist's task.
We do not explain the world.

Spin the wheel again

So

One thing happens after another…

What now defines our science?



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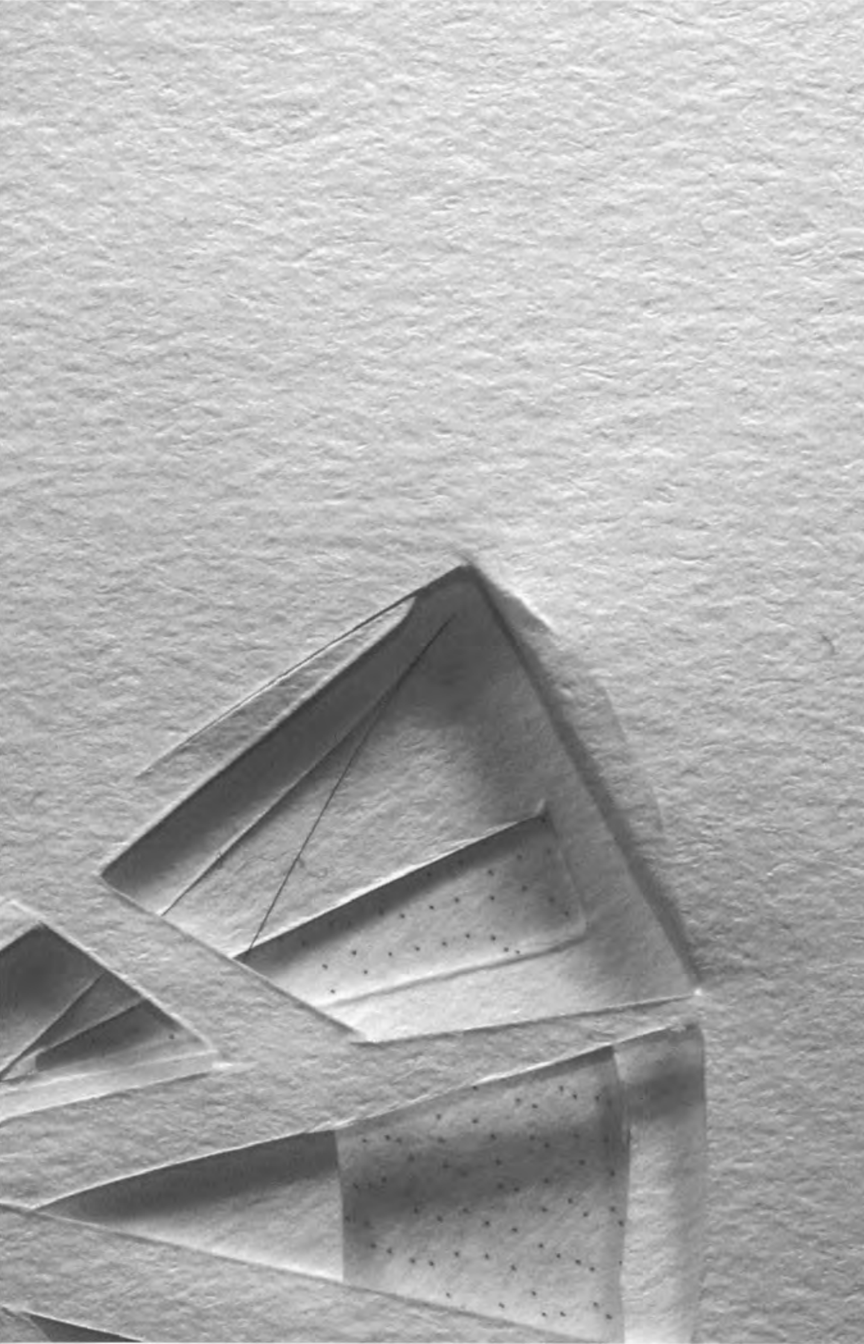

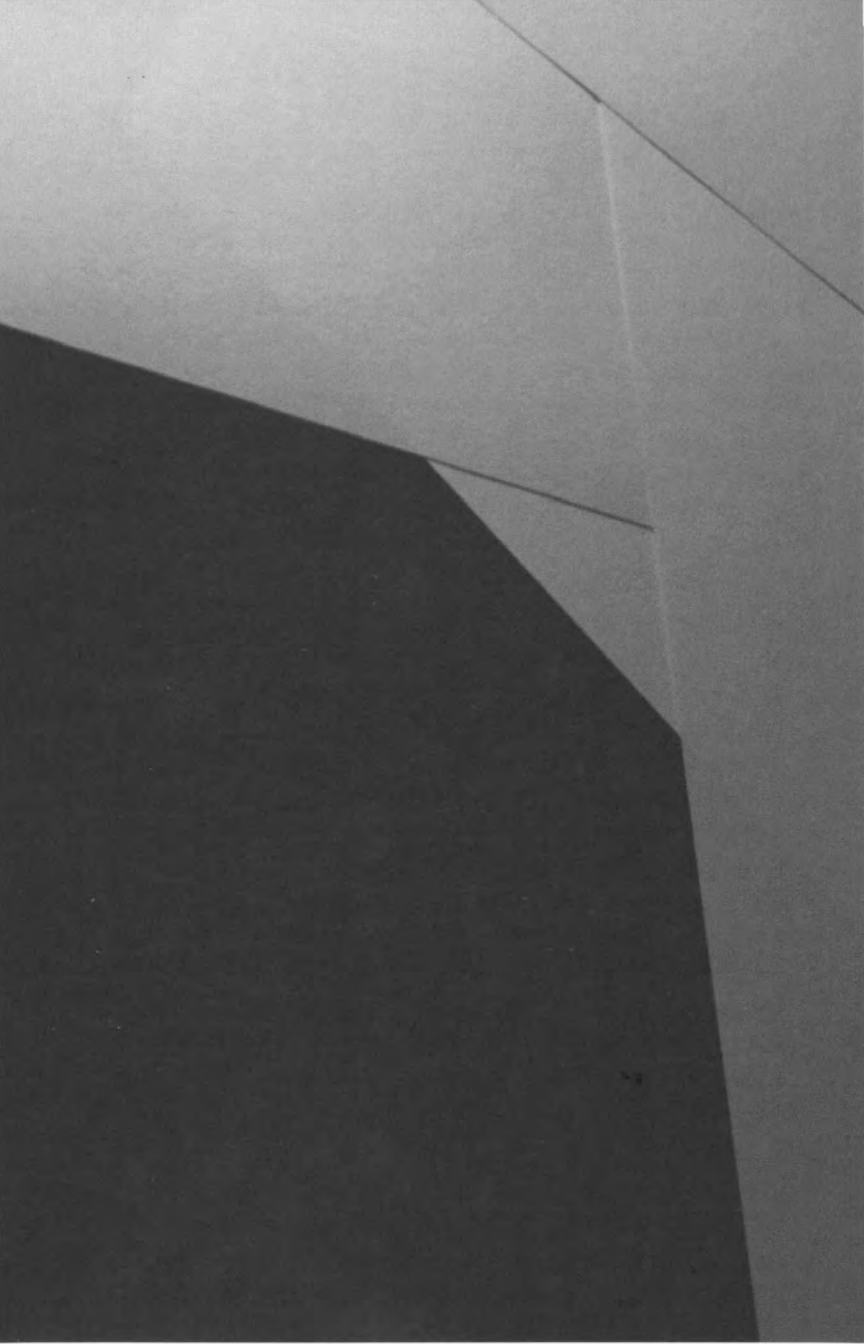

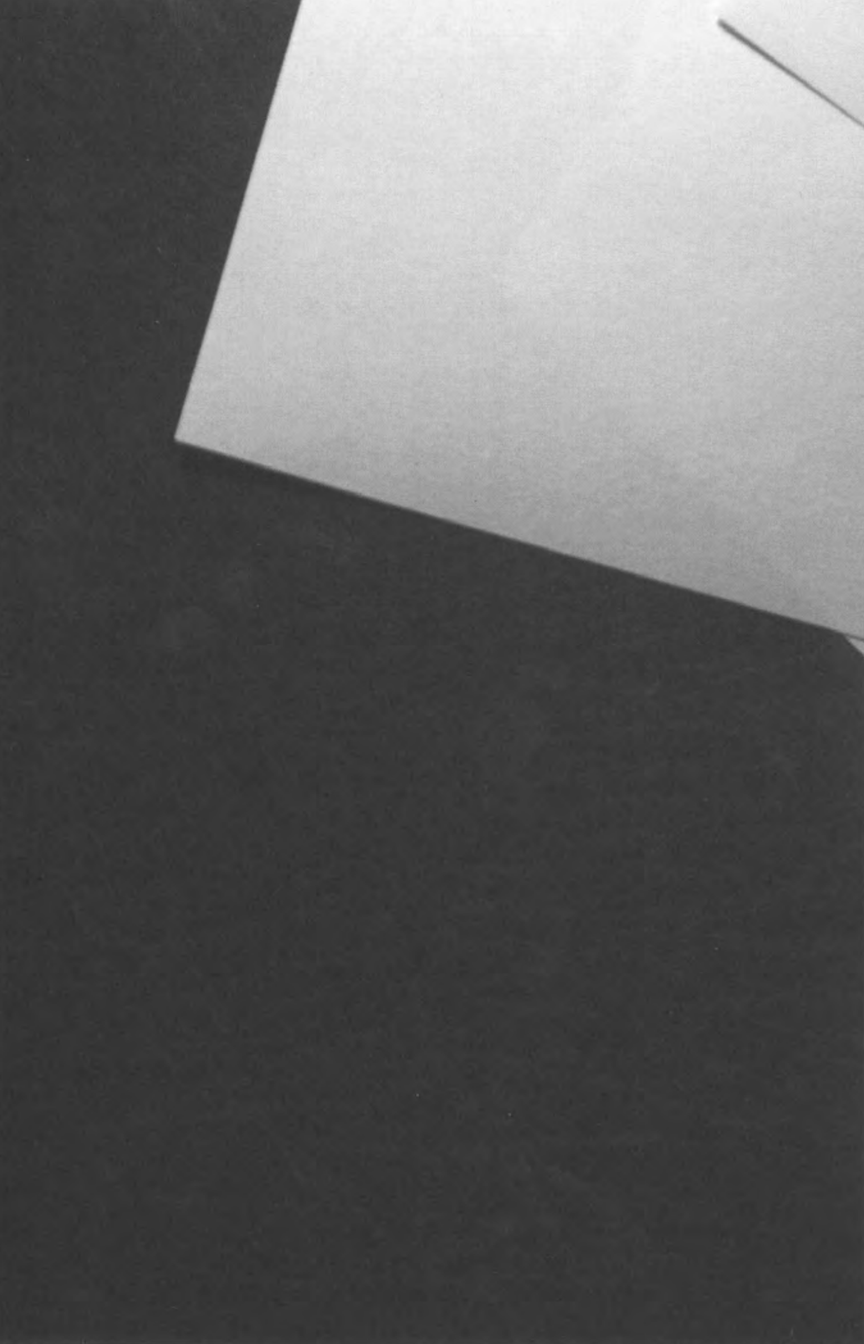

From Collective to Wager: On Some Recent Theories of Probability[1]

Jean Cavaillès

Probability calculus, the extent of its development and the importance of its applications, are still live paradoxes within the system of the sciences. Born of reflections on gambling, a detached branch of combinatory calculus, it will waste no time in making use of mathematical instruments disproportionate to its modest origins, and to the very significance of the results it would claim to achieve. From the eighteenth century, continuous variables were used to represent finite variations; today, following Émile Borel, Paul Lévy and Maurice Fréchet consider as fields of events sets as general as Borel's, confusing Lebesgue's integral with mathematical hope. Now, these generalisations, apart from their intrinsic mathematical interest, turn out to have a practical utility: we know the growing role played by probability calculus in the techniques of social economy as much as in physics. Whence an undeniable discomfort: we began with a notion incapable of justifying the practical applications, a notion that is obscure from their point of view—'the probability of an event, the relation of the number of favourable cases to the number of all possible cases', according to the definition still adopted by Laplace—limited, so it seems, to the finite; but the outcome is an impressive science, which moves naturally within the infinite, but whose very development brings no clarity as to the possibility of its application to reality. No one agrees on the purport of these applications: neither in the human sciences, where one is content to invoke a mysterious 'law of large numbers', nor in classical statistical physics (remember the discussions around the ergodic hypothesis) nor in quantum theory, wherein some see the definitive overthrow of traditional determinism. Certain mathematicians, however, have believed themselves capable of putting an end to this situation, on one hand by applying to calculus the procedures of modern axiomatisation and formalisation, and on the other by giving to its object, mathematically clarified, a concrete meaning that makes its utilisation in nature intelligible.

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[1] 'Du Collectif au Pari: A propos de Quelques Théories Récentes sur les Probabilités', in *Revue de Métaphysique et morale*, 47:2 (1940), 139–246.

Such are the works of R. de Mises[2] and Reichenbach[3] concerning the notion of the *collective*, which raised such grand hopes in the philosophical world, and whose examination is today facilitated by the recent critical studies of A. Wald[4] and Jean Ville[5] and by the philosophical conclusion added this year by Emile Borel[6] to his *Treatise*.

The internal coherence of the calculus was already assured in Borel's *Treatise* via the implicit axiomatisation to which he subjected it. In 1933, Kolmogorov, also inspired by von Mises's ideas, had expressly codified the results of the work of the French school.[7] As in any axiomatisation, it is a matter of translation into a prior domain, whose notions are utilised: here, set theory. We shall call elementary events the points of a fundamental set E, complex events certain parts (subsets) of E belonging to a system F. Probability is a function P, which puts a positive real number into correspondence with every element of F. F and P are endowed by the axioms with the following properties:

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[2] R. von Mises, *Wahrscheinlichkeit, Statistik und Wahrheit* (Berlin: Springer, 1936 [2nd ed.]). See also R. von Mises, T*héorie des probabilities. Fondements et applications* (Annales de l'Institut Henri Poincaré, 1932), 137–90.

[3] H. Reichenbach, *Wahrscheinlichkeitslehre* (Leiden: A.W.Sijthoff, 1935), and *Les Fondements logiques du calcul des probabilities* (Annales de l'Institut Henri Poincaré, 1937).

[4] A. Wald, *Die Widerspruchsfreiheit des Kollektivbegriffes* (Ergebnisse eines mathematischen Kolloquiums h. 8 (Vienna, 1937).

[5] J. Ville, *Étude critique de la notion de collectif.* (Paris: Gaulthier-Villars, 1939).

[6] E. Borel, *Valeur pratique et Philosophie des probabilities* (Paris: Gaulthier-Villars, 1939).

[7] A. Kolmogorov, *Grundbegriffe der Wahrscheinlichkeitsrechnung* (Berlin: Springer, 1933).

1. F is a *field* (that is to say: the sum of, the intersection of, and the difference between any two elements of F, are all elements of F).
2. F contains E.
3. P (E) = 1.
4. If A and B are two elements of F (two parts of E) with no common point, then:
P (A + B) = P (A) + P (B).

Finally, an axiom of convergence concerns the descending series of sets.

Thus we find linked together, from the outset, elementary calculus and its abstract generalisations. The consideration of infinite fields, of any number of dimensions (even infinite) introduces no break in the cohesion of a natural development. At the same time we obviate two difficulties, both as old as the calculus itself, and relating to the two fundamental rules of *total and composite probabilities*: The first is: 'if two events A and B are incompatible, the probability of at least one of them happening is equal to the probability of the two events'.[8] And the second: 'If two events A and B are independent, the probability of their simultaneous occurrence[9] is equal to the product of their respective probabilities'. In each statement, a stumbling block: *incompatible* events, *independent* events, two concepts that have no mathematical meaning whatsoever, and whose concrete meaning, indeed, is rather obscure (contradictory even, in the case of independence). Von Mises points out the first difficulty: 'The event of winning 100 francs at roulette on 30 November 1931 at midday can take place in two different ways: by putting 100 on the red at Monte Carlo, or at Nice; the two ways are incompatible, because one cannot be present at Nice and at Monte Carlo simultaneously.'[10] Each of them having a probability of ½, we have a probability of 1 (that is to say, certainty) of winning 100 francs. Kolmogorov's axiomatic overcomes the difficulty by declaring all elementary events incompatible. Two elements of F (that is to say, two complex events) with no common point are therefore incompatible: the rule is stated in axiom 4. But then what becomes of independence, which is in a certain sense opposed to incompatibility, since it permits us to consider the simultaneous production of two events? We shall call the simultaneous production of two events their intersection. In positing that event A leads to event B, if A*c*B, then we have:

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[8] The probability of obtaining, with a die, a one or a six, being 1/6 in each case, the probability of obtaining one or the other of these (obviously incompatible) results is: 1/6 + 1/6 = 1/3.

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[9] Simultaneity here concerns the wager and not the production of the events. Thus the probability of obtaining two sixes is the same whether one throws two dice at once, or throws the same dice twice in a row (supposing the events to be independent), it is equally: $1/6 \cdot 1/6 = 1/36$.

[10] Von Mises, *Théorie des probabilités*, 150.

$ABcA$ and $ABcB$

A and B are then, by definition, independent if we have:

$$P(AB) = P(A) \, . \, P(B)$$

This is the response given by Borel in his *Treatise*: two events are said to be independent if the rule of composite probabilities applies to them. For other events introducing conditioned probabilities or relations: $P_A(B)$, the probability that B should occur if A occurs. By definition:

$$P_A(B)=P \, . \, (AB) \, / \, P \, (A)$$

So we can see that, in the case of independence between A and B:

$$P_A \, (B) = P \, (B)$$

The notion of independence is thus an operatory notion belonging to the axiomatic of the calculus—that is to say, it is posterior to the combinations of operations that constitute it within the prior theory.

This is even, as Kolmogorov remarks,[11] the principal source of its autonomous development: in its absence, it would fuse with the theory of additive functions of sets. A great deal of the original work on the calculus, by Laplace and Markov, is dedicated to this—to the study of series of trials, whether completely independent or of a dependence fixed by a law, such as *concatenated probabilities*. There is no room to demand a translation of it into set theory, any more than for the parallelism or perpendicularity of two straight lines in number theory, even though geometry borrows the conceptual material of its axioms from the latter (and in which is constructed naturally a model of realization). However, the situation of probability calculus axiomatized in this way cannot be compared to that of geometry: the system of axioms is not categorical—that is to say, it does not give a univocal definition of the objects E, F, P. One can put forward, and indeed there have been put forward, according to the purposes and the fancies of mathematicians, various fields and various functions of probability. The situation is something like elementary geometry without the parallel axiom or without Hilbert's saturation axiom. So is this the sole origin of the discomfort we mentioned above—the impossibility of justifying, mathematically or empirically, the arbitrary stipulations brought into the definitions of E, F and P?

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[11] Ibid., 8.

Note that in geometry, the definition of fundamental operations (displacement groups) leads naturally to the formulation of the axiom capable of completing the edifice: we see this very clearly with the axiom of saturation, if we allow Cantor's formula. It is an axiom of closure: every infinite series of embedded segments defines a point. Nothing analogous seems likely to be forthcoming in probability calculus.

Perhaps, however, it was such a hope that drove Reichenbach in the formalised axiomatic he published in an article before Kolmogorov, and which he reprised in his *Wahrscheinlichkeitslehre*. He uses preexisting theories: set theory and logical calculus. Probability is a relation between two classes of propositions. Whatever may be the intrinsic interest of this realisation as an axiomatisation (and the detailed remarks that accompany it), it brings nothing really new to the problem that we are dealing with. Its principal originality consists in its considering every statement of probability as a hypothetical proposition: if x belongs to class A, y belongs to class B, a relation which is specified by a number p between 0 and 1. This is an English point of view upon which Keynes's *Treatise* in particular insists: a judgment of probability makes no sense except under the hypothesis of a determinate situation (or state of our information). There is no probability of winning roulette if one does not bet—or if one does not spin the wheel. One must therefore always write, in short, P(A,B), the probability, given hypothesis A, that B will obtain. Whence a simple solution to the difficulties of incompatible and independent events: two events B and C can only be incompatible if they took place under the same hypothesis A. We see that this is not the case for Von Mises. The rule of composite probabilities will be written, for all events (whether independent or not), since here all probabilities are conditional:

$$P(A, BC) = P(AB, C) \,.\, P(A, B)$$

The case of independence is expressed as follows:

$$P(AB, C) = P(A, C)$$

As we can see, the change in relation to the foregoing axiomatic is largely one of presentation. Apart from exceptional cases, it is more commodious to leave implicit the statement of the hypothesis—as Reichenbach himself does once he arrives at more complicated calculations. But for Reichenbach this formalisation represents the way to an interpretation of the notion of probability thanks to which all difficulties will vanish. It is here that the notion of collective comes in.

Introducing the collective, Von Mises expresses the intention of giving probability calculus a development and a rigour comparable to that of geometry. Unlike the classical treatises, and unlike Kolmogorov's work, here there is no codification or clarification of the spontaneous process of calculation—since these turn out to be insufficient to determine their meaning in univocal fashion—but a direct definition of the object of calculation via the idealisation of the conditions under which it effectively takes place in reality. Just as the geometer idealises the rods and rounds of nature to make of them straight lines and circles, so the mathematician of probability transforms a series of dice throws, a statistical table, into a collective. Its definition is the mathematical characterization of this idealisation (in fact, to characterise mathematically is to idealise). In the simple case of trials (such as coin-tossing) that yield only two possible results, which we can call 0 or 1, a collective is an infinite series of 0s and 1s, possessing the following properties:

> 1. The relation of the number of 1s in the first *n* terms of the series, at number *n* tends toward a limit as *n* increments indefinitely; this limit will be called the frequency of 1s.
>
> 2. If we make a 'place selection', taking only certain terms from the series independently of the quality (of 0 or 1) of the following terms, then the frequency of 1s (or 0s) in the new subsequence will be the same as in the original series.

This frequency, invariant under place selection, is probability.

We generalise for the case of trials having any finite or infinite (denumerable or continuous) number of results: in the corresponding collective, each of the latter figures with a determinate frequency, independent of place selection. The rules of elementary calculus are deduced from this definition: they are valid for a frequency calculated on a series of trials and are conserved in the passage to the limit. This can be seen particularly easily for total probabilities: two events A and B are incompatible only when they are results of the same trial, and thus members of the same collective. If n_A / n and n_B / n are the relative frequencies of the first n trials, then we obviously have:

$$n_{A+B} / n = n_A / n + n_B / n$$

whence the formula sought in the passage to the limit (for n_A / n *and* n_B / n each tend toward a determinate limit, their sum y also tends toward that limit)—the combination of two collectives—which gives the rule of composite probabilities—is a little more complicated: it must be shown that the new series does indeed have the characteristics of a collective, and one must distinguish between associable and inassociable collectives. The essentials of the calculus can thus be rediscovered. But this is not the main point, however important may be Von Mises's work in the calculus properly so-called. The notion of collective serves to legitimise and to codify the applications: all it does is to make explicit the underlying thought—or the prerequisites of the thoughts—of all those who use probability calculus. The classical definition via equally possible cases is but a vicious circle (what are equally possible cases, if not equally probable cases?) and moreover is usually of no practical value (where do we find these equally possible cases if it is a question of evaluating the risk of fire or of an accident?). In fact, in the three domains where probabilities come in—gambling, general statistics and physics—'what we have before us is a long series of events or phenomena, experiences or observations en masse.'[12] Probability has a role in masses, but it can only signify relative frequency. Considerations of symmetry in games of chance should not fool us: it is a matter here of mechanisms where everything conspires (throwing dice from a cornet, shuffling cards) in order for frequency and symmetry to be brought into accord. Everywhere else—in insurance, in the kinetic theory of gas, etc.—it can only be a matter of more or less easily identifiable frequencies which one postulates to be constant. The calculus is limited, on the basis of these observations within relatively simple collectives, to deducing the frequencies characteristic of the complicated collectives constructed with the former. This is a role of transformation, not of creation, exactly as, in geometry, one does not evaluate lengths but, on the basis of given magnitudes (two sides of the angle of a triangle, for example), calculates others (the third side). Ultimately, there is not the least divergence between the definition of probability as a limit of frequency and the law of large numbers, with which a superficial interpretation may oppose them. In fact, Jacques Bernoulli's theorem does not (as its author believed at the time) assure the passage from supposedly a priori probabilities to frequencies, but only states that there is a probability very close to 1 that, over a long series of trials, the gap between the frequency of a result and its probability is tiny. A theorem which may, obviously, like all others, be translated into terms of collectives: in a collective C, having as its elements the collectives D_t each formed of the results of a first trial E, the frequence in C of D, for which the n first elements bring about one of the results with a frequency nearing to the limit that it will take, tends toward 1 if one chooses a large enough n. Thus, not the least discordance between the limit in the probabilistic sense (which the law of large numbers speaks of) and the mathematical limit that comes into the definition of the collective. 'The theory of probabilities based on the notion of relative frequency', Von Mises concludes in 1931, 'is free of all contradiction, and on the contrary helps shed a little light upon questions that remain, in the classical theory at least, rather unclear.'[13]

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[12] Von Mises, *Théorie des probabilités*, 130.

But a stringent critique reveals major difficulties.[14] Firstly, the condition of irregularity demanded by the collective makes the definition of the latter contradictory, at least in the general form de Mises gives it. This is what A. Wald shows: the notion of a place selection is indeterminate. Every series, formed of indices denoting elements of the collective, constitutes a place selection. Now, if the collective is as follows:

$$a_1, a_2 \ldots a_n \ldots \text{ with } a_i = 0 \text{ or } 1,$$

then there exists at least one series $n_1, n_2, \ldots, n_m \ldots$ with indices such that

$$an_1 = an_1 = \ldots an_i = \ldots = 1,$$

and a series $m_1, m_2, \ldots, m_i \ldots$ such that:

$$am_1 = am_1 = \ldots am_i = \ldots = 0.$$

Two place selections, then, which change the frequency limit whatever the collective happens to be. Wald seeks a remedy for this both in a mathematical restriction and a mathematical specification of the criteria for place selection. He introduces a new system of *selections*. A *selection* is a series of functions f_1, having each for arguments the *i*-1 first elements of the collective, and 0 or 1 as a value. If f_1 is 1, it is kept. We can see that the series of f_1 give us a law that permits the extraction of a new subsequence from the collective in question, C. The invariance of the frequency limit, in the system of series obtained on the basis of C by the system S of selections, will mathematically translate the demand for irregularity.

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[13] Ibid., 174.

[14] For the exposition of these critiques we use J. Ville's work, cited above, which is remarkable for its clarity and density.

But we need to specify this further. Consider a collective D, where the successive trials have as their results not two events, but any (infinite) set whatsoever M of events. Take N, a part of M; the probability of N in D will be the frequency limit of elements of N in D. If M is finite or denumerable, no problem. But if M has a higher power than the denumerable—for example if M is the set of real numbers, or an interval of this set—Wald shows that there is no collective such that the probability of each of the parts of M remains invariant relative to any denumerable system whatsoever of selections. Thus a new restriction must be put in place: we shall consider, for example, when M is the set of real numbers, only the system of parts of M that are measurable by the Jordan procedure. Generally speaking, the definition of a collective must therefore make more precise (for the condition of irregularity) both the system S of selections and the system F of the parts of the set of results whose probability S must leave invariant. A relativity in the definition that renders it obviously arbitrary. Doubtless the restriction operated by the choice of a system of parts of M is unimportant in practice: in physics one does not encounter any set that is not measurable by the Jordan procedure. On the other hand, there are not more than a denumerable infinity of imaginable selections. Or at least, it is arbitrary to fix which of them. Finally, precisely from the point of view of practice, a new difficulty arises: The aim of the irregularity axiom is to define collectives as series that are as similar as possible to those that one obtains in reality through a series of independent trials. Now, the following theorem can be proven: whatever system S of selections is envisaged for a series of trials, giving, for example, two results of probabilities p and $q = 1-p$, there exists at least one property A for the series of results whose probability, calculated in the classical theory, would be null but would nevertheless contain at least one of the collectives satisfying S. In other words, characterization through a system of indifferent selections S does not suffice to eliminate the properties of abstract series which, as the theory shows us, have nil probability of occurring.

Jean Ville wished to obtain a more effective condition of irregularity, inspired by another statement of von Mises's. In games of chance, the irregularity of the series of results is nothing other than 'the impossibility of a *gaming system*, in the argot of the habitués of Monte Carlo'.[15] This principle 'must express in general the aleatory character of the phenomena under consideration. Its position before the real world is the same as that of the principle of the impossibility of perpetual motion.[16] One might consider, for every aleatory series, a player whose bets and gains depend on the foregoing throws: so we have μ_n ($a_{1,}$ a_2..., a_{n-1}), the function that expresses the bet at the *n*th throw. We agree that he will receive μ_n/p if a_n=1, $\mu_n/1-p_n$ if a_n=0, p being, in the series, the probability of 1. We see that, on one hand, *the gaming system* will be defined by a series of functions μ_n, and that on the other, the final gain is equally determined by the series of μ_n. To say that there is no martingale to win indefinitely is to impose an upper limit on the series of μ_n. In studying the resulting restrictions on the collective, Jean Ville arrives at the proof that, on one hand, every system of selection can be expressed by such a prohibition, and that, on the other hand, given a property A of nil probability for an aleatory series, one can make it correspond to it a series of functions μ_n such that the collective defined by the corresponding prohibition does not possess A. The condition of irregularity thus specified therefore contains Wald's, and turns out to be more effective than it. But it is each time relative to the properties of nil probability that it was a matter of eliminating, and thus it is also perforce arbitrary. To search any further makes no sense. Every individual series has nil probability. For von Mises and his heirs, it is a matter of setting aside series 'that are not encountered in practice', a vague condition, we understand, whose 'immediate subjective meaning' Ville wishes to conserve even while translating it into mathematics. Thus he eliminates other more abstract possible criteria: 'to give oneself a martingale and to exclude the series where a player, by applying this martingale, enriches himself indefinitely, this has a very concrete meaning [...] We consider this latter criteria to be satisfactory from an intuitive point of view.'[17]

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[15] Ville, *Étude critique*, 142.

[16] R. de Mises, *Wahrscheinlichkeitsrechnung und seine Anwendung* (Leipzig and Vienna: Deuticke, 1931), 4 (cited by Ville, *Étude critique*, 87).

But is it so from the point of view of the internal coherence of the theory of collectives? We do not believe so. The idea of an axiom of irregularity is attached to old notions of chance. But there is no mathematical definition of chance: Borel often insisted on this. The ultimate meaning of chance is simply ignorance. To say that a series is a chance series is to affirm that one cannot find a mathematical law for the succession of its terms. Indeed, this is almost von Mises's first statement. But to seek a mathematical criterion for this absence of law can only lead to the arbitrary or the subjective. One can demand only that there is no simple law: will the series be more chance-like for it? Doubtless the series we encounter most often have certain properties in common: if all the particular series have the same nil probability, the properties of series have probabilities that may be closer to 1. We have already isolated the group of indifferent series (Popper, Reichenbach), or Bernoulli series,[18] which are but particular cases of collectives subject to Wald's or Ville's criteria. Admitting that we have succeeded in defining exhaustively these privileged properties, it remains that the properties of nil probability, in virtue of the very definition of probability in a collective, may present themselves a finite number of times. It is to say the least paradoxical, in a theory based on the notion of frequency, to see certain series radically eliminated because their frequency is very small. What a strange science it is that claims to describe what is, and refuses to consider a part of what is on the pretext that it is rare! No criteria of irregularity can delimit the domain of application of calculation.

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[17] Ville, *Étude critique,* 138.

Additionally, this demand is not essential to the theory of the collective itself. On the contrary, Reichenbach sees in it 'a grave fault; [...] in practical usage, series of a normal type (that is to say, those not indifferent to place selection) play an important role, and it is a matter of a number of intermediaries between the irregular series and entirely ordered series.'[19] One can therefore limit the definition to the condition of a frequency limit. But here again there is a restriction in relation to the classical theory: in the latter every element of a practically very vast *field* F of parts of E can be a complex event. If E is the set of real numbers, then F contains all the sets that are measurable in Lebesgue's sense: in other words, for the result, for example, of spotting something expressed by a real number, one can consider as an event the fact of the result belonging or not to a Lebesgue-measurable set; now, these sets constitute all the sets of real numbers that can effectively be defined. With the theory of collectives, J. Ville shows that one must limit oneself to sets measurable by the Jordan procedure: a limitation that, as we have seen, is without any real importance for physics, but which can be awkward qua extrinsic to the mathematical argument of the theory (which is governed by the properties of the additive functions of sets). On the other hand, if in this way mathematical idealisation is found insufficient, on the side of the object it may appear exorbitant. For the substitution of a mathematical passage to the limit for a convergence of relative finite frequency can only be an embarrassment for the link between calculation and experience. How can we recognize in reality that we are dealing with a collective?

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[18] Ville shows that the notions of Bernoulli series and the indifferent series are equivalent (*Étude critique*, 78–83).

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[19] Reichenbach, *Wahrscheinlichkeitslehre*, 142.

The finite beginning of an infinite series—all that is knowable—informs us neither on the convergence nor on its limit, if it has one. If 10^{1010} zeros begin a collective, followed by only 1s, it will be impossible not to attribute a probability of 1 to the zeros, whereas it is nil. Doubtless the classical theory often replaces variations in finite terms by continuous variations; but, on one hand, there it is often a case of practical and provisional simplifications—analogous to those which, in a schema, join a finite number of points which only make sense as a continuous line; on the other hand, where the substitution persists, it is precisely, as we have seen, one of the problems posed by the practical fecundity of the calculus. The theory of the collective had as its first aim to fix its link with the real: now, it claims to do so by assigning to calculation an object that, by definition, is not encountered anywhere. The analogy with geometry, as invoked by von Mises, is illusory: geometry does not idealise anything. What is there to think in roundness if not already the circle? It is a naive epistemology that would see mathematical objects as being born through abstraction from the real. In fact, there is an autonomous development of operations which, from the start, are mathematical: practical applications come from the success of the operations codified in the real. If there was abstraction, it would be, not from the real (where there is nothing to abstract) to the operations, but from the operations to the real (the disregarding, in the latter, of certain mathematical properties); it is, moreover, more a matter of approximation. Now, the collective, the passage to the limit, where the infinite is essential, is not approached via any experiential aleatory series. The operations through which the mathematician handles infinite series have nothing in common with those through which the statistician observes a convergence of frequencies. The whole problem remains to characterise these latter approaches, to link them with the mathematical elaboration that would submit them to calculation. The notion of the collective thus remains a stranger to the former and the latter alike. Its introduction does not help us address the problem.

But we can distinguish the mathematical question of the categorical axiomatisation of calculus (or the determination of its field of application, for this follows from an exhaustive definition of its object) from the epistemological problem of the meaning of the notion of probability; or, if you like, the situation of calculation in other sciences, along with the resulting consequences for a representation of nature. Doubtless there is some link between these two problems, and even, it seems, a dependence of the second upon the first. Reichenbach, however, tried to resolve the first through the second. He does not shy away from the difficulties of the notion of the collective; but for him they are inherent to the very notion of probability.

To clarify the latter is, if not to resolve the problem, at least to show how far the solution might be carried and the very reasons for its limitation. For von Mises is mistaken in thinking that probability calculus can be counted at the level of other sciences: it is at the basis of all knowledge of nature. There is no measurement that is not based upon the theory of errors. Every statement of a law, as in thermodynamics, is a statement about maxima of frequency. The problem of probability is that of induction: how to conclude from the past to the future. The mathematician is not bothered about concatenating already-observed collectives (and in fact there could be none, for they would have to be finite), but is concerned with foreseeing the future. Thus the infinitude of the series takes on its true meaning: it is the indeterminacy of a development in the process of becoming. We suppose the determination of this indeterminacy, and there again there is no certainty: probability governs everything, even the status of its own interpretation. At least, this is the only way possible for science: if it does not succeed in this way, then there is nowhere else to look.

The solution lies in a broadening of traditional logic: two-valued logic is a first approximation, just like classical physics is for the world. A logic with a continuous infinity of values is just as necessary today as the physics of relativity. The element that replaces the true or false proposition of classical logic is the wager, with values ranging from 0 to 1, of the logic of probabilities. A wager is linked to an infinite series of bivalent propositions each bearing upon an element of the collective. Take the collective a_1, a_2..., a_n..., formed of the results of a trial, P a class of these results (for example, tails, when tossing a coin), and the series of propositions will be:

$$a_1 \varepsilon P. \; a_2 \varepsilon P.... \; a_n \varepsilon P,... \qquad (1)$$

true or false propositions. If we attribute the value 1 to true propositions, and 0 to false propositions, and if we make the sum ν, for the first n propositions, the relation ν/n will coincide with the frequency of the result P in the collective. Just as in the passage to the limit. The value of the wager, founded on the series (1) of propositions, is equal to the probability of P in the collective. But we can only know this value when we are dealing with a case of collectives in the process of becoming. We are therefore thrown back, in order to give a meaning to the wager, onto the problem of the determination of probabilities in reality. There is no circularity here: we will superpose upon the wager on events a second-degree wager on probability, coordinating with it a series of elementary series. Here again, a difficulty arises: the ideal wager would have as its value the limit of the frequency of elementary series, in which the frequency of the event E tends toward a certain limit. One can proceed by trial and error: if the observed frequencies tend toward a limit, a moment will arrive when they remain held between certain limits. If on the contrary there is no limit but, for example, an oscillation between two extreme values, one can proceed through extraction of partial series (by cutting up the primitive series) and by considering the limit frequencies that they may have. There is advantage in these trial and error procedures in superposing wagers: for let us consider a series S of series $T1$. If we suppose that S and T have limits of frequency, there exists a rank $n1$ in the series $T1$ on whose basis, for mTi, the frequency of E remains within a certain interval δ. Equally, there exists a rank $n2$ in the series T on whose basis the frequency, among the mTi (m being the same in the two cases), of those for which the frequency of E remains in the interval δ, remains within an interval ε. It can be seen that $n_2 \leq n1$; for rank $n1$ all the mTi fulfill the condition, for rank n_2 only a majority (fixed by the interval ε) do so. Such therefore will be the procedure of the physicist, and of any scientist who utilises probability calculus: superposing wagers in order, through successive approximations, to approach, where they exist, frequency limits, and thereby to confirm (or reject) the primitive wagers. A hesitant allure of science, a modest solution to the problem of induction; we must quit the sharp-edged world of certainties (an initial, crude image) to enter into the fuzzy kingdom of approximations, where acts and wagers intersect each other. The very confidence that one will succeed is a wager, but it is the only reasonable wager. Only probability, the blind man's cane, can lead us down the path of the future—if there is a path.[20]

These philosophical reflections on the notion of the wager seem incontestable to us. Their link with the technical solution, however, is rather loose. Three criticisms may be formulated. Firstly, the intervention of polyvalent logic is a *trompe l'oeil*. It is excessive to claim that it resolves everything: apart from the general affirmation that the wager is not a proposition susceptible of being true or false, one could scratch everything about it without changing anything in the result. The wager is situated between two systems of bivalent propositions: propositions corresponding to elements of the collective, and propositions superposed on the wager and attributing to it its logical status—that is to say, determining a probability. These latter are what is essential. Furthermore, a certain incoherence appears: it is said, concerning the superposed evaluations of probabilities, that 'first-degree wagers remain exact [*richtig bleiben*]'.[21] Exactitude and nonexactitude: bivalence without relation to the continuous scale of values between 0 and 1. A wager is exact when one wins:

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[20] Reichenbach, *Wahrscheinlichkeitslehre*, 420.

[21] Ibid., 405.

but it ceases, at that very moment, to be a wager. What becomes of the coordination with the totality of the collective, since, by hypothesis, the latter is not complete? A science effectively submitted to a polyvalent logic must not give way to the intervention—here decisive—of bivalent propositions. The justification of the superposition of wagers—that is to say, the whole method of approximations—is based on the confidence that the frequencies each have a limit—that is to say, on bivalent affirmations.

The uneasiness comes from the second cause of difficulties, the representation of the future by mathematical infinity. Mathematical infinity is but a relative indeterminacy, that is to say an indeterminacy submitted to a law, but still essentially an indeterminacy: it has nothing in common with the unforeseeable nature of an outcome. That which, mathematically, is indeterminate in the series of decimals of π, is the point at which one will stop, not the decimals themselves. On the contrary, the future event, for probability calculus, is the decimal that one might find at place n. In reality, the mathematician of probabilities never has to deal with a collective: the passage from past to future takes place between closed systems. In statistics, one wagers that the frequency of purchases of a product, in a given place and a given year, will be the same or different from that of the preceding year: there is no wager on one sole series of purchases whose frequency may vary before our eyes. In the same way, in statistical physics, there is a wager on the distribution of speeds at a given instant, and the assimilation of a succession of states of a body to a series of trials is only a condition of symmetry for the manipulation of the coordinate *t*. We do not move forward in time, but we consider in advance, en bloc, all of the states (all future states) of a certain succession: the distribution of their probabilities is obtained either through considerations of symmetry, or in some other way—never by way of approximations along a development.

Finally (the third difficulty), these approximations themselves are ineffective: we have seen that the beginning of a series tells us nothing about its limit, if it has one. For Reichenbach there are privileged series with which his manipulation succeeds; only the series submitted to this 'axiom of regularity' give rise to science: the existence of science depends upon their existence. But this is to narrow the problem down too much; if there are wagers and approximations, their model remains entirely indeterminate. It is always dangerous to prescribe to science what its path must be. Probability itself overflows its definition as frequency limit.

For there can be no probability of an isolated event. Here again, the notion of the wager given by Reichenbach is awkward: if I wager on the coin coming up heads on the *n*th toss in a series of coin tosses, the anticipated event is not *tails*, but *tails at the* n*th toss*, a singular event that has no frequency. It is very important to specify the rank, if the collective unrolls, since my evaluations of probabilities (that is to say, the value I attribute to the wager on the event) depend precisely on the place where I find myself (depend on the frequency observed in the first n-1 tosses). Reichenbach does however give an ingenious solution for the classical case of an isolated event: in reality, there is always a frequency of a secondary event linked to the judgment of probability. For example, the probability, for a historian, that Julius Caesar visited Great Britain, is evaluated by the frequency of truths in the class of documents to which belong those which tell of this landing. It is not a question of the probability of Caesar's landing, but of the probability of not being mistaken in relying on such a document. The same goes for the future. But, as Borel points out, on one hand, the classes considered are often far too narrow for one to be able to speak of frequency (or collective); and on the other, in the majority of examples, these classes have to be constituted from elements that are too heterogeneous for frequency to have any meaning. What group of chronicles is our historian of Julius Caesar to consider? All the chronicles of Britain, spread over a hundred years? All the chronicles concerning Caesar? The least crazy thing would be to consider the class of events that relate to the chronicle being studied: if one can control a certain number of them, a frequency will appear. But the events are varied: one chronicler may have had an interest in lying, another may have been misinformed. And how many events are there that are controllable like this? A hundred? This is already a large number for a historian, but pretty small for a frequency. In fact, the historian proceeds otherwise: he is more interested in a selection, a likelihood, a logical chain. It cannot therefore be a question of frequency: psychological reconstruction plays an essential role. The credibility of a text is evaluated by way of a multitude of operations too complicated to be prescribed in advance, too subtle to be reduced to a mere enumeration. So is the historian wrong to speak of probability? Émile Borel does not think so. But then another definition must be given.

For Émile Borel, 'the notion of the probability of an isolated case is the foundation of probability calculus. This notion is natural to each of us, just like the notion of hot and cold.'[22] The determination is made in two steps: firstly subjective probability, which is 'defined by the conditions of the wager that one is disposed to accept for or against the event'. Let us offer to a witness A the choice between winning a certain sum on the toss of a coin or gaining the same sum by betting on the success of tennis player X: if he chooses the second choice, it is because he estimates that there is probability greater than a half that X will win. A's opinion, and his choice, are of no interest except in so far as A possesses a certain competence in tennis. In other words, the statement of probability supposes an investigation and a prior knowledge: rational knowledge (the number of faces of a regular polyhedron thrown into the air), empirical knowledge (what A knows of the psychology, of the habits of player X), information on 'results, which are often, if not always, frequency statistics'. Whence the possibility of arriving at the second stage: the objective judgment of probability. 'We shall define objective probabilities as those whose value is the same for a certain number of equally well-informed individuals on the conditions of an aleatory event.'[23] Thus, the objective determination of the coefficients of probability operate according to a complex method, where the principal role is played—as for subjective probabilities—by the comparison between probabilities already obtained in the case or a simple mechanical model, and considerations of symmetry that allow calculation; for example, the similarity with drawing balls from a box. Just as for magnitudes, one cannot define probabilities in an absolute way, but only relations between probabilities. Ultimately the supreme instance, the basis of all objectivity, remains experience: it intervenes through the intermediary of small probabilities. 'In numerous cases one can obtain, as the result of a calculation, extremely small probabilities.' Now, events possessing such probabilities hardly ever come to pass. Borel clarifies this notion of a practical exclusion through the distinction between three scales: probabilities that are negligible at the human scale, of an order of magnitude less than 10^{-6}; 'a man who constantly wishes to take account of possibilities as improbable as this quickly becomes a maniac or a madman'.[24] For the set of men the terrestrial scale presents itself: probabilities smaller than 10^{-15}. And finally, for the set of 'phenomena which may come to pass in the whole portion of the universe that is accessible to us…, the probability 10^{-50} is negligible at the cosmic scale.' If therefore the evaluation of a coefficient of probability leads one to bring in negligible probabilities of events that do come to pass, one must reject them. The standard of impossibility maxima to which Borel refers is the miracle of monkeys randomly hitting typewriters and reconstituting the entire contents of the Bibliothèque Nationale, a miracle whose probability is of the order of 10^{1012}. 'Such a miracle must be regarded as impossible.'[25] Generally speaking, 'when the probability of an event not happening is less than 10^{-50}, we must regard this event as absolutely certain.'[26] Here two misunderstandings must be dealt with.

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[22] Borel, *Valeur pratique,* 104.

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[23] Ibid., 105.

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[24] Ibid., 6.

[25] Ibid., 20.

[26] Ibid., 7.

Firstly the misunderstanding of coincidences: if we consider the probability of obtaining, by drawing out at random letters of the alphabet (which we put back each time into the box), Racine's verse:

> *Pour qui sont ces serpents qui sifflent sur vos têtes*

It is $26^{-44} < 10^{-50}$. But the probability is exactly the same for obtaining any series whatsoever of forty-four letters:

> *yfbucsomyvmxjdgtgvwvyjzmsrfucemnxnrkgswkhecj*

Now, the second series has in fact been obtained through the random drawing of lots: it is an event that has happened. The law of the impossibility of events of small probability is therefore false. It is enough to recall here that the event whose probability one calculates is not the production of a series of any forty-four letters of the Latin alphabet, but of a series given in advance. In other words, the judgment of probability is always a wager, logically anterior to the production of the event to which it applies. As the submission to the criteria of the experiment implies that the event has happened, it is important each time to specify to which anterior conditions the calculation of its probability is linked. Here we rediscover the demand of

Keynes and Reichenbach to explain probability as the relation between two events.

The second misunderstanding is related to the very meaning of the judgment of probability: doesn't the practical impossibility affirmed by Borel operate a surreptitious passage between a probability very close to 1 and certainty? Reichenbach shows that it is enough to admit the apparently inoffensive axiom: (A) 'When an event C in a series possesses a probability tending toward 1, it appears at least once in the series,' to affirm that, in every normal series (every Bernoulli series), frequency converges, in the mathematical sense, toward the probability. It is enough to take for C the event that, for a given interval α as small as one likes, the frequency of the primitive event E in the *n* first trials should be comprised between $p+\alpha$ and $p-\alpha$, p being the probability of E. We know that, for a big enough *n*, the probability of C tends toward 1 in a Bernoulli series. If C certainly appears once, this means that the frequency tends mathematically to the limit. However, Borel's condition seems far stronger than (A). But there is a confusion here between mathematical certainty and practical certainty. The axiom (A) passes from one to the other—a passage which Reichenbach refuses. Borel considers only the statements of experimental sciences: the confidence that we can have in any law whatsoever does not surpass the order of probabilities whose difference from 1 is negligible at the cosmic scale.

The result of an addition of 100 numbers of 8 digits each is only known with a probability of error of 10^{-3} if it is done by one accountant, of 10^{-23} to 10^{-27} if five accountants work on it separately. Every physical relation is established between the product of measurements, and thus is subject to the theory of errors. In physics or in biology, there is no statement that is not, in the final analysis, a statement of probability. The difficulty comes from the fact that classical epistemology is subtended by a realist ontology. The hypothesis of an in-itself of things that the scientist is supposed to describe, and of which the laws he discovers are only approximations, is profoundly embedded in our consciousness. Even when rejected explicitly, it guides the discussion: the reduction of probability to a limit frequency aims to make of the statement of probability a judgment on *what is*. But if, in fact, to speak of *what is* is meaningless, if every physical law is but a wager of action, the scandal of probability ceases; far from being an inadequate substitute for our power to know, it is the very type of this power, the source of all scientific activity. Thus, in the kinetic theory of gases, that two gases, in the presence of atmospheric pressure should, at the end of an appreciable time, yield a heterogenous mixture, is of the same order of probability as the miracle of the typing monkeys; the miracle of Jeans no more unlikely than that water should change into ice at the normal temperature. To interpret it in terms of frequency amounts to saying: in the immense majority of isolated systems containing a sufficient number of molecules, entropy grows with time; but in others? What meaning would a statement about them have, since there are no observations of them?

To know the world is to wager—to wager that certain acts, laboratory experiments, or industrial techniques will succeed. The vital, extra-intellectual character of this is profoundly perceived by Borel in his description of the wager: ask a man to choose between a toss of the coin and such a forecast, and his choice will be instructive. It is the law of interest that is guiding here: to insert oneself into nature, living within becoming, to invent movements that succeed, invention itself being a part of becoming, an element of a dialogue, like the gestures of the body when climbing. It seems that an explanation faithful to the intention of the physicist has to follow this line—the cosmogonic intention, the status of description and of knowledge of physical theories does not seem to be able to agree either with the utilisation of probabilities, nor, what is more, with the other characteristics of modern physics (for example, Einstein's analyses of space and time). The mathematical elaboration of theories would represent a systematic coordination of effective gestures, processes of retardation, of the amelioration of action, which, following the observation of psychologists, can take itself as an aim, forgetting the finality that gives it its sense. But even high-flown theories—those without any practical value in the usual sense—find their justification only in an effectively realised act, in the observed accord between the results of two measurements. The physical experiment is an event in history; its forecasting, a wager; its success, the possibility of new acts.

Such is, so it seems, the direction in which Émile Borel's interpretation takes us. This, to our eyes, in the current state of things, is the best (or the only) way to conceive the role of probability calculus in the natural sciences. The immediate difficulties—not to mention those that concern ontology properly speaking and of the epistemological difficulty of identifying the link between mathematical knowledge and physical technics—are of two orders: (1) To interpret the success of a wager, the appearance of the event posterior to the action; its observation seems to be a statement with a certain character, or at least something other than a wager. One can seek it in the senses: a possible continuation of action; this is at least to try and tackle the difficulties inherent in the 'crude concept' of action. There is, what is more, the problem of median probabilities: 'if it is proposed that we stake 100 francs on the dice against an equal sum, the conventions being that we will win with a 1,2,3 or 4 and lose with a 5 or 6, we must reasonably accept. If we lose, we must no less continue to affirm that we were not wrong in accepting this wager and that it is our adversary who was quite unreasonable.'[27] What 'being reasonable' means is rather difficult to determine; perhaps an examination of the notion of the game will help here.[28] For classical physics it seems that the only meaning of median probabilities is, thanks to repeated trials for example, to be linked to small (or very large, that is to say very close to 1) probabilities, themselves subject to experiment. But only the effective utilisation of science can decide. (2) What link can we make between the notion of probability-wager and the methods of its evaluation? The success of considerations of symmetry is no more intelligible here than elsewhere. In fact, doesn't the use of the notion of frequency presuppose a sort of symmetry: a homogeneity of spatiotemporal domains (for the public records during a year of a given city, for example)? It is relative to this process of evaluation that the too-vague notion of the wager takes on its true sense. It is possible that there is, what is more, an irreducible polymorphism—that probability in the sense of insurance companies only coincides in very broad terms with probability in the sense of quantum theory. Only a detailed epistemological analysis can clarify this; the notion of probability—like every scientific notion—has as its proper site the governing intention of the procedures of the scientist: or as a prerequisite for the intelligibility of the system of these procedures. This means that it is each time modified by transformations in the latter, that its unification may not come about. We have already remarked that the probability that Louis de Broglie speaks of has no relation to frequency. The noncategorical nature of the axiomatic of probabilities would be, consequently, irreducible: its singularity qua technique within the sciences, that it can help equally, but not in the same fashion, according to their own axioms, would prevent any precision further than Kolmogorov's five axioms of the common procedures that it puts to work.

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[27] Borel, *Valeur pratique*, 106.

[28] See, on this subject, Bruno de Finetti's study on the notion of the fair game. He also interprets probability as a wager. B. de Finetti, La Prévision, ses lois logiques, ses sources subjectives (Annales de l'Institut Henri Poincaré, vol. VII). Also see E. Borel, 'Éloge du Jeu', in *Valeur pratique*, 3, 447.

The theory of the collective represented an effort at unification, in order to safeguard a naive realist ontology. It seemed to permit a reconciliation between Bernoulli's theorem, the simple result of combinatory calculus, and Bernoulli's theorem, the law of large numbers, empirically observed. If so-called *a priori* probabilities are but the approximation of frequencies, there would be no leap out of experience, and calculation would be one among our developed descriptions of nature. This latent possibility of reduction would reassure philosophers and scientists. The merit of von Mises, Reichenbach, Wald and Ville is to have expressed integrally all the resources of such a solution: the mathematical difficulties, the insufficiency as to the link with experience, the very unintelligibility of the notion, are now in the full light of day. The regularity of certain frequencies, the object of approximative statements, is but a starting point for actions that succeed, and does not possess in itself any explanatory value. It is to a more profound reform of our ideas about the real that probability calculus invites us, a reform whose magnitude we should not underestimate. It is not a question of a resurrection of pragmatism, which fails because it is too easy. The very activity of consciousness, the relation between reason and becoming, at first opaque, but which reason partly penetrates, is in play here. The wager is situated on the dividing line between pure lived action and autonomous speculation: at once an impulse toward the future, a recognition of radical novelty, risk; and, on the other hand, an attempt at domination through the imposition of an order, and the establishment of symmetries. Its essence, the unification of these two constitutive themes, is far from being clear. It seems that the difficulties raised at the level of calculation, in forcing us to study ever closer both its history and the detail of its application, must furnish for epistemology the occasion to provoke, if not to carry out, a conceptual renewal in which the elements issuing from this analysis of the wager play the preponderant role.

COLLAPSE VIII

The Ultimate Cooler

Interview with Steve Forte

Steve Forte is a gaming expert and is considered to be the most skilled sleight-of-hand artist in the world. He has worked in, managed, and consulted with casinos worldwide about how to spot cheaters and con artists.

Forte came to Las Vegas in the late 1970s and worked as a crap dealer at the Aladdin Hotel and Casino (owned by the Detroit mob). He regularly played poker at the Stardust and witnessed widespread cheating firsthand (controlled by Chicago mobsters), and as a young casino manager worked for notorious gangster Moe Dalitz. Some of the iconic operators he has worked for include Baron Hilton, Jackie Gaughan, Steve Wynn, and Jack Binion.

Forte made his knowledge and experience available to the industry in the game protection 'bible' Casino Game Protection: A Comprehensive Guide,[1] *probably the most*

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[1] S. Forte, *Casino Game Protection: A Comprehensive Guide* (Las Vegas: SLF Publishing, 2004).

important book published on the subject and a must for any casino executive or surveillance/security personnel, and which includes detailed discussions of many different scams, hustles and cheating methods, as well as Poker Protection, *which expanded the poker chapter in* CGP.[2] *He demonstrates his own mastery of some of these astonishing techniques in the* Gambling Protection Series *of videos.*[3]

Forte has been retired from the consulting business for over ten years, and is now retired from a playing career that goes back over twenty. He rarely gives interviews, but his expertise is still sought out by gamers, companies, and players. He was a consultant on the classic movies Rounders (*1998*) *and* Casino (*1995*).

COLLAPSE: First of all let's talk about what a 'game of chance' is. In the ideal model of a game of chance, we have a set of possible outcomes (e.g. the faces of the die) which turn up unpredictably with each throw, but with a frequency that is constant over time. The simplest way of gaining an advantage is through knowledge of these long-term odds.

We also assume symmetry: with dice, roulette wheels, etc. there is ideally no bias toward any one outcome. Of course, the physical, environmental, and human contingencies surrounding the game invariably

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[2] (Las Vegas: SLF Publishing, 2006)

[3] Now available as a DVD set—see www.stevefortegps.com.

'contaminate' this ideal model: Gaming equipment is made of materials which may be imperfect (advantage players can get an edge from flaws or peculiarities in casino equipment) or can be altered (introduction of marked cards, loaded dice); the gaming environment can be exploited to obtain information that ideally wouldn't be available (use of mirrors or cameras, teams signaling across tables, corrupt dealers); and dealers and other players are humans who can be influenced in various ways. So your view on games of 'chance' must be very different. Is it possible to give a broad overview of your mental model of a game, as a professional: the factors you have to take into account when examining a game in order to anticipate the different 'angles' that might be taken to exploit these shortcomings in the ideal model?

Steve Forte: One of the most eye-opening revelations for anyone pursuing a career as a professional gambler is that the games you read about in books and the games you find on the casino floor are worlds apart. Live games present a completely different set of dynamics, challenges, and opportunities for skillful play.

I recall playing blackjack in a big Reno club. I'm sitting on third base and notice that the dealer's riffle shuffle is open and high (versus closed and tight). Though not apparent initially, I begin to realize that the riffle is providing me with an almost imperceptible flash of about ten cards from the top of the left half (after splitting the deck into two halves for the riffle). At first it was just a blur, but after playing a while, I learned to let my eyes relax (instead of tensing up and over-anticipating the last riffle), and let my brain naturally try to recall what I had seen. Within a few weeks I reached a point where I could almost call out the ten flashed cards in order!

Let's assume that you can see about ten flashed cards and can occasionally and accurately classify the cards as 'high' or 'low'. Despite the fact that the flashed cards are riffled into approximately the same number of unknown cards from the other half, this is still an *enormous amount of information* that allowed me to camouflage my strategy to the extent that I was never suspected of being a card counter, yet I was playing one of the most sophisticated card-counting systems of that era (Lawrence Revere's 14 Point Count—an advanced four-level count with over 200 playing deviations committed to memory).

If the riffle exposed a preponderance of low cards, I would cut about twenty cards down, *cutting the low cards out of play*. This allowed me to increase my bet significantly off the top and maintain this bet size irrespective of what the count might indicate to bosses and surveillance.

If the riffle exposed a preponderance of high cards, I would cut as deep as the rules allowed, make a medium-size bet, and hope that the first hand showed an excess of high cards, because I was going to double up or parlay my bets irrespective of what the first hand's count indicated.

The additional information provided by the high riffle allowed me to confuse the pit and surveillance, securing my longevity as a player. I would routinely watch card counters get heat and even get backed off, but I was allowed to play because I wasn't playing the *theoretical game*, the standard which casinos use to evaluate all suspect play!

One of the fascinating discoveries made after playing this angle for many months was that many dealers riffled *slower* on their final riffle, which of course is the only riffle that mattered. Apparently, since the final riffle was the last step in the shuffling procedure and the last chance to thoroughly shuffle the cards, many dealers slowed down and riffled more deliberately.

From a management and game-protection standpoint, one of the realities associated with these kinds of strategies is that not only is each dealer uniquely different, but individual dealing styles and habits can change over time, and not always in a positive way (with experience, many dealers get complacent, lazy, and sloppy). So, for example, even in a club with 100 games that are well managed and supervised by a knowledgeable staff, and with every dealer shuffling properly *except one*, the club is still vulnerable to skilled players.

Though this is just one example of an offbeat strategy that targets the shuffle, from a conceptualization process, once you open your eyes and begin to truly appreciate the possibilities, it's like searching for gold. Most of the time you find nothing. Then there are the nuggets from time to time. And every once in a while you hit the jackpot.

With the best players, assessing the pros and cons of one's opponent is an arduous, detailed, exhaustive process—more so than most gamers would ever imagine—and it often starts long before the player walks into the front door, with pre-game knowledge of a club's history, management philosophy, attitude towards skilled players, average age of the staff, procedural consistency from dealer to dealer, experience of the dealers, and much more.

Once a professional gets to the game, the analysis really gets down to the nitty gritty, examining each facet of the rules, conditions, and procedures, followed by dissecting every minute component of the shuffle, cut, deal, payoff phase, and assembly of the deck for the next shuffle.

The best players are also cognizant of the other players. How many black check players? Are there any high-rollers playing? In games with only one player, should the professional take a seat, would the player's cards be visible (so they could be factored into the strategy)? With a sense of the action and where most of the pit's attention is directed, it's easier to pick the best strategic approach based on one's goals (blend in, hit-and-run, direct with no camouflage, high-roller, etc.).

There are also the psychological aspects of selling the play—strategic deception—and the basics of interacting with bosses such as being prepared with a story should a boss say, "Hello, where you from; have you stayed with us before?"

In short, my conceptualization of casino games was simple: Knowledge is power; the more you know about your opponent, the better your prospects, so do your homework. Then, in any game with a human element, anything is possible, and exploitable advantages are virtually *guaranteed* to be discovered in any casino if (a) you know what to look for, and (b) you are willing to make the commitment to find what most gamers and players *never see*.

C: In *Casino Game Protection* the term 'exploitable information' seems to cover all of these available sources of dissymmetry.

SF: The phrase 'exploitable information' is generally associated with *advantage players*, i.e., legitimate gamblers looking to exploit casino weaknesses. Examples include dealers who unintentionally flash their hole-cards, inadequate shuffling procedures that allow visual tracking of key cards ('shuffle tracking'), or the inevitable mechanical bias that develops in most roulette wheels over time. Take a seat at any casino table game in the world and you're presented with an environment of information. When that information is provided to *all players*, it's generally accepted to be within your rights as a player to consider and strategize the information to the best of your ability. Of course it takes skill to identify and profitably strategize the various types of information, which is exactly what advantage players are all about.

C: Advantage play has been recognised at least since the nineteenth century, right?

SF: In fact, there's very strong evidence suggesting that the concept of 'advantage play' can be traced back to the first organized study about games of chance, *Liber De Ludo Aleae* (*Book on Games of Chance*) by Gerolamo Cardano, posthumously published in 1663, though believed to have been written in 1520–1530:

> Cards have this in common with dice, that what is desired may be got by fraud; the most contemptible kind is that which is backed by the sword; a second

> kind has to do with the recognition of the cards—in its worst form it consists of using marked cards, and in another form it's more excusable [...] [T]hose, however, who know merely by close attention what cards they are to expect are not usually called cheats, but are reckoned to be prudent men.

It's not known whether Cardano was referring to a player unintentionally flashing the cards as they were dealt, or shuffling so poorly as to enable a shrewd gambler to know which cards were about to be dealt; only that Cardano was clearly making a distinction between cheating and being prudent when knowledge was derived 'merely by close attention'.

Scams, on the other hand, do not depend on casino weaknesses per se, because cheaters create their own sources of exploitable information. In sharp comparison to the aforementioned strategies, examples include 'playing the bend' (crimping and waving the cards into readable patterns), a scam that enables cheaters to ascertain the dealer's hole-card even when dealt properly—without flashing. Cheaters may conspire with the dealer to false shuffle a slug of cards so that a previously memorized sequence remains intact during the deal—like playing with the cards face up! And roulette cheaters have been known to stand next to a dead game and drill a tiny hole through the side of the wheel and into the ball track with a small custom built battery-operated hand-drill hidden in a women's pocketbook; later, a cheater standing next to the wheel would attempt to manipulate the spin by inserting a thin wire into the hole to knock the ball off the track into targeted sectors.

Though the legal definitions of casino cheating can vary slightly from one jurisdiction to another, they all tend to encompass three basic principles that can be found in the gold standard, Nevada's Revised Statutes (NRS), where cheating is defined as follows:

> 'Cheat' means to alter the elements of chance, method of selection or criteria which determine result or payment.

Also within the NRS is the Fraudulent Acts statute:

> It is unlawful for any person to determine the course of play after acquiring knowledge not available to all players.

Though there are other laws for possession of cheating devices, manufacturing and selling cheating devices, teaching others to cheat, and so on, these three basic criteria prove to be an effective test as to when an act crosses the line from advantage play to cheating: Was the random distribution altered? Was the intended payment altered? Was information utilized available to all players? For example, switching cards or dice changes the result. 'Capping' and 'pinching' scams (increasing or decreasing a bet after the result) alter the intended payoff. And a dealer peeking the top card of the deck and signaling this information to an accomplice provides cheaters with information not available to all players.

One of the earliest and most important cases to set the tone for the legal interpretation of advantage strategies occurred in the early 1980s, *State of Nevada vs. Einbinder and Dalben*.

Dalben sat on first base where the dealer was unintentionally flashing the hole-card to this position during the peeking action (unlike in the UK, blackjack dealers used to deal a hole-card and peek under tens and aces for blackjacks). Einbinder sat across the table, betting big, and receiving signals from his friend about the strength of the dealer's hand. Both players were arrested for cheating.

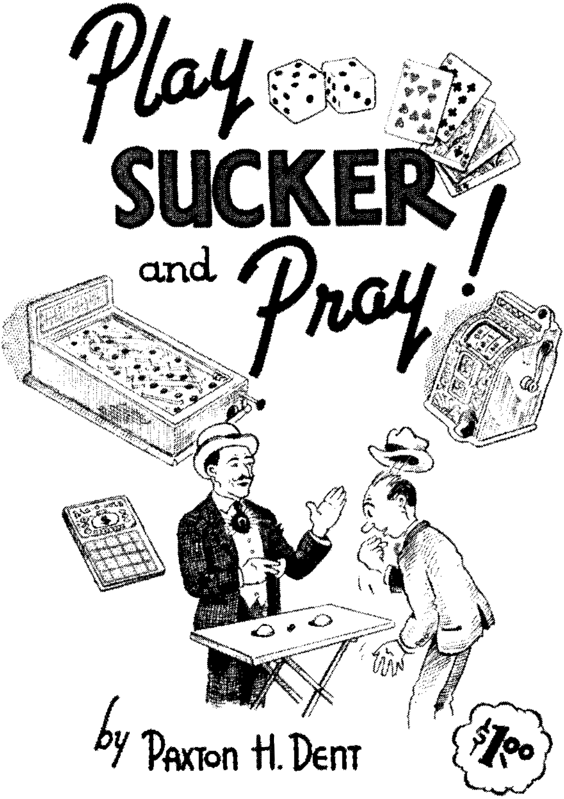
On December 18, 1984, the Supreme Court of the State of Nevada ruled in favour of the players, citing the following:

> Respondents were charged with cheating at gambling and other related felonies. The facts of the alleged offenses were essentially undisputed. In particular, the evidence showed that respondent Dalben was lawfully seated at his position at the Blackjack table,

> that he did not use any artificial device to aid his vision, and that he was able to see the dealer's 'hole' card solely because of the admittedly 'sloppy' play of the dealer.
>
> Respondent Dalben then communicated his information to respondent Einbinder. The district court ruled that respondents' conduct did not constitute a violation of the cheating statutes.

The signaling between players was also challenged: Was this a conspiracy? Interestingly, the answer was a resounding 'no' for one simple reason: You can't have a conspiracy without a crime!

C: So, as you write in CGP*:* 'If a strategy utilizes information made available to all players, it's legal, provided it does not alter any inherent characteristics of the game.' But this availability of information is not a fixed quantity. Firstly, one can't make the assumption that all players are able to process the 'available information' equally. But also, it alters along with new techniques and technologies. For example, when Edward Thorp published *Beat the Dealer*, which systematically laid out the science of card counting, what had been taken to be a game of chance suddenly became a game of skill and knowledge. Before then, players tacitly assumed that there was pretty much an equal chance of any card turning up next—which is obviously not the case!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Paxton Dent, *Play Sucker and Pray* (1939)

But it takes a good deal of analysis to learn how to exploit that asymmetry. Card counting in blackjack basically becomes possible when we realize that the deck of cards is not a 'random generator', but changes throughout the game, creating information asymmetry. Is it ever reasonable to assume randomness in the casino context?

SF: There's no such thing as true mathematical randomness in the casino industry, only acceptable levels of 'pseudo-randomness'.

Today's slot machines can be deemed random for all practical purposes, but to appreciate some of the technical challenges with trying to achieve randomness, consider the video poker machine.

Purists contend that true mathematical randomness can only exist when all deck orders are equiprobable, but even with help from the computer, limitations persist. A computer's random number generator and random function starts with a value called the 'seed'. For older 32-bit systems, the number of possible seeds is 2^{32}, or about 4 billion possible starting values, which leads to about 4 billion orders, just a *tiny fraction of all possible orders.* Even 64-bit and 128-bit platforms fall short.

A deck of cards can be arranged in 52 × 51 × 50 … × 1 different permutations. The result is an extraordinarily humongous number (8×10^{67}) that has fostered several analogies to help put the number in perspective. Here's a favourite: If each person on the planet were to shuffle a deck at the rate of 1000 shuffles per second for 10 billion years, collectively, they could only produce a small fraction of all possible orders. An even more profound characterization states that every shuffle produces a new order, one that has never been seen before, and one that will probably never be seen again.

Moving from technology to the other side of the spectrum we find a small cube of plastic, the casino die. Casino dice are generally considered to be good randomizers, but this wasn't always the case. There was a time when many believed that the dice were naturally biased due to a discrepancy between the weight of the spotting compound (epoxy resin/paint) and the weight of the cellulose removed when drilling the spots. If the compound weighed more, you would expect more aces; if it weighed less, you would expect more sixes.

According to many early dice makers, the bias was real. The epoxy resin/paint was lighter, but only slightly so. Where the story picks up speed and credibility is when you learn that right up to the 1960s, craps layouts barred ace-ace on the *don't pass* and *don't come*, and then for some mysterious reason, barring two sixes became the norm. Coincidence?

Finally, at the heart of every card game is the shuffle. When the cards are shuffled adequately, the laws of probability run their course and give all players a fair shake.

When the cards are shuffled poorly, biases can lead to strange results and exploitable opportunities for the professional gambler. We have already discussed some of the strategies that target these weaknesses, but it's not just the shuffle that is nonrandom, it's the *entire game* that operates in a nonrandom way.

Most dictionaries define randomness as 'lacking in aim or method, purposeless, haphazard', yet when we look at a blackjack game in action, the entire process is controlled by predetermined procedures and predictable actions. The decks start in new deck sequence; they are shuffled by all dealers in the same manner according to procedure; the cards are dealt from left to right and picked up from right to left (most often starting with busted hands and blackjacks); the same number of cards are dealt before reshuffling; the played cards and cutoffs (unplayed cards) are assembled in the same way before each shuffle; even the typical player's strategy and position of the player's cut can be anticipated. This normality creates a difficult environment for producing randomness (which can facilitate some advantage strategies).

In the complex and counterintuitive world of randomness also lie some of the gambling world's biggest misconceptions. Most gamers believe that once a process has been tested and stamped 'random', it's a process safe from predictive exploitation. But this is absolutely not true, as illustrated by the following story.

After watching a demonstration of one of the early shuffling machines, the inventor boasted that his shuffler had just passed a barrage of statistical tests for randomness conducted by a respected gaming lab and that the shuffler was safe from the myriad strategies currently beating hand-shuffled games (location, slug tracking, and sequential tracking). I commented, 'You know, that doesn't necessarily mean that the shuffler is not vulnerable'. A heated debate ensued.

To prove my point, I put two queens and an ace face down on the table in a row and invited the inventor to play a game, 'Find the ace'. I asked him to move the cards around until he was confident that each card had a 1 in 3 chance of ending up in each position, and that any statistical test would confirm the process to be random. He moved a few cards around and said, "Let's say that I continued to shuffle the cards for 20 minutes, now what?"; "Okay, lets play the game." I pointed to a card and proposed, "I'll bet $10,000 that this card is the ace!" Of course he objected, stating that I had *watched the shuffle*, which was my point all along. Here's a shuffling process that would be approved by any gaming lab to be truly random, yet I can predict where the ace will be with certainty. Albeit an overly simplistic example, the point is that just because a process is deemed to be random doesn't mean that it's automatically immune from predictability.

Several early slot machines were proven to be vulnerable to prediction, after passing the required statistical tests. Several early shuffling machines were also proven to be vulnerable after being successfully tested. And the same principle holds true with other games, too. A roulette wheel that exhibits a bias to the ball track is still producing random numbers and generating a random distribution. But the track's bias enables wheel clockers (visual prediction players) to strategize ball speed, rotor speed, and bounce, and still predict the winning number, or sector, or half of the wheel, despite playing against a *random process*!

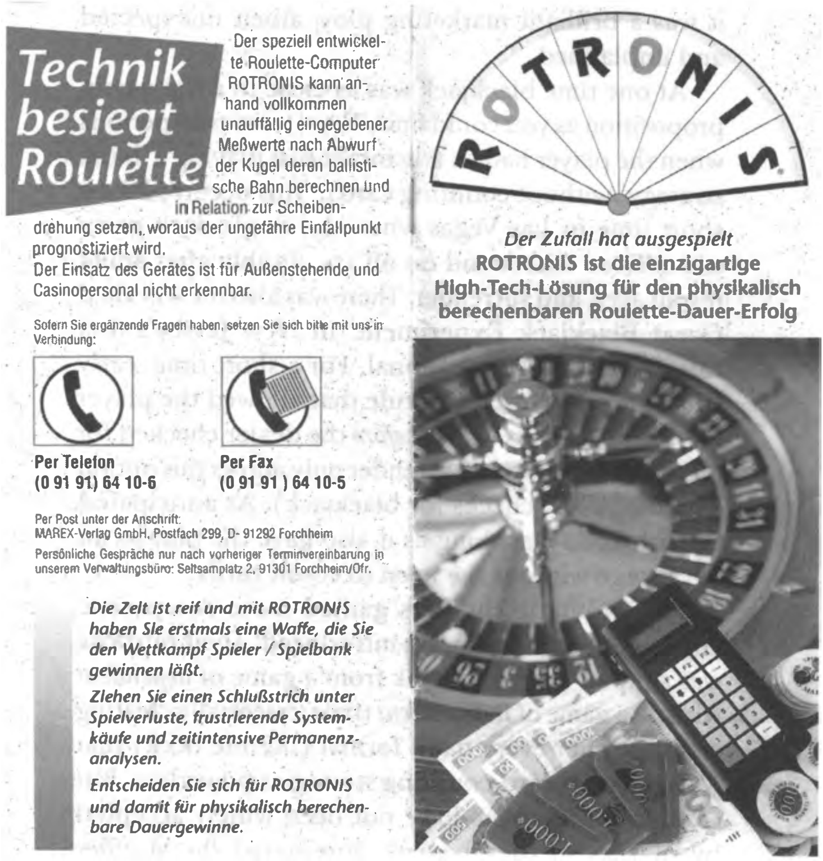
C: How did the industry cope with Thorp's book? Some of them were in denial about this transformation—and yet in fact it increased profitability (decreasing hold percentage but increasing volume).

SF: The landmark *Beat the Dealer* was definitely a game changer. When the industry first learned that scientific play was possible in blackjack, they panicked and immediately changed the rules. But overreacting proved to be a mistake as the casinos lost business due to unattractive games. It didn't take long before everything reverted back to the old rules and procedures, however, as the casinos began to realize that few card counters can win over the long run, and that the perception of skill was a good thing; in fact, it was a brilliant marketing ploy, albeit unexpected and unplanned.

At one time blackjack was as close to a flip-a-coin proposition as you could find. There were even periods when the player had an advantage just playing a 'basic strategy' without counting cards! This occurred for a short time in Las Vegas when the single-deck game was offered with stand on all 17s, double after splits, resplit aces, and surrender. There was also the so-called 'Great Blackjack Experiment' in New Jersey's first casino, Resorts International. For a short time 'early surrender' was offered, a rule that allowed the player to give up half his wager *before* the dealer checked for blackjack (traditional surrender only allows this option *after* the dealer checks for blackjack). As anticipated, the rule didn't last long as it also gave the players an advantage without the need to count cards.

As automatic shufflers gained more acceptance, 'continuous shufflers' were introduced. Their purpose was simple: Turn blackjack from a game of *dependent* trials to a game of *independent* trials, essentially creating a shuffle-after-every-hand format (infinite deck) that would render card-counting strategies powerless. But continuous shufflers have not been widely accepted by players so they haven't dominated the shuffler marketplace as was anticipated.

Some sixty years later, the industry is still apparently bent on eliminating blackjack's skill factor, and



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'Rotronis' roulette computer (Germany, c1980s)

their latest brainstorm is the advent of the 6 to 5 payoff for blackjacks. The traditional payoff has always been 3 to 2, so for comparison with a $10 wager, blackjacks used to pay $15; now they only pay $12.

Most rule changes don't have a significant effect on players. When casinos hit soft 17 versus stand on all 17s, the house advantage increases by approximately 0.2%. When the player is only allowed to double down on 10 and 11, the house advantage also increases by about 0.2 percent. Even when casinos go from one deck to shoe games (4–8 decks), the house advantage increases by about 0.5 percent. But this latest change has all but rendered the game unplayable from a skill standpoint as the revised 6 to 5 blackjack payoff adds another 1.4 percent to the house advantage!

Though there are still a few beatable games today, it generally takes a professional (or professional team) to play skillfully, profitably, and undetected.

C: 'Availability of information' also depends very much on what one is primed to notice. You raise some interesting examples in *CGP*: You're playing a card game and spot that some cards are marked. Or you notice that the dealer deals in a certain way, and you can systematically take advantage of it. Are you cheating if you exploit this, since the information is theoretically 'available' to everyone?

SF: You're absolutely right, the notion of available information only has meaning if one is primed to notice. For example, when players sit down to play blackjack, they have many strategic options based on their knowledge and skill, or lack thereof. They can choose to simply play for fun. They can play systems based on hunches, streaks, and betting progressions, the classic SWAG player (scientific wild-ass guessing). They can learn 'basic strategy' and buck the lowest house advantage possible without counting cards. They can observe all cards and factor this information into their decisions. They can learn to count cards. Or, they could master the appropriate basic strategy, learn a card-counting strategy along with the most important strategy deviations in the game (based on strategy indexes), and then take their strategy to the ultimate level and consider all other sources of information made available to them, which entails combining their skill and knowledge with an ancient competitive principle found in warfare, business, sports, games, and life—targeting the weaknesses of the opponent. This is exactly what the world's best advantage players do—they seek every possible mathematical and psychological advantage and are experts at strategizing every source of information that is made available to them.

C: So that's advantage players; let's turn to cheating. In *Casino Game Protection* you speak of *spectra of technique*.

Could you map out, broadly, what these different spectra are? How would you group the different types of activity that you try to detect?

SF: The 'spectra of technique' simply refers to a range of techniques that accomplish a particular goal.

Consider the classic dice switch. The most difficult switches are done entirely with one hand during the toss and they can be done instantly and deceptively. There are 'hand-to-hand' switches where cheaters will create believable scenarios to cover the switch, such as picking up the dice in the right hand and apparently placing them in the left hand (which conceals the crooked dice) to have the cheater's female companion blow on the dice for luck. There are also 'prop switches' where a cheater will use cash or chips in his hands to facilitate the switch; two-player switches when, for example, one cheater slides the dice to his partner, switching them in the process; and switches that require gaffs or devices for their execution, such as 'chip shells'. These are stacks of chips that have been glued together and gutted to create a shell that can hide one or two dice inside, allowing the cheater to *show both hands empty* during the switch. Finally, cheaters don't always switch both dice; some scams require the switch of only a single die.

So, for this particular manipulative objective there are literally dozens of variants, as there are with card marking schemes, false shuffles, past posting (betting after a result is known), and many others. Since I did not want *Casino Game Protection* to be an *encyclopedia* of moves, scams, and strategies, for each objective, legal or otherwise, I tried to present a variety of material that best represented the range of possibilities.

C: Are there different 'species' of cheaters corresponding to the 'spectra of technique'? Some who excel in social skills—acting and creating the situation where there is an opportunity; and some who are more technical? Or do you have to master all of this to be successful? And what characterises a professional cheat as opposed to an amateur trying their luck?

SF: The most salient attributes of the professional cheater is good judgement. In any given situation, they know when to 'move' (cheat) and when to 'pull up' (quit). They know when conditions call for a cautionary path, and when to take dead aim (a bold, direct approach). They can sense 'heat' (scrutiny) even when it's not visibly apparent, and they have an uncanny sense of when enough is enough. And perhaps most importantly, they have learned to control the greed factor—the downfall of many cheaters. The professional sees greed as a cancer to his profession, and judgement as the key to grinding out steady, safer wins.

Experience is another obvious distinction: One can only reach the status of professional with experience, both good and bad. A professional is much more apt to spend time working out the details, carefully considering the best way to 'frame a play', the length of time to play, how much 'splashing' (cover) is appropriate, and the always important backup plan. Preparation is paramount.

The professional is also much more likely to be on the cutting edge, always more likely to be playing with the next new scam, or with the next new cheating device. Their thought process is one of always trying to solve the next puzzle, beat the next industry countermeasure, beat the next new industry device, or beat the next new game.

Also, professionals are generally more technically proficient than amateurs. Some cheating techniques are so difficult that it can take months and sometimes years of practice to perfect them. You won't find this level of dedication with amateurs; in fact, many of the most difficult moves are rarely attempted.

When it comes to interacting with dealers, bosses, and other players, professionals are also better actors. Believability is crucial, and they know it!

Finally, few amateur cheaters have big bankrolls. Many play with 'blood money' (case money, or borrowed money) so they are always subject to poor decisions due to desperation. But a big bankroll offers

many advantages, not least of which is betting more and going for bigger scores!

While the common perception is that the best cheaters have mastered it all, I have met many who were incredibly talented technically, but who never had any significant monetary success, and have met many with little or no technical skill who have stolen fortunes.

C: From all of this it sounds as if you have to be hugely disciplined. What kinds of people enter into this as a really serious commitment? Both in terms of mindset and in terms of what other professions they might come from?

SF: It obviously takes discipline to master any craft, but where it really makes a difference with professional gamblers is *after* one becomes an expert.

Sooner or later all players run into severe statistical fluctuations. Some call it ‘luck’, others call it the ‘x-factor’ or the ‘unknown factor’, and mathematicians/statisticians call it ‘normal statistical fluctuation’, but whatever you call it, you can’t avoid it. Envision a winning poker player or card counter playing for weeks or months and still showing a net loss. It can be disheartening and easy to doubt one’s skill. I’ve seen literally hundreds of winning players run bad for long periods of time and head straight for the crap table or the sports book in an effort to get even. (I’ve seen

poker players lose *one pot*—the classic bad beat—and head straight for the pit!)

Peter Griffin, one of the most respected gambling mathematicians and theorists, estimated that the winning blackjack player is only at his all-time high about one percent of the time! Think about that.

Legendary high-stakes blackjack professional Ian Anderson simply and succinctly stated these realities in his classic, *Burning the Tables In Las Vegas*.[4]

> So you can't depend on winning the next time you play, or the next week, or the next month. I have never had a losing year at blackjack, but could it happen? Absolutely!

In poker it's often called the 'law of least tilt'. Between two players of equal skill, the player with the most discipline will prevail over the long run.

So why is discipline so important? It keeps the professional player on track when faced with adversity, ensuring that every decision is motivated by sound judgement, mathematics, and science. Discipline is synonymous with self-control, and the minute a professional gambler loses control, he's no different than every other 'sucker', 'egg', 'pigeon' or any other pejorative moniker for gamblers who have no chance to win.

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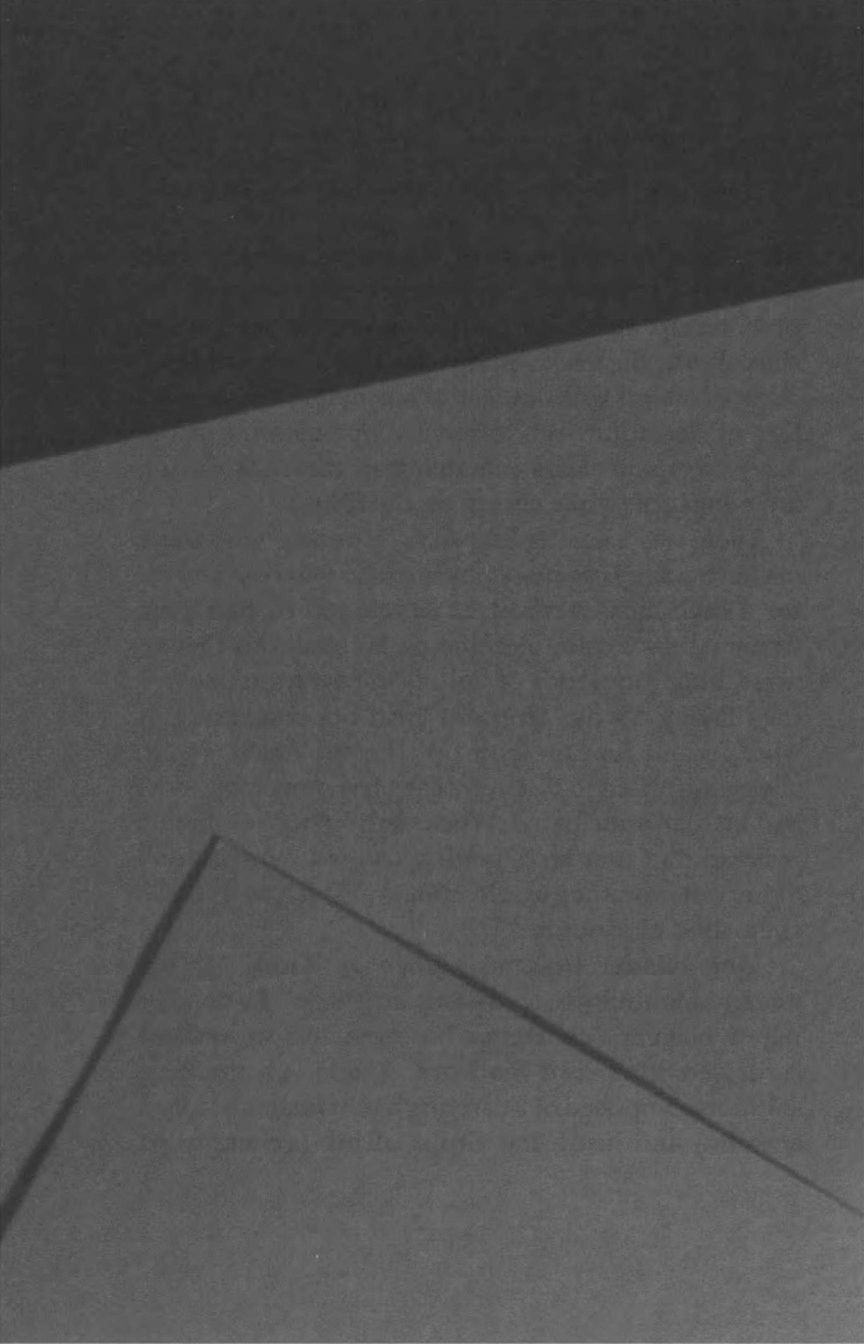
[4] I. Anderson, *Burning the Tables in Las Vegas: Keys to Success in Blackjack and in Life* (Las Vegas, NV: Huntington Press, 1999).



C: What 'masters of the art' have you come across?

SF: Through forty years of aggressive research into this world, I have been fortunate to meet several. The best 'runup man' (stacking) I have ever seen could riffle shuffle the deck without any hesitation and stack three of a kind without fear of suspicion, never mind fear of detection. While serving our country in the Navy, he spent years practicing in the dark during long voyages (while sitting on the toilet).

There was a hustler known as 'Houdini' who was a master at many casino scams but who was best known for a diabolical method he developed to past post bookmakers. Posing as a doctor, his story was that he was taking thousands of dollars in bets from doctors, then laying off the action to local bookmakers. But when it came time to 'settle up', the bookmakers were always surprised to discover that a few more long shots had hit than anticipated. When the bookmakers finally realized that they were getting conned, but couldn't figure out how, they would remark, "This guy must be some kind of Houdini!"

One hustler became known as 'God' for his remarkable ability to read and play 'shade'. Even other 'paper players' (cheaters who specialize in marked cards) couldn't read his work. Shade is a marking solution comprised of a carrying agent (water, alcohol, acetone) and just a few drops of ink (generally an aniline dye). It's used to mark any *white portion* of the card, darkening it ever so slightly, and is considered one of the more sophisticated marking systems due to the laborious practice required to read the marks in live play. In one high-profile casino case, the cards were suspected of being marked, but after all attempts to detect the work failed, the decks were sent to the FBI laboratories for analysis where a faint foreign substance was identified. The problem, however, was that despite detection and knowledge of the location of the marks, the cheaters were never pursued because no one could read the marks for a magistrate or jury. Most assumed that special glasses or contact lenses had to be employed to enhance the marks, though the truth is that the system's secret was twofold: (a) it took about 100 hours of practice, and (b) the cheater learned to read the work lighter and lighter (reducing the amount of ink) until it was highly improbable that anyone else could read the marks without going through the same arduous training regimen.

C: As this makes quite clear, at the highest levels this is a matter of attuning perception and control of one's play to an extraordinary degree. In CGP you write that 'professional cheaters can reach a level of skill, timing and finesse that borders on the supernatural'. Are the magical arts and cheating historically linked?

SF: Though there's definitely a link between cheating and magic, the crossover is tenuous and generally limited to some very basic tools and concepts.

While both groups may use sleight of hand, devices, and misdirection, the sleight of hand employed by cheaters face a tougher deception standard, their devices and applications are designed to accomplish different goals, and the misdirection—the term used in magic—is uniquely different in virtually all cases. In short, the two professions are worlds apart.

For starters, magic is a performing art, cheating is a criminal act. In cheating, the psychological environment starts with the presumption that the game is legitimate until some result or action raises suspicion; in magic, the environment is openly consumed by deception and suspicion since every spectator knows that the magician will attempt to use every trick in the book to fool and entertain. Cheaters generally have to follow acceptable card- and dice-table protocols; there are no such restrictions for magicians. In gambling, no one wants to be cheated; in magic, everyone wants to be fooled and entertained. Finally, cheaters are looking to be forgettable; magicians are looking to be spectacular. The list goes on and on.

While it's true that moves and ideas from the magic world occasionally find their way into the repertoires of cheaters, just the opposite is much more likely. There is a fascinating history of many famous magicians tracking down cheaters to learn their sleight of hand as they believed that the sleight of hand employed by cheaters is more sophisticated and deceptive than the sleight of hand employed by magicians—though you rarely hear about cheaters reaching out to the magic world for the same reasons.

I have found that both professions have their elite. Some of the finest sleight of hand I've ever witnessed was in the hands of both cheaters and sleight-of-hand-artists. But I stop there. It just doesn't make sense to make further comparisons, because you'll never find any other common ground, apart from a few generalities.

C: So arguably the cheater has the tougher gig…Yet one skill professional cheaters and magicians share is that of anticipating the expectations of their respective 'audiences'—i.e., knowing what people *want* to believe—and setting the scene accordingly—altering the environment to create the best possible conditions for success.

SF: Cheaters have to manufacture believable scenarios because unusual results raise suspicions. They accomplish this goal in many ways.

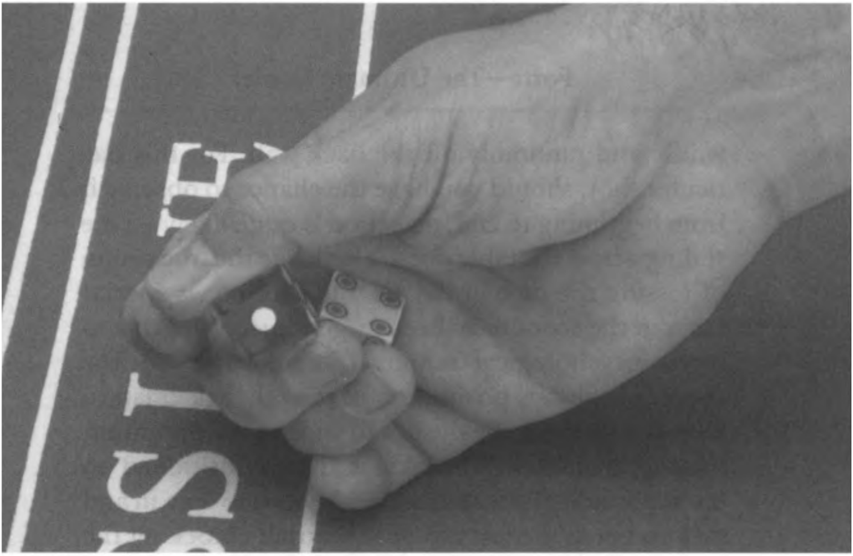
Cheaters will often 'splash' a move to test the awareness and knowledge of the players. For instance, if a dice mechanic is getting ready for a 'money switch', he'll go through the motions a few times with money in his hands to establish the move and to see if anyone blinks. Once the other players get used to seeing the cheater toss the dice with money in his hands, it becomes acceptable in their minds. When the switch actually occurs, since the actions associated with the switch have been established, suspicion is alleviated and it's easier for the brain to 'see' legitimacy.

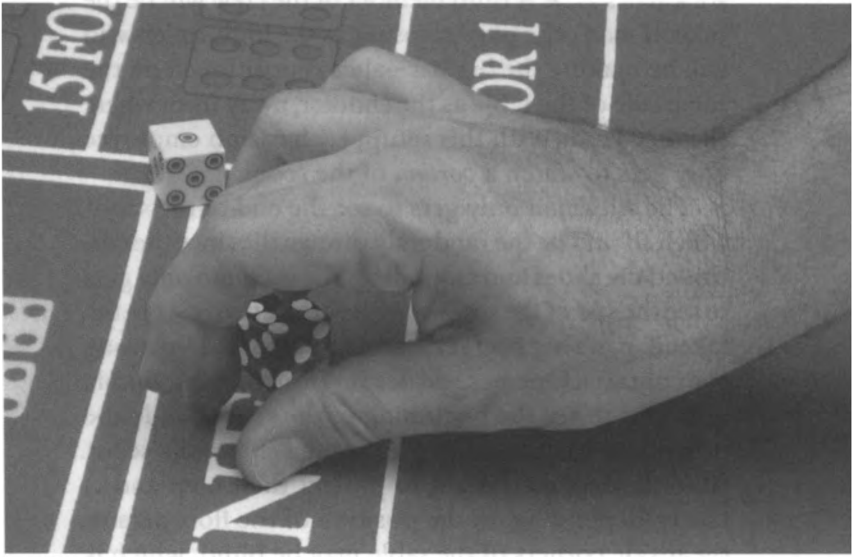
Some cheaters splash with an *actual move*, such as dealing a card off the bottom of the deck. But they do so without the intent to cheat. They will shuffle legitimately, have the cards cut, and while pitching the cards around the table they deal one card off the bottom. Since the bottom card is a random card, even if someone suspects the move, there's no rhyme or reason. Or they might do a 'push-through'—a false shuffle where the halves are riffled together, pushed in at an angle, and then stripped out with one half getting slapped on top to emulate a true cut. But after the push-through, they will riffle legitimately a few times. Again, the move has no purpose other than to test game conditions.

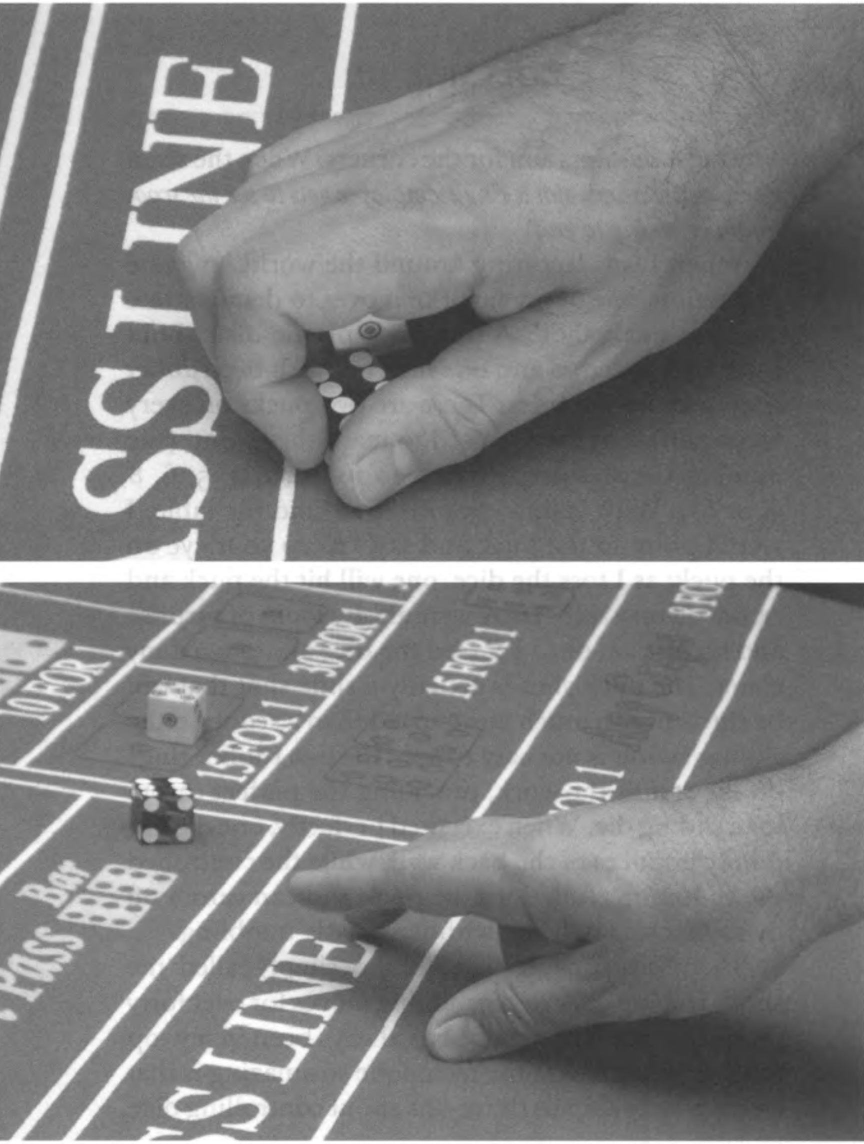
C: What's particularly striking in the GPS videos are the controlled dice shots, which are totally counter-intuitive since the die is an emblem of uncontrolled randomness. It's incredible just how much control one can have over the result; but these moves also depend on misdirection to some extent.

SF: Take the 'scoot', a gutsy scam where one die is slid short of the back wall while the other die bounces wildly and randomly off the back wall. For this particular shot, should you have the chance to observe it from beginning to end, detection is quite likely—a die sliding across the table doesn't look like the true action of tossing the dice in the air. But dice crews specializing in the scoot have been largely successful due to clever 'psychological framing' (diabolical setup). The shooter is always positioned next to the stickman to keep the distance the die has to slide to the minimum. Another member of the crew is always positioned on the other side of the stickman; his job is to lean in and make a bet at the last moment, partially blocking the stickman's view. A third member of the crew will be the 'takeoff man', the player posing as the high-roller who will be making the big bet—always positioned on the same side of the table as the shooter, away from where the dice land. With this setup, each casino employee only gets to watch a *portion* of the scoot.

The stickman only gets to see the end of the scoot, which should be the randomly thrown die since the controlled die slides and stops first. The boxman only gets to see the end of the scoot since he's forced to react to the takeoff man's big bet (generally accompanied by strong eye contact). One base dealer (in front of the shooter) only gets to see the beginning of the scoot, while the other base dealer only gets to see the end of the scoot. (Base dealers are taught to protect their own ends.) Lastly, depending on the position of the floorperson, the inside corners of the table may be blind, which is




15 FO
OR 1


10 FOR 1
30 FOR 1
15 FOR 1
15 FOR 1
Bar
Pass

'The Scoot'—The forwardmost die (white) leaves the hand first and randomly bounces off the back wall; the other die (dark) slides short of the back wall.

why most scooters aim for the corners. When the scam goes as planned, *not a single employee gets to see the scoot from beginning to end*!

When I was lecturing around the world on game protection, one of my favorite moves to demonstrate was the 'puck shot'. A puck is a plastic disk about three inches across and one inch tall with two rubber rings around the sides. There are two pucks on every craps table and they're used to mark the 'point' (the number the shooter is trying to roll; i.e., 4, 5, 6, 8, 9, or 10). With casino executives around the table, I would point to the puck and say, "Keep your eye on the puck; as I toss the dice, one will hit the puck and carom off on a six!" There were always looks of surprise and scepticism until I tossed the dice and proved my claim. The puck-shot is actually a slide-shot that can be thrown with much more speed than a scoot, so the sliding action is not easy to see. The two rubber rings do the rest of the work, providing the perfect carom for a sliding die. When executed perfectly, one die randomly bounces of the back wall, while the controlled die slides forcefully into the puck and can carom off by as much as two feet without the die tumbling.

There's also a controlled dice shot simply called 'the shot'. Having collected gambling moves for over forty years, this particular move has always been in my top ten list. What makes the technique so amazing is that it completely dispels the myths about controlling dice.

With this method, one die is thrown with air! What this means is that the controlled die is thrown about three inches off the table. Now instead of an obvious slide, the controlled die will wobble, and can even bounce, while maintaining its lateral control. Though a *percentage shot*, I've met cheaters who have won fortunes with this move.

Awareness and general knowledge are important factors that all contribute to one's belief that something just witnessed was legitimate. Bosses, for example, who believe that a slide-shot would be easy to detect, but that controlling a die that's thrown in the air is impossible, would definitely be vulnerable. So when you talk about 'what people want to believe', it's what's in their heads in terms of knowledge, experience, awareness, and perception that can set the stage for cheaters' techniques to go undetected, even when perpetrated in plain view. Depending on the mindset of the observer, the brain can get fooled over and over again.

Finally, for an interesting aside to those who watch closely but never see anything, consider a boss 'burning' a suspect player (intense heat and scrutiny). Many of the best cheaters, advantage players, and card counters interpret intense scrutiny as a sign of *weakness* and as no reason for concern. It's the classic poker tell of acting strong when weak, and vice versa. These players will tell you that they're much more concerned about bosses who keep their distance while casually supervising the games out of the corner of their eyes, which they view as a kind of psychological trap designed for them to take the bait and expose their true intentions.

C: So there is a whole game of deception and counter-deception here.

SF: Deliberately acting as if being careless, clumsy, or absent-minded is just one way for cheaters and advantage players to portray a nonthreatening image—most don't associate these traits with the slick, polished, sophisticated professional gambler. But the idea of cheaters and advantage players 'acting' for various reasons happens every day.

Cheaters have to act to hide their crimes (criminal deception); advantage players have to act to hide their skill (strategic deception).

One of my favorite stories along these lines is about an old-time hustler that was a master 'paper player' (marked cards). He would intentionally sit at the end of the table, wear thick-rimmed glasses, and routinely rise off his chair and peer down the other end of the table to read the cards. The thick rims suggested that the lenses were also thick, and occasionally rising off his chair was an act designed to further the impression of poor eyesight. In truth, the hustler had 20/20 vision and the lenses were normal and uncorrected. When someone detected the marked cards one day, 'old man Harry' was the last player suspected; after all, it was a struggle for him to even read the faces of the cards!

In the early 1960s when card counters began to get backed off and barred, it was immediately apparent that to have any chance to win, one also had to hide one's skill. This led to the concept of 'strategic deception' and is the reason why most of the early books on card counting included chapters on camouflage, comportment, cover, and image. For the same reasons, advantage players need to hide their skill, too.

An example of strategic deception employed by advantage players can be seen in the case of a very successful, creative bias wheel player. He had discovered a mechanical defect and was betting the same bias numbers, winning a substantial amount of money. His act involved the use of an astrological chart that conveniently depicted a circle of 12 different 30-degree divisions called 'signs'. The player was able to convince the bosses that 12 (divisions) multiplied by 30 (degrees) represented the roulette wheel (360 degrees with 36 numbers excluding the single and double zeros), and that his strategy was based on some nonsense about the path of the Moon, Sun, and the planets. Apparently, the casino believed the player was crazy for several months before the mechanical biases were discovered. From a detection standpoint it's relatively easy to cut right through these facades and avoid being confused by all the external noise, and the secret is simple: Don't be swayed by stereotypes. Ignore age, sex, race, dress, words, and mannerisms. Strive to conduct a solely scientific evaluation that focuses on two criteria: the betting and playing decisions of the suspect player.

In blackjack, for example, there are countless methods for marking cards, and no one can have knowledge of all methods. Fortunately, from a detection standpoint, there are essentially only three ways to exploit marked card information and all are easy to recognize. They are 'top-carding', hole-card play, or a combination of the two (known as playing with 'anchors' who are small players who will purposely forfeit a bet if necessary to help win the big bets).

When a player knows the top card before it's dealt and he's in a position to receive the first card, there's often a strong correlation between higher-than-average bets and starting the hand with a ten or ace. (By the way, advantage players can get this information legally in a variety of ways!) If the player knows the dealer's hole-card, the appropriate strategy is generally very transparent because it requires one distinct strategy when the dealer's initial two-card total is strong, and another when the dealer's two-card total is weak. When both the top cards and hole-card are known, it's even possible to *control the result.* If the dealer has a 'stiff' (totals 12–16), an anchor sitting last can leave a ten-valued card on top that will bust the dealer and ensure a win. It's also possible for one or more anchors to sit in front of the 'takeoff man' and play to leave a favourable card for their cohort. For example, the anchor could leave a ten-valued card on top when he sees that the big player is about to double down with eleven.

C: Along the same lines, let's talk about 'turns'.

SF: 'Turns' are planned distractions designed to hide something. Though the least scientifically interesting of all the questions, turns are one of the most colourful topics in the entire cheating genre!

Turns are an essential element in many scams and may refer to the person who intentionally and momentarily diverts the attention of a dealer, supervisor, or surveillance as in, "For this play we'll need *turns* on both sides of the game". The term may also refer to the physical action—as in, "You *turn* the boss". Often the turn provides more of a blocking action than a distraction, as in the case of 'past posting' (betting the winning number after the ball has landed). Here the turn leans over to make a bet and completely blocks the view of the dealer. Without a turn, many scams would have little chance for success.

Consider the scams of 'mucking' and 'switching' (one- and two-player card switching). The turn works one side of the game while the cheater(s) plies his trade on the other. Eye contact is an integral part of turning, and any action accompanied with strong eye contact may do the trick. Or, to force a response, the turn may expose his cards, look to the dealer and ask, “How would you play this hand?” One turn, when signalled to divert the dealer’s attention, would blatantly pick up his bet and place it on top of his cards, rather than simply sliding the cards under his bet—the proper way. This would drive dealers crazy as they would all immediately respond, “Sir, please don’t touch your bet, just slide your cards under your chips”. The turn would do this two or three times, always with an apology, and always as the switch was occurring. The turn knew that most dealers are anxious to take charge, so he let them, forcing the anticipated response.

By the way, the best defense against these kinds of turns is for dealers to learn how to ‘walk the game’, which is to lean to the right and left, not turn to the right and left, and always maintain a strong peripheral vision of the game so that no player is ever completely out of sight. These are the toughest dealers to manipulate, which is why cheaters typically scout for the right dealer; they’re looking for puppies, not bulldogs.

When a turn is signalled to act, he or she can be very creative. I’ve seen cheaters take insurance against a deuce, hand the dice to their girlfriend, set their drink on the winning number in roulette, and just about anything else that would force the dealer or supervisor to react, because once they do, it’s generally too late.

Calling a boss to get the cocktail girl, engaging in a conversation, telling jokes, staging disputes, and using pretty girls (the more scantily dressed, the better) are common ruses. If a crew wanted to pull a boss off a crap game, a turn might just walk into the pit and ask, "Is Mike working tonight?" After the boss responds, "Mike who?" the turn replies, "You know, he looks a lot like you". The entire interaction takes only five seconds, but with many scams, that's all the cheaters need. After a turn does his job, he'll often walk right out the door. They don't want to be connected to any suspect play and risk having a boss put two and two together: "See the guy over there; he pulled me aside to ask me a question, and I think the shooter slid the dice."

On the strong side, turns have been known to knock over stacks of checks into the pit, spill drinks on other players, pretend to fall asleep on the game, start fights, and even stage heart attacks. The colourful stories are plentiful. In one infamous scam, a strong turn was required to switch an entire eight-deck shoe. When signalled, *the turn jumped up on top of a blackjack table*, took off his jacket to reveal a Superman outfit, and started yelling, "I think I can fly, I think I can fly." The turn was so strong that not only were the bosses and security guards turned, but every player in the near vicinity got caught up in this madman's antics. The crew successfully kicked in a $160,000 cooler, but after getting indicted a year later, the authorities were able to find numerous employees and patrons who still remembered the Superman incident. The turn was over the edge, it was too strong. The best cheaters will tell you that the best turns are those that no one remembers!

C: At what point in the history of gambling did game protection come into existence as a discipline, with a history and professional status?

SF: This is a fascinating question.

Any gambler worth his salt understands the importance of protecting himself from cheaters, so the idea of *individual* game protection has undoubtedly been around since the first games of chance. Modern translations of Cardano's *Liber De Ludo Aleae* (c1500s) classified the work as a gambler's handbook, because it included brief explanations of false dice, marked cards, and other cheating techniques.

The first book to expose the methods of cheaters in American literature—also the first book with the word 'gambling' in the title—was Jonathan H. Green's 1843 *An Exposure of the Arts and Miseries of Gambling*. Green was known as 'The Reformed Gambler', and he would go on to author several cheating exposés.

Fastforward to the 1950s and several authors were writing books with detailed information about cheating and, more specifically, how to protect oneself against cheaters. Most notable were John Scarne and Micky MacDougall. Scarne may have been the first independent casino consultant, while MacDougall was the famous card detective who accompanied Ed Thorp into the Las Vegas casinos to detect crooked blackjack dealers while Thorp was writing his seminal *Beat The Dealer*.

The first commercial video series to expose the methods of cheaters was produced in 1981 by game-protection expert George Joseph—currently president/owner of Worldwide Casino Consulting.

For many years it was customary for the clubs to hire ex-cheats who would watch the games from the catwalks (with binoculars). Eventually, surveillance systems were introduced and the sophistication of these systems and supporting technologies advanced rapidly.

My consulting career began in the middle 1980s. At that time there were only a few outside consulting firms offering game-protection training (though many clubs addressed the topic in-house). Today there are dozens of security-based companies and game-protection consultants working around the world.

For decades, game protection was the number one priority of most casino operators, but not any more. Its importance has gradually declined, with today's operators focusing their efforts on customer service.

Apparently, shuffling machines, peeking devices, low-profile roulette wheels, surveillance software for analyzing suspect play, and a host of other high-tech security-based implementations have lured operators into a false sense of security. Sure, the games are better protected than ever before, but there's always a way...and it has been my experience that the best cheaters and advantage players are ten years ahead of the industry!

C: One means of control must involve stamping out any material asymmetry in the equipment itself: What kind of work today goes into developing the design of roulette wheels, making dice symmetrical, making cards robust and unmarkable, etc.?

SF: The makers of cards, dice and wheels are highly competitive with each trying to trump the other by offering something new to improve functionality, security, and player appeal. Here are a few examples.

Dice have essentially been made the same way for decades, and dice makers have done a good job at maintaining acceptable manufacturing tolerances. For security, makers can add a 'glow spot' (epoxy spotting compound is mixed with an ultraviolet ink), 'key spot' (letter or number monogrammed on the inside of a spot), or nontraditional spotting orientations.

The same is true for playing cards, though recent high-profile cases have drawn attention to manufacturing tolerances regarding the back design's registration, or how accurately the back design is positioned. If the tolerances are off too much, an asymmetrical back design is the result, which can be cleverly strategized by sophisticated advantage players as the cards provide another source of information that is made available to all players.

Roulette wheels, however, have experienced dramatic changes. It started with flattening the traditionally deep-sloped center of the wheel ('cone' or 'dome') along with reducing the height of the pocket walls ('frets') to create the modern 'low-profile' wheel. With the new design, the ball bounces longer and more unpredictably (more scatter).

Pocket walls used to be separate pieces but they would loosen over time and create a bias—a wall not firmly in place will absorb the ball's force when hit and minimize bounce around the bias. To counter this issue, solid, one-piece number rings were designed. Changes to the traditional pocket design followed including triangle- and scallop-shaped pockets.

The quality of the bearings has improved dramatically, resulting in almost no decay in rotor speed.

Some manufacturers have redesigned the ball track by changing slope, or curvature, or by using a more durable material for the track's surface.

To monitor the levelness of the ball track, in-track sensors built right into the track are also available!

After the ball exits the track, it may or may not hit a small deflector before reaching the pockets. These deflectors are also called ‘canoes’, ‘diamonds’, and ‘pins’. Their purpose is to create more variance from spin to spin. As one would expect, deflectors come in different shapes and sizes, all in an effort to ensure a random outcome.

Much more so than dice and cards, roulette wheels can also be highly decorative, being offered with different colors, themes, translucent bowls, and hand-painted domes. Even internal LEDs can be used to aesthetically heighten their appearance.

Originally designed for roulette’s version of the slot machine (console roulette/automated roulette), there are even models that eliminate the need for the dealer to spin the ball, instead using compressed air to launch the ball!

From a security standpoint, one of the most practical and effective measures for ensuring the trueness of the wheel is to record all wheel data for statistical analysis. Using reader technologies that identify the winning number, the data can now be automatically fed through a software package that conducts ongoing statistical tests in an effort to identify bias before the player.

C: The obvious way to minimize the exploitable information at the disposal of players is to ensure randomness. But as we've already observed, randomness is a tricky concept. This is shown by the very informal definition of a random shuffle you cite from *The Theory of Gambling and Statistical Logic*: 'We define the random shuffle as an operation equivalent to scattering the deck in a high wind and having the cards retrieved by a blindfolded inebriate.'[5] Do all shuffles therefore fall short of a 'real shuffle'?

SF: The short answer is yes: Studies have concluded that it takes several shuffles (riffles) to ensure randomness, though casinos have never met this standard. They operate their games with a productivity mindset: The more decisions each hour (hands, rolls, spins) the higher the profits. When I was breaking in, I recall the mantra from many bosses, 'Keep the cards and dice in the air, and the wheels spinning'.

In 1997, Professor Robert Hannum of the University of Denver conducted a study entitled 'Casino Card Shuffles; How Random Are They?' Actual casino shuffles were recorded and evaluated using several statistical tests. The conclusion of the study was no surprise:

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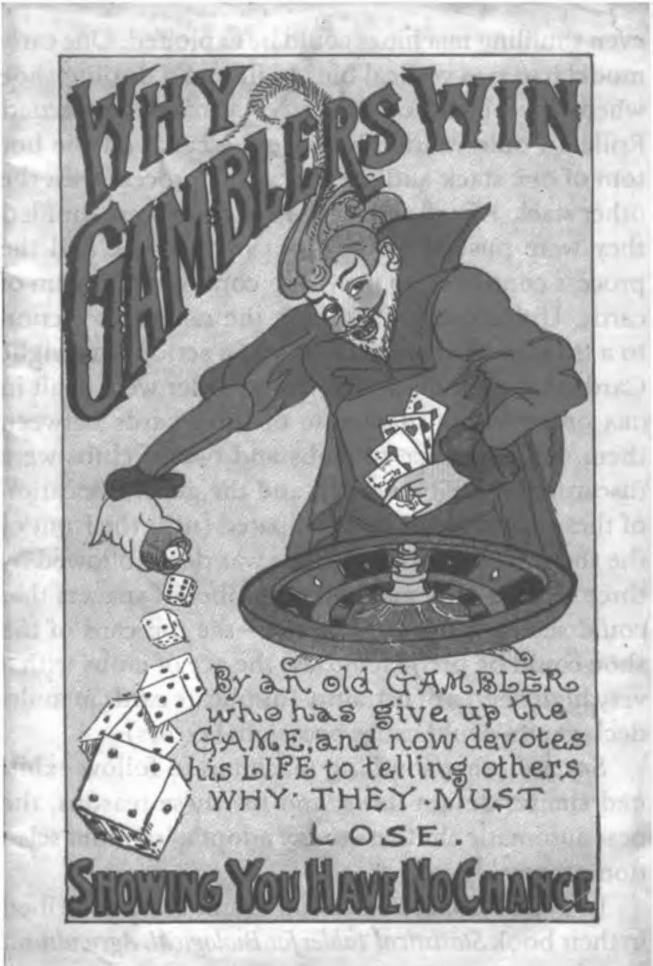
[5] R.A. Epstein, *The Theory of Gambling and Statistical Logic* (Burlington, MA: Academic Press, 1967).

> The six-deck shuffles failed virtually all tests for randomness [...] the single and double-deck games offer mixed results, failing on some while passing on other tests for randomness.

Since it was impossible to achieve randomness with just three riffles and a quick running cut—the standard one-deck casino shuffle—flaws in these shuffles would eventually be discovered by sharp gamblers, and these loopholes were even more evident with multi-deck games.

For example, consider a four-deck shuffling procedure where the decks are divided into two piles, and then 'grabs' of about 35 cards are taken from each pile and shuffled together several times. If a 'shuffle tracker' was able to count the two appropriate 35-card slugs as the cards were played and placed into the discard rack, determining that grab #1 had about ten extra high cards (more so than probability dictates), and grab #2 had about five extra high cards, these two packets of cards could be shuffled together 1000 times and never change the player's assessment that the combined 70-card slug was rich in high cards by a factor of about 15 extra high cards on average. This favourable slug could then be cut to the top of the shoe, or near the top, and strategized in various ways.

Challenges along these lines led to the introduction of automatic shuffling machines, but as it turned out,


WHY GAMBLERS WIN
By an old GAMBLER who has give up the GAME, and now devotes his LIFE to telling others WHY THEY MUST LOSE.
SHOWING YOU HAVE NO CHANCE

John Phillip Quinn, *Why Gamblers Win* (1912).

even shuffling machines could be exploited. One early model had two vertical bins built into a dealing shoe where the played cards were alternately discarded. Rollers would randomly move 1–3 cards off the bottom of one stack and the repeat the process with the other stack. After a small group of cards were shuffled, they were pushed to the front of the shoe and the process continued to provide a continuous stream of cards. Unfortunately, limiting the random selection to a maximum of three cards was a serious oversight. Cards that were discarded in ABC order were dealt in CBA order with a maximum of three cards between them. So, if the ace of clubs and two of clubs were discarded in ace-two order, and the general location of these cards could be anticipated (near the front of the shoe), and the two of clubs was dealt followed by three x-cards—the maximum number of spacers that could separate the ace and two—the top card of the shoe could be predicted to be the ace of clubs with a very high degree of certainty (duplicate cards in multi-deck games could cause occasional errors).

Several other shuffling machines to follow exhibited similar design flaws, and for these reasons, the best automatic shufflers today adopt a 'random selection process'.

In 1938, Ronald Fisher and Frank Yates described in their book *Statistical Tables for Biological, Agricultural* *and Medical Research*[6] a method for randomly reordering an array of numbers. Using pencil and paper, a list of numbers (say 1–10), and a precomputed table of random numbers, they randomly selected a number from 1–10, crossed that number out and used the number to start a new list. Then a number from 1–9 was randomly selected, crossed out, and became the second number in the new list. This continued until the new list was completed resulting in a random permutation of the original list. The process is often compared to dropping ten slips of paper in a hat numbered 1–10, mixing them, and picking out the slips one by one without replacement to determine a new order.

In 1964 the idea was adapted for the computer by Richard Durstenfeld in *Communications of the ACM*, and popularized by Donald E. Knuth in his book, *The Art of Computer Programming*.[7] In the context of shuffling cards, a card was randomly selected from 1–52 and swapped with the bottom card of the deck. The next card was randomly selected from 1–51 and swapped with the second card from the bottom of the deck, and so on. The net result was an 'in-place' shuffle that was optimal in runtime and space—the algorithm could not be shortened and the memory required to run the algorithm could not be reduced. In other words, the algorithm achieved a mathematically random shuffle in the fewest steps possible.

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[6] R. Fisher and F. Yates, *Statistical Tables for Biological, Agricultural and Medical Research* (London: Oliver & Boyd Ltd, 1938)

[7] R. Durstenfeld, 'Algorithm 235: Random permutation', *Communications of the ACM* 7:7 (July 1964), 420; D. E. Knuth, *The Art of Computer Programming* (Reading, MA: Addison-Wesley, 1968).

As is the case with all shuffling algorithms of this kind, when the method used to generate the initial seed is random, so is the end result.

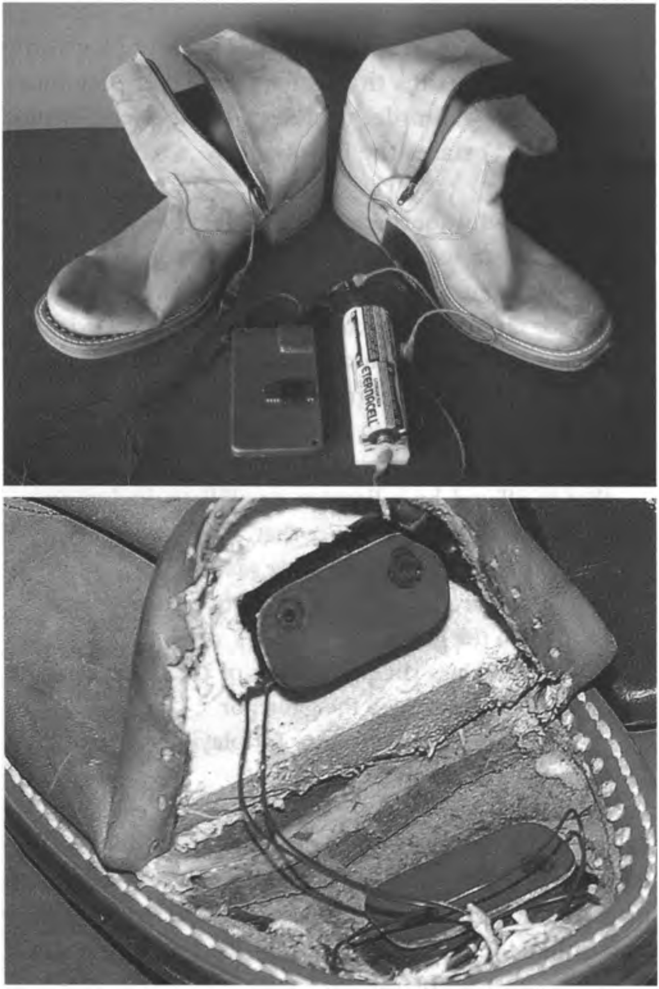
Although the premise has been around for over seventy years in the computer world, it was first duplicated, mechanically and electromechanically, in the Random Ejection Shuffler introduced by Casinovations Incorporated in 1995 (I was a co-inventor). Most of the best modern shufflers have followed this conceptual lead.

C: Continuing with the technological theme, there must have been a massive increase in the use of electronic player assistance—signaling devices, computers, cameras—with the emergence of cheap electronics and computing power. How does game protection deal with a situation where you have to imagine not only what a human might do, but what a powerful, speedy, number-crunching computer, or an array of concealed cameras, might be able to do—you say in *CGP* that 'these devices force us to look at the games from every conceivable angle'.

SF: Although the possibility always exists that the industry could run into hidden card-counting computers, perfect strategy computers, and roulette computers, most casinos—at least in the US—now have 'device laws' that prohibit the use of any electronic or mechanical means that helps the player play more skillfully. For example, the Nevada Revised Statues (NRS 465.075) states the following:

> It is unlawful for any person to use, possess with the intent to use or assist another person in using or possessing with the intent to use any computerized, electronic, electrical or mechanical device, or any software or hardware, or any combination thereof, which is designed, constructed, altered or programmed to obtain an advantage at playing any game in a licensed gaming establishment or any game that is offered by a licensee or affiliate, including, without limitation, a device that:
>
> *1. Projects the outcome of the game;*
>
> 2. Keeps track of cards played or cards prepared for play in the game;
>
> 3. Analyzes the probability of the occurrence of an event relating to the game; or
>
> 4. Analyzes the strategy for playing or betting to be used in the game.

In blackjack, for example, a player equipped with a perfect strategy computer (optimal betting correlation and playing efficiency) plays the game at a level of sophistication unlike the best card counters. That said, advanced playing decisions can be very composition-dependent. A deck depleted in threes and fours might prompt a



An early 'perfect strategy' blackjack computer codenamed 'David', c1970s.

perfect-strategy computer to have the player split tens against a seven, since it's weakened by the absence of any threes and fours, though the best card counters would rarely make such a play. This is the kind of playing decision, when accurate, that can be identified by experts as being outside the majority of players' human capabilities.

In roulette, there are no base strategies, per se, so a much more prudent course of action is to look at the mechanical and physical traits that tend to exist with most high-tech strategies and ask a few basic questions: Is the player consistently betting late (last four revolutions)? Is there a bias to the ball track where the falls tends to fall from the track at the same point? Is a fall-off point above a deflector, especially a vertical shaped deflector (creates a situation where the ball falls from the track and hits a wall, absorbing speed and impact, and directs the ball downward directly to the pockets)? Is the rotor speed too slow? Does the bounce appear to be manageable (a function of rotor speed)? Could size and composition of the ball be factors?

Moving from computer to camera, the use of hidden cameras definitely adds another step in the evaluation process, because now the analysis of suspect play must be expanded to include the possibility of *watching and/or recording* the game from almost every conceivable perspective. Since the typical spy camera is tiny, it can be concealed almost anywhere, and this includes a power source and transmitter. Typically, these units only have to transmit short distances to a 'booster' or 'repeater' which is a larger, more powerful transmitter hiding in a woman's purse close by. A 'booster' or 'repeater' then sends the video signal to a remote location (hotel room, parking lot, nearby structure) where the signal can be played back several times, even in slow motion, after which the appropriate strategy can be sent back into the casino to one or more players (via audio link). These kinds of systems can be used to peek the dealer's hole-card as it's dealt, record the riffle shuffle, and even detect marked cards otherwise not visible to the naked eye.

During my consulting career, when asked to evaluate suspect play I always considered the possibility that a camera could be hidden in any conceivable location, and that the game could be remotely observed or recorded from behind, at table level, or from normal eye level. I considered every prop as a potential hiding place including cash, stacks of chips, cigarette boxes, cellphones, coffee cups, or anything laying on the table. Lastly, I always considered the possibility of the camera hiding on the player or dealer.

In summary, no one knows how the advances in technology will affect the game protection landscape. All we know for sure is that both sides keep getting better at their jobs.

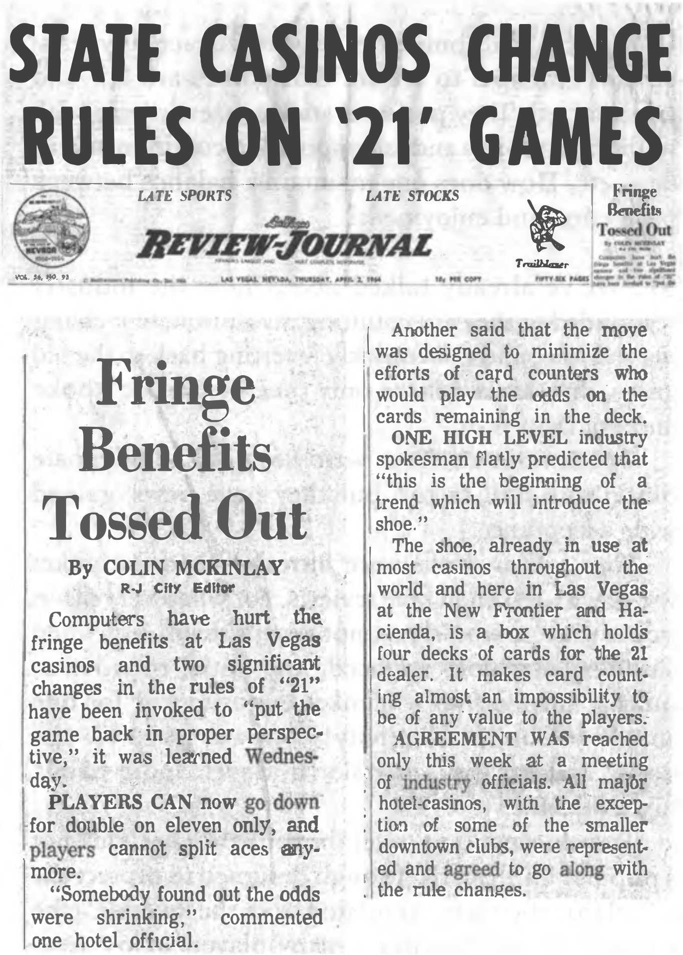
C: It seems that sometimes players will actually resist certain attempts to ensure that games are fair and randomized. They prefer to stick conservatively with traditional set-ups and are opposed to continuous shufflers, etc. How does one maintain a balance between protection and enjoyment?

SF: We've already talked about how the industry responded to the card counting revolution, first changing the rules and then quickly reverting back to the old game, but this is not the only time the public 'spoke' and got their way.

Continuous shufflers were designed to eliminate blackjack's skill factor, but they have never gained wide acceptance.

Four-colour decks were introduced to the poker world with less than rave reviews. For whatever reason, poker players would just not accept them. But when shuffling machines surfaced, any initial trepidation quickly turned into a blanket endorsement for one simple reason: productivity! This was good for the house and for the professional player: more hands, higher profits.

Translucent domes over the roulette wheels are not a popular implement. Though designed to protect the wheel from being manipulated from the 'outside' (the players' side of the table), many players enjoy *sweating* the result (like watching the horses come down



STATE CASINOS CHANGE RULES ON '21' GAMES

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Las Vegas
REVIEW-JOURNAL

Trailblazer

LAS VEGAS, NEVADA, THURSDAY, APRIL 2, 1964 10¢ PER COPY FIFTY-SIX PAGES

Fringe Benefits Tossed Out

By COLIN MCKINLAY
R-J City Editor

Computers have hurt the fringe benefits at Las Vegas casinos and two significant changes in the rules of "21" have been invoked to "put the game back in proper perspective," it was learned Wednesday.

PLAYERS CAN now go down for double on eleven only, and players cannot split aces anymore.

"Somebody found out the odds were shrinking," commented one hotel official.

Another said that the move was designed to minimize the efforts of card counters who would play the odds on the cards remaining in the deck.

ONE HIGH LEVEL industry spokesman flatly predicted that "this is the beginning of a trend which will introduce the shoe."

The shoe, already in use at most casinos throughout the world and here in Las Vegas at the New Frontier and Hacienda, is a box which holds four decks of cards for the 21 dealer. It makes card counting almost an impossibility to be of any value to the players.

AGREEMENT WAS reached only this week at a meeting of industry officials. All major hotel-casinos, with the exception of some of the smaller downtown clubs, were represented and agreed to go along with the rule changes.

Nevada Casinos Respond to Card Counters—*Review Journal*, Las Vegas, NV, April 16, 1964 the stretch) and the domes impeded their view, often reflecting light and other images.

Many slot players are not crazy about virtual reels (computer generated images) and prefer to play machines with a physical reel and a limited number of symbols. Many aren't fond of coinless machines, either.

I remember when the first 'peeking device' was introduced. Many experts—including myself—couldn't fathom how the casinos would agree to install small mirrors into their blackjack tables; after all, cheaters have been known to use small mirrors called 'shiners'. But the device was widely accepted and applauded for solving a serious problem (hole-card exploitation) in a very affordable, straightforward way.

Many innovations come with challenges and not every player is quick to buy into a new way of doing things, especially the older-age market who have been frequenting casinos for half a century. They always want to remind you of the old days, but the times have definitely changed.

As a general rule, if the industry wants to introduce a new game, side-bet, device, procedure, design, or a new way of doing things, there's very little the public can do. Players can lodge their complaints, slow down progress, and even refuse to play, but sooner or later, the casinos always end up getting their way…you can bet on it!

C: This leads us to the question of what players actually expect or want from their casino experience. We would assume that a typical customer enters a casino to feel the rush of a submission to chance and hazard.

SF: Every player is different, each hoping to enjoy a positive gaming experience. For some, it's all about fun. They don't expect to win unless they get lucky. For others, it's a more serious form of 'entertainment'. They may not be experts, but they're not oblivious to the concept of a strategy. When playing blackjack, for example, it has been my experience that many players want to 'feel the rush' of being in a *true skill* situation and *not* blindly submissive to hazard. Players want to feel that their decisions matter and that they have some control over their destiny. We often see 'card watchers' who enjoy the challenge of watching the cards from round to round. They are not card counters, but if they haven't seen many tens over the last few rounds, they're more inclined to take insurance against the dealer's ace. If they notice many ten-valued cards and aces, they are less likely to parlay their bet after a win. Other pure skill-based mathematical games that find favour with these kinds of players are video poker, sports betting, and of course, poker.

Other classic casino games like baccarat and roulette are generally classified as pure games of chance, but that's a misconception. Baccarat and roulette are unknowingly offered as games of skill all the time. For those who believe that 'setting the dice' before tossing them can favourably influence the outcome, craps could also be included in this category.

Winning strategies for beating baccarat started in the 1960s when Ed Thorp developed a simple card counting strategy to beat a side bet on natural eights and nines; once discovered, the option was quickly removed from the layouts.

Roulette has a rich history of bias-wheel players who have had great success identifying and beating wheels with mechanical imperfections.

Many of the best advantage players in the world contend that most casino games are beatable, even those purported to be games of chance.

C: New advantage plays and scams eventually result in the casinos tightening up their game. Has there always been something of an 'arms race' between cheaters and game protection? Have you been surprised in the past by the emergence of new scams that you couldn't have anticipated?

SF: Once again, it's important not to directly compare cheating with advantage play. Cheaters perpetrate scams; advantage players apply strategies that target casino weaknesses. While it's true that both groups have become more sophisticated due to tougher casino conditions and the implementation of many modern tools: shuffling machines, peeking devices, evaluation software, etc., it's not true that advantage play led to cheating, or vice versa. Each group must be looked at separately. Their strategic approaches, histories, and impact on the industry tell two completely different narratives.

With cheating, many of the older scams have disappeared, but only in terms of application and execution. The perfect example is the 'old-fashion cooler', a scam that starts with stealing six decks from an inside source and ends with a blatant switch of all six decks! (Of course the dealer is involved with this scam.) With one supervisor responsible for watching between four and eight games at a time, it was easy for cheaters to get a supervisor looking the wrong way for a split second when the decks could be switched (often from and into secret pockets called 'webs'). But today we have the omnipresent surveillance camera, and in many jurisdictions it's required by law that every game be recorded 24/7. The old surveillance adage, 'The Eye Never Blinks', is particularly true today; and should a cooler be suspected, it would immediately be detected after a quick review of the surveillance footage, which is also true of many other scams that don't fare well in an environment where one or more surveillance cameras are guaranteed to record every move.

That said, an overhead camera provides only a single perspective, while cameras watching a game from the sides can often be blocked by cheaters simply standing. For these reasons, a whole new genre of sleight of hand has evolved known as 'sky moves', moves that are difficult to detect from an overhead vantage point due to its limited depth of perception. We've all seen talented sleight-of-hand artists fool us from just inches away; imagine the difficult of detecting a sophisticated false shuffle from an overhead camera sixty feet in the air!

In respect to advantage players, they're smarter today than ever. They also have a greater understanding of the games and their mathematical nuances than ever before. This is due in large part to the evolution of the computer. Sophisticated gamblers can now quantify almost any aspect of any game in ways not possible previously. It's often impractical to use manual calculations to analyze a new game or rule due to complexity and sheer time restraints, but a player with programming skills could write the appropriate code, run a 100,000,000 hand simulation, and produce an accurate statistical analysis in short order.

When the science of card counting was first publicly exposed and mathematical proof was presented that blackjack could be beaten with skill, academia took notice, and the stereotypical professional gambler (diamond pinky ring, slick moustache, etc.) began to transform into the science-orientated, geek-like, college whiz kid, and this new breed of player proved to be a formidable foe; in fact, advantage players have had more impact on the industry than cheaters over the last forty years!

For just one example, consider the hole-card players/teams (recall *State of Nevada vs. Einbinder and Dalben*). In 1988, Las Vegas casinos began abandoning the tradition 'peek game' and converting to a no-peek format because it appeared that one premium player after another was playing with *hole-card information* (the players' strategies were unusual, yet obvious). The correlation between the playing strategies and the dealer's hole-card was so strong, the industry could only come to one conclusion: the dealers must be 'tipping' or 'sending' their hand to outside 'agents' (accomplices). But something wasn't right. Tipping the hole-card was a rank scam, one that the industry had faded for many years, and the suspect dealers were universally held to be experienced and trusted employees. The industry was bewildered. All they knew was that it had to stop, so sixty years of dealing the peek game came to an end, and it was the advantage players that forced the change!

C: So still no one knows how that was done? Are there many examples of that kind of thing in the history of cheating, where someone simply got away with it and no one knows how?

SF: This happens all the time. In fact, it's probably happening right now!

To put it all in perspective, as a professional blackjack player during this era, my team alone had over 300 dealers who were unintentionally exposing their hole-card in one way or another in just the Las Vegas area. I would run into other hole-card players/teams almost every day. Many were highly financed and organized. Untold tens of millions were won by these players before the industry had enough and said, "Okay you win", and decided it was time to change the old way of doing things. And they did. In the US today, almost every blackjack table in the country is now equipped with a 'peeking device'. Dealers no longer have to lift their hole-card to peek it; the upcard and hole-card are slid into a reading device when a LED either blinks green (continue play), or red (stop, dealer has blackjack).

C: Once again, there must be a compromise—that is, game protection has to allow leeway in order for the game to still be relaxed, fun and playable, and not to intervene too much and put off profitable customers. So an 'arms race' with the cheaters goes hand in hand with a 'tug-of-war' with the players, when game protection tightens things up too much, and business falls off as a result.

SF: The modern casino environment is no place for casual or shabby game protection philosophies. Though the atmosphere needs to be fun, pleasant and almost party-like to assure a positive gaming experience, the capability to instantly and systematically evaluate suspect play is a must, because each time a new game, side bet, device, or procedure is introduced in the industry, hundreds of sophisticated gamblers are *scientifically* dissecting every component of these implementations in an effort of finding exploitable angles.

C: So when you're working in game protection, you have to have an eye to innovations on the other side?

SF: From a game protection standpoint, it has always been a challenge to keep up with the best cheaters and to anticipate the next big scam. But when you're a true student of the games, you'll often find that though the scams may change slightly, the principal areas of the games most targeted by the various scams stay the same.

For example, in 1983, a player was found to be playing with a mini-camera hidden in his belt buckle. Standing on the game, this was the equivalent of squatting down to get his eyes at table level. The camera recorded the action of dealing the hole-card where the video was transmitted to a van in the casino's parking lot.

There the video was reviewed to determine the dealer's hole-card and this information was sent back to the player (via audio link). This was the first camera scam detected by the industry and they were shocked, but the same traits indicating a hole-card strategy were present, which were no different had the player, without the aid of a camera, spotted the dealer's hole-card as it was unintentionally flashed.

In 1998, a sophisticated miniature camera with zoom and tilt capabilities was discovered hidden in player's cigarette pack. The camera was able to surreptitiously look up into a shuffling machine and record the shoe's entire order of cards, *after the shuffle*! After the shuffle, the machine would transfer the cards one at a time to a removal bin; it was during this postshuffle phase that each card was visible to the camera. The headlines read 'High-Tech Scam Hits Mini-Baccarat', and again the industry was exposed to sophisticated high-tech possibilities.

Let's look at one more level of sophistication, a scam that truly surprised me. To appreciate how a scam can evolve, consider the following excerpt from *Casino Game Protection*:

> Can you think of any possible way one could instantly 'cold deck' a six-deck game and determine the shuffle's order following a legitimate shuffle? Impossible? I know of a crew that came remarkably close to doing just that. The concept was in the early

development stages over a decade ago. The system utilized a novel marking system for shoe games, so there was collusion, but none from the dealer. The cards were marked on the long edge within a small half-inch center strip. Marked with an ultraviolet solution, completely invisible to the eye, the marks were comprised of a series of dots and dashes. The cards could now be shuffled legitimately and presented for the cut. One player, the cutter, was wired up with a miniature lipstick-sized camera, black light, and a periscope/mirror setup strapped to the wrist—the black light and camera were not aimed at the cards, but at the image reflected from the mirror. The player would take the cutcard and slowly move it back and forth over the top of the shoe as if to say, "Where should I cut?" The marks were videotaped during this action. Once recorded by a bodyworn VCR, the player left and headed straight for his hotel room without making a bet. Waiting for him was another VCR ready for playback. Under magnification, the crew would pick a random mark as a starting point, entering it and all cards to follow into a miniature computer ready for table game play. Once a good-size slug was entered into the portable unit, it was rushed to the game. As the cooler hit the layout, a few cards in sequence were entered into the computer, which in turn identified the position of the slug. From here, big bets and optimal strategy followed. But there were problems.

> The edge of a playing card is like a sponge—it's not coated with the varnish used to coat the front and back of the card—so the ink would seep into the card making it difficult to read. It was also discovered that the cards are rarely squared perfectly when presented for the cut, so it was easy to miss hidden cards. These factors forced the crew to temporarily abandon the approach. Although it turned out to be unsuccessful, it came dangerously close to the ultimate cooler!

Several years after *Casino Game Protection* was published, a high-tech scam hit South-East Asia. As the shuffled decks were presented for the cut, a player took a gaming 'plaque' (essentially a high-denomination chip but in the size of a rectangle measuring about 4×3 inches), placed it on top of the decks, pounded it a few times with his fist for good luck, and then cut the cards.

It was later discovered that the cards were marked with an infrared ink, invisible to the human eye, and that the plaque was a sophisticated, miniature scanner! The pounding action was no good luck gesture, but a calculated action that ensured that each card was perfectly squared and flush, making it easier for the scanner to read all of the marks. The plaque was handed off to an accomplice who rushed it to a hotel room where the data was reconstructed into a long sequence of cards. Eight-deck shoes can take a long time to deal, especially when the players are *deliberately slowing down* *the action*. The cheaters were able to get back to the target game in plenty of time to play, with knowledge of the exact order of about four decks!

This is a good example of how this particular scam evolved and how one crew of cheaters solved the problems facing another crew from an earlier era. The pounding of the plaque was a cultural idiosyncracy, so the same gesture wouldn't work in most places, but nonetheless, it was a clever solution to the challenge of squaring the cards after the shuffle.

So when you talk about being surprised, it happens all the time. You can take any scam, despite its history, and you will find that no scam lies dormant; it continues to evolve with new twists and turns that are better suited for the modern casino environment (often a function of advances in technology). For those in the game protection business, this is not necessarily a bad thing. If there were no surprises, the game protection business wouldn't be any fun!

C: What are the hot issues for the future, as far as you are concerned: biometrics, accountability systems, automation…?

SF: These are all hot issues, and when you combine them, you are basically looking at more and more accountability.

When you couple technologies like RFID inside chips with dealing shoes equipped with reader technologies that scan/read every card as it's dealt, you're scarily close to 'complete accountability systems' that can track every hand, every bet, every decision. These systems could even know *in advance* what cards you're about to be dealt. When this information is then monitored and evaluated by sophisticated detection software, there's not much need for street-smart surveillance operators or even the sharpest game protection experts, because most won't be able to compete with powerful, sophisticated, reliable software.

When a system has access to this much information, from this point on, it's all about the *sophistication* of the software analyzing the playing and betting decisions.

Bally Gaming came close to such a system some years back with a complete-accountability table system called Mind Play. The system required a specially-designed blackjack tabletop, encoded playing cards, 14 tiny cameras, and special chips that could be identified by sensors embedded in the table. If you were playing blackjack on a Mind Play table, the system knew every move you made. At a cost of about $20,000, Mind Play also had the capability to evaluate your play and report any suspicious activity. Sounds like the perfect plan, but the system ran into technical problems and Bally stopped development in 2007. But many of the same technical challenges facing Bally just a few years ago are no longer difficult problems to solve, technologically speaking, so I'm betting that unintrusive, commercially viable table systems offering complete accountability will soon become a staple in the industry as common and accepted as peeking devices, shuffling machines, and low-profile roulette wheels.

C: Most scams are small-scale and negligible, but massive internal conspiracies have in the past been the ruin of more than one casino operator. How important is game protection in this regard?

SF: It's important to be aware of the possibilities. Employee theft is a reality in any business and the gaming industry is no exception. While dealer theft, dealer-agent scams, and scams involving bosses are still relatively common throughout the world, *massive* internal conspiracies are very rare in today's modern casino environment.

Organized crime is out and corporations are here to stay. In most jurisdictions around the world, it's considered a *privilege* to work in gaming, and your right to work can be revoked for any impropriety. Moreover, to work in any decision-making capacity (key licence) requires extensive background checks and the need to jump through several investigative hoops before one is approved.

There are more checks and balances than ever before, tighter regulatory control and oversight than ever before, and more security and surveillance than ever before. For these reasons, by all accounts, massive internal conspiracies appear to be a problem of the past.

C: Finally, as a consultant you've worked with some of the greatest legends in the history of casino industry. Do you have a favorite operator, casino, or story about one of these icons?

SF: The original Binion's Horseshoe in downtown Las Vegas immediately comes to mind as a casino operation that stood out from the rest. I have always had great respect for the Horseshoe as a player and later as a casino consultant.

Binion's Horseshoe was a true gambling house. They were willing to take action on any bet and were famous for telling gamblers that they could *set their own limit* with their first bet! When many clubs were running scared and closing single-deck blackjack games, the Horseshoe was spreading more games with higher limits. They were also one of the first casinos to offer a 4 percent commission on BANKER bets in baccarat, 4 percent commission on buy bets in craps, and other liberal player options.

The Horseshoe also employed many psychological subtleties in their procedures. For example, they liked to pay *colour for colour*. If a player bet $75 in $5 checks and won, Horseshoe dealers would just size into the bet with $5 checks instead of breaking the bet down and paying it with three $25 checks. This made average players feel like high-rollers, and it became fun for players to bet *stacks of checks*. Also, every time you walked into the Horseshoe there was always this sense that many players were winning (because of all the checks in front of them).

From a security standpoint, they allowed one of their pit/shift bosses to walk around *the outside of the pit* and observe the games from the same side of the table as the players. This was a brilliant operational strategy in my view, and one that I was exposed to firsthand during my playing career. I was playing an 'index dealer' and firing blacks. (An 'index dealer' unintentionally exposes the holecard's index as it's dealt to centre-position players.) I leaned back and noticed that one of the bosses was *behind* me. The flash of the index was subtle, so thankfully it wasn't detected, but the boss continued to circle the pit, carefully taking a few minutes to observe each dealer. It was intimidating to have a boss watch the dealer from the *player's perspective*, because the protocol gives management its best chance to spot index dealers and other related loopholes that would otherwise be almost impossible to detect from the pit.

Ask any supervisor about the difficulties of supervising games where you're always looking at the backs of dealers and always trying to manage the inherent blind spots, and you will immediately appreciate the protocol's purpose.

The Horseshoe has always had respect for experienced dealers; this was not the norm in downtown Las Vegas, where the clubs employed almost exclusively break-in dealers. If you were a twenty-year veteran and out of a job, the Horseshoe was the place to go because they viewed your experience as an asset—as they should—whereas the other properties were wary of experienced help.

On a personal level, I dealt with Jack Binion, a first-class operator and gentleman. Mr. Binion is the only casino owner/operator who ever called me directly to inquire about consulting services during my entire consulting career; in all other cases, I was contacted by a casino executive, not an owner. Now that's a hands-on owner/operator!

Though I have many wonderful stories about these icons, let me end with one of my favourites.

I have been fortunate to meet many legendary casino executives during my career, but it was Jimmy Payne, a casino operator who had run casinos all over the world, who first asked if I had any interest in the consulting business. I met Jimmy when I was still in my late twenties, so I didn't know anything about the consulting business. But Jimmy was like a father away from home, and given my respect for him, I said, "Maybe". One day Jimmy called me: "Put some of your equipment together and I'll pick you up in the morning at 9:00 sharp; I want you to meet someone."

This was not unusual as I had met many of Jimmy's friends before, so I packed some cards, dice, electronic gaffs, and a few other things from my gambling collection. Jimmy picked me up and we drove to the Las Vegas Hilton. Jimmy picked up a courtesy house phone and made a call, and we headed for the executive offices. I asked, "Jimmy, what's going on, who are we going to meet?" He said, "Baron Hilton."

We walked into a room with a blackjack table and there sitting around the table was Mr. Hilton and some of his executives.

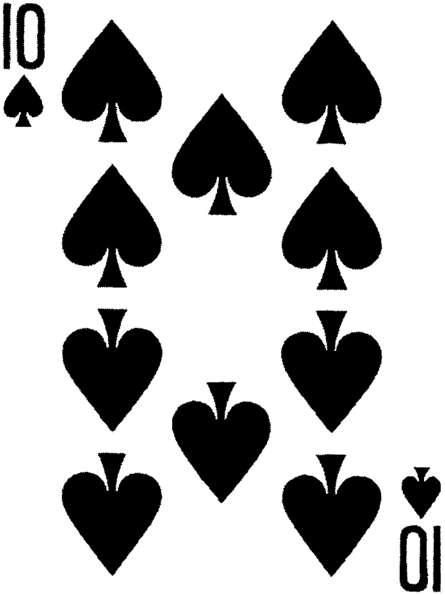
The first question Mr. Hilton asked me was if I knew anything about Gin Rummy—he was a passionate Gin player. I told him that it was played every day in my home growing up, and proceeded to demonstrate a few table hops, stacks, and holdouts. He laughed and seemed to genuinely enjoy the gambling sleight of hand. Then the conversation turned serious as Jimmy asked me to demonstrate a few casino scams and several advantage strategies. (Jimmy always believed that with his expertise in casino cheating and my experience as an advantage player, we might have something to offer the industry.) After about 45 minutes, Mr. Hilton looked at me and said, “Okay, how much is this going to cost me?” I immediately said, “$50,000 Sir”. And he didn’t hesitate: “Pay these gentlemen; I want my people to see this.”

The truth is that I was only kidding with Mr. Hilton. It was not my position to negotiate anything; that was up to Jimmy. But Mr. Hilton was such a gentleman, and given several light-hearted moments, it was easy to joke with him. All I ever expected was a smile. But that didn’t happen. And that’s how I got into the game-protection and consulting business!

Angel Deck with Line Work

Unknown Artist

The Angel Back was once a popular card used in underground casinos and private/home games where hybrid casino games were frequently played. The backs in this particular deck have been marked with a system known as 'line work', a subtle form of 'blockout work' where the cards are marked with a matching coloured ink/dye. Each card has a distinguishable mark.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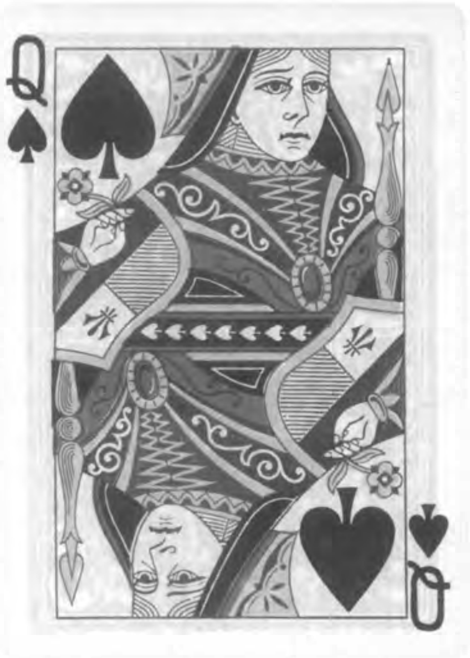
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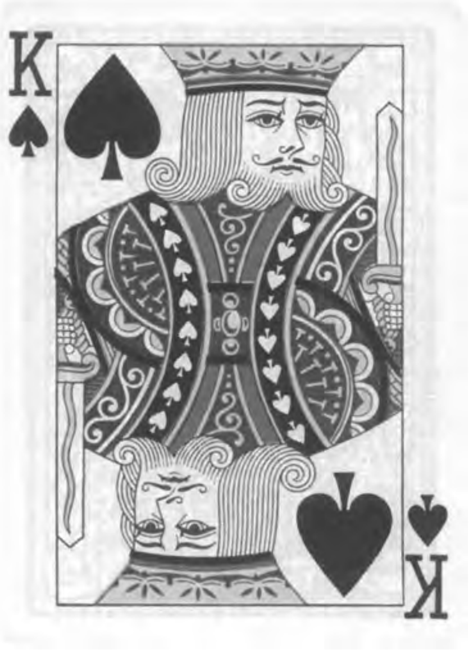
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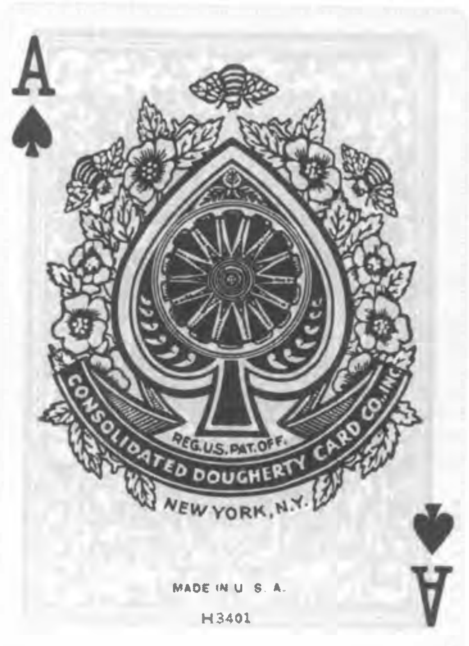
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Play
VIDEO POKER

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Engineering Chance

Natasha Dow Schüll

> *Types of machines are easily matched with each type of society—not because machines are determining, but because they express those social forms capable of generating them and using them.*
>
> GILLES DELEUZE[1]

The gambling experience has evolved in step with technological innovation. Once a relatively straightforward operation in which players bet a set amount on the outcome of a single payline, today machine gambling begins with a choice among games whose permutations of odds, stakes size, and special effects are seemingly endless.[2] Instead of inserting coins into a slot as in the past, players are more likely to insert paper money, bar-coded paper tickets, or plastic cards with credit stored on chips or magnetic stripes.

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[1] G. Deleuze, 'Postscript on the Societies of Control', *October* 59 (1992), 3–8.

[2] See chapter 3 of N. D. Schüll, *Addiction by Design: Machine Gambling in Las Vegas* (Oxford and Princeton. NJ: Princeton University Press, 2012), from which the present text is an edited excerpt, for a fuller genealogy of the contemporary gambling machine.

To activate the game, they no longer pull a lever, but instead press a button or touch a screen. Denomination of play can vary from one cent to one hundred dollars, and players can choose to bet from one to as many as one thousand coin credits per game. On or above the play area, which typically features a video screen or three-dimensional reels behind glass, 'pay tables' indicate the number of credits to be awarded in the event that certain symbols or cards appear together.[3] To the right, a digital credit meter displays the number of credits remaining in the machine. Linked via telecommunications systems to a central server, the machines also perform data-gathering and marketing functions for the casino. Critical nodes in the larger networked system of the casino rather than stand-alone units, they have 'become the central nervous system of the casino', an industry representative remarked in 2007.[4]

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[3] Some machines additionally post their 'theoretical payout percentage', also known as the 'return to player' (RTP), which is the amount a player is likely to receive back over an extremely extended period of play—1 million spins, for example; in the short term, the return may deviate radically from this figure. RTP is predetermined down to a decimal point by factory-generated computer chips that are randomly spot-checked by state gaming agents (M. Cooper, *The Last Honest Place in America: Paradise and Perdition in the New Las Vegas* [New York: Nation, 2004], 116). Different jurisdictions require different RTP minimums; in Las Vegas, the minimum is 75% but is typically higher.

[4] Todd Elsasser of Cyberview, panelist for 'Server Based Gaming II: The State of the Industry', G2E 2007. In the terms of actor network theory, the electronic gambling machine has become a 'thick node' in the larger networked system of the casino. As I discuss in chapter 5 of *Addiction by Design*, the slot machine becomes even more central to the casino with emerging systems of 'networked gaming' (also called 'downloadable gaming' and 'server-based' gaming) in which game content, customer tracking applications, and other services exist on an online server and are downloaded to individual machine units.

Until the mid-1980s, green-felt table games such as blackjack and craps dominated casino floors while slot machines huddled on the sidelines.[5] By the late 1990s, however, they had moved into key positions on the casino floor and were generating twice as much revenue as all 'live games' put together. In the aisles and meeting rooms of casino industry event G2E, it became common to hear gambling machines referred to as the 'cash cows', the 'golden geese', and the 'workhorses' of the industry. Frank J. Fahrenkopf Jr., president of the American Gaming Association, the commercial interest lobby that sponsors the annual expo, estimated in 2003 that over 85 percent of industry profits came from machines.[6] 'It's the slot machine that drives the industry today', he declared.[7]

Several factors contributed to the dramatic reversal of slots' once lowly status in the gambling economy. Relatively unburdened by the taint of vice as a result of their association with arcade gaming, women, and the elderly, they played a key role in the spread of commercialized gambling in the 1980s and '90s, as recession-stricken states sought new ways to garner revenue without imposing taxes.[8] The low-stakes devices fit comfortably with the redefinition of gambling as 'gaming' by industry spokespeople and state officials who hoped to sway public endorsement of the activity as a form of mainstream consumer entertainment rather than a form of moral failing or predatory entrapment.[9]

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[5] C. Turdean, *Betting on Computers: Digital Technologies and the Rise of the Casino* (1950–2000) (PhD dissertation, Hagley Program, Department of History, University of Delaware, 2012). In 1980, 45 percent of casino floor space in Nevada was dedicated to coin-operated gambling; by the late 1990s, the figure had risen to 80 percent (G. Thompson, 'Video Slots Taking Over Casino Floors', *Las Vegas Sun*, September 14 1999).

[6] Panelist for 'State of the Industry', G2E 2003. In Nevada gambling machines typically earn a lower percentage of gaming revenue than in other states (70 percent versus 83 to 92 percent) (American Gaming Association, *State of the States: The Survey of Casino Entertainment*, a survey conducted for the AGA, Washington, DC, 2011).

[7] Quoted in G. Rivlin, 'The Tug of the Newfangled Slot Machines', *New York Times Magazine*, May 9 2004, 42–81: 44.

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[8] Many view revenue generation through gambling as a 'tax on stupidity'; others view it as a 'regressive tax' in which funds are withdrawn from disadvantaged communities into the general revenue pool, following an upward redistribution of wealth (e.g., see R. Volberg and M. Wray, 'Legal Gambling and Problem Gambling as Mechanisms of Social Domination? Some Considerations for Future Research', *American Behavioural Scientist* 51 [2007], 56–85). Whatever the case, states' ongoing attempts to shore up budget deficits with gambling revenue has driven the expansion of gambling over the past thirty years in the United States. As recently as 1976 there were no casinos outside of Nevada, and only thirteen states had lotteries; today, one can make some sort of wager in every state except Hawai'i and Utah, and tribal gaming has grown into a nearly $27 billion industry since its inception in 1988, today featuring 442 casino operations in twenty-eight states (*North American Gaming Almanac* [Casino City Press 2010]).

[9] 'Gaming' and 'gambling' were interchangeable terms in the United States until the mid-1800s, but afterward the latter term came to specifically denote the act of wagering on an uncertain event (although the word 'gaming' was used in the Nevadan regulatory context since at least the 1920s [J. Burbank, *License to Steal: Nevada's Gaming Control System in the Megaresort Age* (Las Vegas: University of Nevada Press, 2005), 4]). In the 1970s, responding to the industry's image-cleansing campaign, writers at the *Wall Street Journal* began to use the term 'gaming' instead of 'gambling'; by the late 1980s other media venues had followed suit, and by the late 1990s it had become widely accepted. To defend this semantic reform, the American Gaming Association makes reference to the *Oxford English Dictionary*, which indicates that the word 'gaming' dates back to 1510, predating the use of 'gambling' by 265 years (AGA website, http://americangaming.org/Industry/factsheets/general_info_detail.cfv?id=9). Nevertheless, English-language dictionaries consistently define games as activities involving skill, and gambling as activities involving chance.

The growing consumer familiarity with screen-based interaction that accompanied the rise of the personal computer and electronically mediated entertainment such as video games further facilitated the cultural normalization of machine gambling. Meanwhile, the ongoing incorporation of digital technology into gambling machines altered the player experience in subtle but significant ways, broadening their market appeal.[10] Gambling regulations were revised in lockstep with technological innovation.

Since the early 1980s, when machine revenues surpassed table revenues for the first time, the ascendancy of machines in the culture and economy of American gambling has continued unabated. The devices are now permitted in forty-one states (up from thirty-one in 2000) and are under consideration by others. In 1996 there were 500,000 devices in the United States; in 2008 the count had reached nearly 870,000—not including an underground market of unauthorized machines in bars and taverns, truck stops, bowling alleys, and restaurants across the country, nor devices engineered to circumvent restrictions by fitting state definitions for bingo, amusement machines, or sweepstakes games.[11]

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[10] While in 1983 only 37 percent of casino players reported machines to be their favorite form of play, by 2005, this preference rose to 71 percent (*Harrah's Profile of the American Casino Gambler 1991–2006*).

[11] *North American Gaming Almanac*, 2.

SHALLOW PLAY?

The French sociologist Roger Caillois, author of *Man, Play, and Games*, believed that games carried clues to the basic character of a culture.[12] 'It is not absurd to try diagnosing a civilization in terms of the games that are especially popular there', he wrote in 1958. Caillois argued that one could make a cultural diagnosis by examining games' combination of the following four elements of play: *agon*, or competition; *alea*, or chance; *mimesis*, or simulation; and *ilinx*, or vertigo. Modern cultures, he claimed, were distinguished by games involving a tension between *agon* and *alea*—the former demanding an assertion of will, the latter demanding surrender to chance.

This tension is at the heart of the cultural diagnosis made by the American sociologist Erving Goffman in 1967 based on his ethnographic study of gambling in Las Vegas, where he worked as a blackjack dealer and was eventually promoted to pit boss. Goffman regarded gambling as the occasion for 'character contests' in which players could demonstrate their courage, integrity, and composure in the face of contingency.[13] By offering individuals the opportunity for heroic engagements with fate, gambling fulfilled an existential need for 'action' or consequential activity in an increasingly bureaucratic society that deprived its citizens of the opportunity to express their character in public settings of risk. For Goffman, gambling was not so much an escape from everyday life as it was a bounded arena that mimicked 'the structure of real life', thereby 'immersing [players] in a demonstration of its possibilities.'[14]

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[12] In his foreword to *Man, Play, and Games* (New York: Free Press of Glencoe, 1979 [1958]) M. Barash observes that Caillois regards games as 'cultural clues' (ix). Caillois was building on the earlier work of Dutch historian and cultural theorist J. Huizinga, author of *Homo Ludens: A Study of the Play Element in Culture* (Boston: Beacon Press, 1950 [1938]), a treatise on the importance of the play element of culture and society. As Caillois points out at the start of his text (*Man, Play, and Games*, 5), Huizinga was dismissive of games of chance. 'In themselves', Huizinga wrote, 'gambling games are very curious subjects for cultural research, but for the development of culture as such we must call them unproductive. They are sterile, adding nothing to life or the mind' (Ibid., 48). Caillois disagreed fundamentally, pointing out that uncertainty and risk are key aspects of all forms of play (Ibid., 7; see also T. M. Malaby, 'Beyond Play: A New Approach to Games', *Games and Culture* 2:2 [2007], 95–113).

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[13] E. Goffman, *Where the Action Is: Three Essays* (London: Allen Lane, 1967), 260–61. As G. Reith notes, sociological accounts have often attempted to endow the unproductive activity of gambling 'with some kind of utilitarian function' (*The Age of Chance: Gambling in Western Culture* [New York: Routledge, 1999], 8). Edward E. C. Devereux, for instance, wrote in his 1949 analysis that gambling was 'a particularly convenient mechanism in which the psychological consequences of economic frustration, strain, conflict and ambivalence may be worked out without upsetting the social order' (*Gambling and the Social Structure* [New York: Arno, 1980 (1949)], 955). The idea of gambling as a 'safety valve' or 'shock absorber' for the conflicts of a capitalist economic system persisted through the 1970s. Gambling was understood to be an escape from routine and the futility of working-class lives. As Caillois had written earlier: 'Recourse to chance helps people tolerate competition that is unfair or too rigged. At the same time, it leaves hope in the dispossessed that free competition is still possible in the lowly stations in life' (*Man, Play, and Games*, 115).

[14] E. Goffman, 'Fun in Games', in E. Goffman, *Encounters: Two Studies in the Sociology of Interaction* (Indianapolis: Bobbs-Merrill Educational Publishing, 1961), 34.

Along these lines, in 1973 the anthropologist Clifford Geertz famously interpreted Balinese cockfight gambling as a 'tournament of prestige' that simulated the social matrix and laid bare its status dynamics. The activity, he argued, served as a medium for rehearsing the collective and existential dramas of life. Like Caillois and Goffman, Geertz emphasized the synergistic interaction of randomness and competition in the cockfight. The less predictable the outcome of a match, he observed, the more financially and personally invested participants became and the 'deeper' their play, in the sense that its stakes went far beyond material gain or loss.[15] Fyodor Dostoyevsky's description of a sudden windfall at a Swiss roulette table in *The Gambler* captures Geertz's idea of deep play as a compelling mix of chance, risk, and status: 'Why, I had got this at the risk of more than my life itself. But I had dared to risk it, and there I was once again, a man among men!'[16]

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[15] C. Geertz, *The Interpretation of Cultures: Selected Essays* (New York: Basic Books, 1973). The concept of 'deep play' was first elaborated by Jeremy Bentham to describe play in which financial stakes run 'irrationally' high despite the fact that chance will determine the outcome, indicating that more than just money is at stake (431).

[16] F. Dostoyevsky, *The Gambler*, tr. H. Alpin (London: Hesperus Press, 1972 [1867]), 199. The semiautobiographical novel was written during a period when Dostoyevsky struggled with his own excessive gambling. The quoted passage carries echoes of Schiller's German romanticist view of gambling: 'man only plays when in the full meaning of the word he is a man, and *he is only entirely a man when he plays*' (quoted in Caillois, *Man, Play, and Games*, 163). For an existentialist perspective on gambling, see I. Kusyszyn 'Existence, Effectance, Esteem: From Gambling to a New Theory of Human Motivation', *Substance Use and Misuse* 25:2 (1990), 159.

Caillois, Goffman, and Geertz each referred to coin-operated machine gambling in the course of their analyses, and each of them dismissed it as a degraded, asocial form of play not worthy of cultural analysis. For Caillois, it was pure *alea*—an absurd, compulsive game in which one could only lose.[17] For Goffman, it was a way for a person lacking social connections 'to demonstrate to the other machines that he has socially approved qualities of character'; machines stood in for people when there were none to engage with.[18] 'These naked little spasms of the self occur at the end of the world', he wrote of machine gambling in the very last line of his analysis, 'but there at the end is action and character'. Geertz described slot machines as 'stupid mechanical cranks' operated by concessionaries at the outer circumference of the cockfight circle, offering 'mindless, sheer-chance-type gambling' that could be of interest only to 'women, children, adolescents [...] the extremely poor, the socially despised, and the personally idiosyncratic.'[19] 'Cockfighting men', he continued, 'will be ashamed to go anywhere near [the machines]'. In other words, the devices were not a medium through which to become 'a man among men', as Dostoyevsky had written of roulette; unlike the 'exquisitely absorbing' *affaire d'honneur* of deep play, slot play was shallow, without depth of meaning, investment, or consequence. Incapable of illuminating the fundamental codes and concerns of a culture, machine gambling was not a properly 'sociological entity', Geertz wrote.

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[17] 'The development of slot machines in the modern world and the fascination or obsessive behavior that they cause is indeed astonishing', wrote Caillois in a footnote to his text, noting that there were 300,000 slot machines in cities throughout the United States in the mid-1950s. He followed with a long passage by a reporter in Times Square in 1957: 'In an immense room without a door dozens of multicolored slot machines are aligned in perfect order. In front of each machine a comfortable leather stool [...] allows the player with enough money to sit for hours. He even has an ash tray and a special place for his hot dog and Coca-Cola...which he can order without budging from his place' (Caillois, *Man, Play, and Games*, 183). Caillois described how the mania for 'pachinko' machines in Japan became so intense that they were installed in doctor's waiting rooms. He quoted an observer of these contraptions: 'An absurd game, in which one can only lose, but which seduces those in whom the fury rages' (Ibid.).

[18] Goffman, 'Fun in Games', 270.

The dramatic turn to machine gambling in American society (and beyond) since the 1980s prompts me to question such dismissals; surely, in this turn, one can find clues to the distinctive values, dispositions, and preoccupations of contemporary culture. But what kind of clues, and how to access them? Unlike Goffman's card gaming or Geertz's cockfighting, machine gambling is not a symbolically profound, richly dimensional space whose 'depth' can be plumbed to reveal an enactment of larger social and existential dramas. Instead, the solitary, absorptive activity can suspend time, space, monetary value, social roles, and sometimes even one's very sense of existence. 'You can erase it all at the machines—you can even erase yourself', an electronics technician named Randall told me. Contradicting the popular understanding of gambling as an expression of the desire to get 'something for nothing', he claimed to be after nothingness itself.

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[19] Geertz, *Interpretation of Cultures*, 435–6.

Similarly, when I asked Mollie, a frequent video poker player, if she was hoping for a big win, she gave a short laugh and a dismissive wave of her hand. 'In the beginning there was excitement about winning', she said, 'but the more I gambled, the wiser I got about my chances. Wiser, but also weaker, less able to stop. Today when I win—and I do win, from time to time—I just put it back in the machines. The thing people never understand is that *I'm not playing to win*'.

Why, then, does she play? 'To keep playing—to stay in that machine zone where nothing else matters.'

IN THE ZONE

To put the zone into words, the gamblers I spoke with supplemented an exotic, nineteenth-century terminology of hypnosis and magnetism with twentieth-century references to television watching, computer processing, and vehicle driving. 'You're in a trance, you're on autopilot', said one gambler. 'The zone is like a magnet, it just pulls you in and holds you there', said another.[20]

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[20] The term 'zone' is used in association with machine gambling in other English-speaking countries as well. One author reports that in Australia, no theme is as resonant among gamblers 'as the idea of 'the zone', a term used by many gamblers and counsellors to describe the dissociated state

It is not the chance of winning to which these gamblers become addicted but, rather, the world-dissolving state of subjective suspension and affective calm they derive from machine play. The memoirist Mary Sojourner has described video gambling as 'a trancelike preoccupation in which perpetuating the trance was reward enough'.[21] 'It's like being in the eye of a storm', says Mollie, her fingers playing on the tabletop between us. 'Your vision is clear on the machine in front of you but the whole world is spinning around you, and you can't really hear anything. You aren't really there—you're with the machine and that's all you're with.'

While all forms of gambling involve random patterning of payouts, machine gambling is distinguished by its solitary, continuous, and rapid mode of wagering. Without waiting for 'horses to run, a dealer to shuffle or deal, or a roulette wheel to stop spinning', it is possible to complete a game every three to four seconds.[22] To use the terminology of behavioural psychology, the

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that problem gamblers seem to enter during periods of intense play' (C. Livingstone, 'Desire and the Consumption of Danger: Electronic Gaming Machines and the Commodification of Interiority', *Addiction Research and Theory* 13:6 [2005], 528). The zone, Livingstone elaborates, 'is a particular space and time which is not consonant with the rest of life [...] a place away from the world where nothing really mattered except the present, timeless moment' (ibid).

[21] M. Sojourner, *She Bets Her Life: A Story of Gambling Addiction* (Berkeley: Seal Press, 2010), 149.

[22] D. Cote, A. Caron, J. Aubert, V. Desrochers, and R. Ladouceur, 'Near Wins Prolong Gambling on a Video Lottery Terminal', *Journal of Gambling Studies* 19 (2003): 380–407.

activity involves the most intensive 'event frequency' of any existing gambling activity.

'It is *the* addiction delivery device', says Henry Lesieur, a sociologist who wrote the first book-length ethnographic account of nonelectronic gambling addictions in 1977 before becoming a counsellor in the wake of machines' spread.[23] Others have called modern video gambling 'the most virulent strain of gambling in the history of man', 'electronic morphine', and, most famously, 'the crack cocaine of gambling'.[24] Sensationalist metaphors aside, most researchers place different forms of gambling along a continuum of intensity that progresses from lottery, bingo, and mechanical slots to sports, dice, cards, and finally, to video slots and video poker. 'No other form of gambling manipulates the human mind as beautifully as these machines', the gambling addiction researcher Nancy Petry told a journalist.

Forms of gambling differ not only in the intensity of play they facilitate but also in the kinds of subjective shifts they enable. Each type of gambling involves players in distinctive procedural and phenomenological routines—betting sequence and temporality, frequency and amount of payouts, degree of skill involved, and mode of action (checking books, ticking boxes, scratching tickets, choosing cards, pressing buttons), producing a unique 'cycle of energy and concentration' and a corresponding cycle of affective peaks and dips.[25] The game of craps, for instance, can produce a state of high energy and suspense punctuated by euphoric wins whose thrill depends largely on social feedback. The solitary, uninterrupted process of machine play, by contrast, tends to produce a steady, trancelike state that 'distracts from internal and external issues' such as anxiety, depression, and boredom.[26] Based on his clinical practice in Las Vegas, the psychologist Robert Hunter has concluded that modern video gambling 'facilitates the dissociative process' more so than other gambling formats.[27] 'The consistency of the experience that's described by my patients', he told me of machine gambling, 'is that of numbness or escape. They don't talk about competition or excitement—they talk about climbing into the screen and getting lost'.

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[23] Henry Lesieur, quoted in R. Green ('Long-Shot Slots, Part I', *Hartford Courant*, May 9 2004, http://courant.com/2004-05-09/news/0405090003_1_gambling-machines-long-shot-slots-problem-gambling/2; H. R. Lesieur, *The Chase: Career of the Compulsive Gambler* (Garden City, NY: Anchor Press, 1977).

[24] The first statement is by Robert Breen (quoted in Green, 'Long-Shot Slots, Part I); I heard the term 'electronic morphine' used by Robert Hunter; both Hunter, Howard Shaffer, and many others have used the 'crack cocaine' metaphor when speaking of gambling machines.

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[25] G. Reith, *The Age of Chance: Gambling in Western Culture* (New York: Routledge, 1999) chapter 3. See also J. Elster, 'Gambling and Addiction', in J. Elster and O. J. Skog (eds.), *Getting Hooked: Rationality and Addiction*, (Cambridge: Cambridge University Press, 1999), 208–34 and T. M. Malaby, *Gambling Life: Dealing in Contingency in a Greek City* (Urbana: University of Illinois Press, 2003) have made similar observations.

[26] C. A. Thomas, G. B. Sullivan, and F. C. L. Allen. 'A Theoretical Model of EGM Problem Gambling: More Than a Cognitive Escape', *International Journal of Mental Health and Addiction* 7:8 (2009): 3.

[27] The medical doctor and slot enthusiast David V. Forrest suggests that machine gambling produces a meditative, trancelike state because its pace and rhythm (three spins every ten seconds, or what he calls 'basal slot play rate') coincides with that of human breathing (*Slots: Praying to the Gods of Chance* [Harrison, NY: Delphinium, 2012], 49).

If Goffman's social gamblers sought out 'fatefulness' as 'the mark of the threshold between retaining some control over the consequences of one's actions and their going out of control', today's repeat machine gamblers could be said to retreat from that threshold, seeking instead a smooth, insulated zone where nothing unexpected or surprising can happen— the 'eye of the storm', as Mollie described it.

ASYMMETRIC COLLUSION

The gambling industry invests a great deal of resources and creative energy into the project of helping gamblers to 'lose' themselves—experientially and financially. Slot designers' goal is to build machines that can extract maximum 'revenue per available customer', or revpac, and of this all-consuming objective they talk freely and explicitly among themselves—on conference panels, in journals, and in the aisles and meeting lounges of exposition floors. How to get people to gamble longer, faster, and more intensively? How to turn casual players into repeat players? How, in other words, to design the zone?

Design techniques for promoting absorption, self-forgetting, and continued play are myriad. Modern machines allow players to insert large bills or so-called loyalty cards and then draw from credits displayed on a small digital meter—easier than entering coins one by one and an effective way to hide real-life monetary value. Push-buttons replace pull-handles, greatly accelerating the speed of play; the buttons are within easy reach on an ergonomically curved console so that a gambler can simply tap a finger. To prevent visual fatigue, graphic engineers softly pixelate machines' video monitors and avoid signage that is too bright, erratic, or otherwise over-stimulating. Sound engineers seek to soften and balance slots' acoustic elements; some use anti-noise technology to envelop players in a protective 'sound cone', and one company's audio director programmed its video slots to play all their sounds in the universally pleasant key of C. Screens are tilted at precise angles to ensure ergonomic comfort and the conservation of players' energy.

More important to the zone than audio-visual or ergonomic elements, however, are the computational mechanisms that lie behind the screen, working to compute the outcomes of the game. 'Math is what will make players stay', game designers emphasize. By 'math', they mean the programming that determines a particular game's 'reward schedule' or 'reinforcement schedule' to use the language of behaviorist psychology. 'It's like the player is reclining on a math model and you need to get them comfortable', one designer told me.

'They're investing a lot of money into an invisible structure and they need to be made to feel that they can trust it. The machine needs to communicate that trust through its delivery of rewards.'

Departing from Marxian accounts of industrial production in which factory labourers become alienated from themselves in the process of operating machinery, Foucault characterized the relationship between humans and disciplinary machinery as one of connection rather than estrangement, in which 'a coercive link with the apparatus of production' joined a given body to the object it handled.[28] Although linkage is certainly a more pertinent descriptor than alienation for the contemporary gambler-machine relationship, the link in question is forged not through coercion, but through a kind of *collusion* between the structures and functions of the machine and the cognitive, affective, and bodily capacities of the gambler.

The turn from coercion to collusion fits with Gilles Deleuze's characterization of contemporary society as a 'mutation of capitalism' in which a logic of discipline and restriction has given way to a logic of control whose protocol is not restriction or confinement but, rather, the regulation of the continuous and flowing movement of bodies, affects, and capital.[29] Although machine gamblers act within the enclosed space of the casino, seated before the consoles of stationary devices and repeating the same routines, they tap into a flow of credit that can bring them into the flowing nonspace of the zone and allow them to be 'continuously productive', as casino managers put it, for as long as that credit lasts.

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[28] Foucault, *Discipline and Punish*, tr. A. Sheridan (NY: Vintage, 1995), 153.

[29] Deleuze, 'Postscript'; see Schüll, *Addiction by Design*, chapter 1.

'Textbook capitalist exploitation thrives in peaceful and productive coexistence with the play-drive of the exploited', Dibbell observes of the phenomenon he calls ludocapitalism.[30] The key is to hold players in a desubjectified state of uninterrupted motion so as to galvanize, channel, and profit from their affective capacities, or 'experiential affect', as two consultants for the industry term it.[31] Design strategies for rendering continuous productivity match gamblers' desire for the insulating continuity of the zone and vice versa; gamblers in search of the perpetual 'now' of the zone become collaborators in the industry's attempt to derive value from long-term statistical probability. 'In the casino', writes the sociologist James Cosgrave, 'the calculation of probabilities is the rule, the house has the edge and, as much as possible, nothing is left to chance.'[32]

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[30] J. Dibbell, 'The Chinese Game Room: Play, Productivity, and Computing at Their Limits', *Artifact* 2:3 (2008), 3.

[31] K. Mayer and L. Johnson, 'Casino Atmospherics', *UNLV Gaming and Review Journal* 7 (2003): 21–32.

[32] J. Cosgrave, 'Goffman Revisited: Action and Character in the Era of Legalized Gambling', *International Journal of Criminology and Sociological Theory* 1:1 (2008): 80–96.

MECHANICAL TO DIGITAL: THE 'REALLY NEW GOD'

Slot machines underwent a significant transformation in 1963 with the incorporation of electromechanical technology that enabled manufacturers to control the motion of reels with electrical motors and a circuit board of switches rather than mechanical springs and gears.[33] Removing the motion mechanisms from the reels protected slot machines from tilting, shaking, and other physical abuse that could affect outcomes.[34] Once they became reliable, notes a historian, 'the attention of designers shifted to maximizing the devices' potential to attract and retain gamblers'.[35] While casino managers appreciated the tamper resistance of electromechanical machines, players liked the fact that their motor-driven hoppers could render unprecedented automatic payouts of up to five hundred coins, which meant larger and more frequent payouts.

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[33] In 1964 Bally developed the first fully electromechanical slot machine called *Money Honey*. The device allowed unprecedented automatic payouts of five hundred coins instead of a mere twenty coins, as did all prior devices.

[34] Until then it had been possible to cheat on the machines by manipulating their mechanics. One method, called 'rhythm play', involved pulling the lever in such a way as to influence the stopping of the reels; 'stringing' involved pulling a coin in and out of the slot with each spin; 'handle slamming' attempted to disable the payout control mechanisms on old machines; and 'spooning' required a special device (B. Friedman, *Casino Management* [New York: Lyle Stuart Publishers, 1982 (1974)]; C. Turdean, 'Betting on Computers: Digital Technologies and the Rise of the Casino (1950–2000)' [PhD dissertation, Hagley Program, Department of History, University of Delaware, 2012], 15–16). Some slot cheats used 'slugs' or fake coins, 'shims' or wire pieces that were inserted into holes made in the machine's case or glass, or simply poured substances into the pay slot to fix its handle into play mode. Others attempted to stop the reels in certain positions with help from magnets.

[35] Turdean, 'Betting on Computers', 46.

Digital microprocessors (computer chips with memory) came on the scene of machine gambling in 1978, endowing the devices with further security and appeal. Just as motors and switches had replaced gears and springs, now digital pulses of electricity drove the motion of slot reels. Although players continued to interact with reels, the outcomes of their spins were now determined by a digital entity whose workings were thoroughly opaque to them.

The hidden operations by which gambling machines arrive at and deliver their verdicts are a source of great wonderment and conjecture among gamblers, as is evident in the countless discussions that gamblers initiate on Internet forums. 'One of the great questions in philosophy', begins an article in the gambling magazine *Casino Player*, 'is how the body of man, which is mechanical and concrete, can contain the element of mind, which is ephemeral. This has come down to the simple statement that we have a 'ghost' or 'god' in the machine. So too with today's slots.'[36] Evoking the ephemeral, ghostlike will of the random number generator (RNG), some in the industry

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36. F. Scoblete, 'The God in the Machine', *Casino Player*, March 1995, 5.

call this component the Really New God.[37] 'The RNG runs on a computer chip, but people act like it's casting a spell', a designer told me.

The 'mystery chip' that determines the outcome of a spin is programmed with mathematical algorithms that execute a game's particular scoring scheme and predetermined hold percentage (or 'house edge'), working in concert with a random number generator to generate its outcomes. Even as a gambling device sits idle, its RNG cycles through possible combinations of reel symbols or cards at approximately one thousand per second.[38] The device is in perpetual motion, indifferent to the presence or absence of players. When a player initiates a game by pulling a handle or pressing a SPIN button, its program 'polls' the RNG, whereupon it generates whichever numbers it happens to be cycling through at that exact moment—one for each of the reels displayed. These generated numbers, which typically fall between one and four billion, are fed through an algorithm that translates them—by a process known in computer programming as 'indirection' or 'indirect reference'—into stops on the microprocessor's 'virtual reels'.[39] The selected virtual reel positions are then communicated to the correlating positions on the actual, physical reels. All this is decided instantaneously, before a game's reels stop spinning—yet gambling companies take care to preserve the illusion of a mechanically actuated reel mechanism so as to perpetuate players' sense of being kinetically involved in the game. 'Operating the machine requires that you pull the handle', a journalist explained in 1980, 'but by then, you're no longer gambling—you're simply activating the readout.'[40]

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[37] Ibid.

[38] Technically, the RNG is 'pseudorandom' which means that since it is a designed program, it can never truly be random in its functioning (unless it draws its numbers by sampling random noise in the environment). Slot machine RNGs sample a real-time internal computer clock to establish a 'seed' value and then derive each random number from the previous one, following a recursive function. Given that their cycles contain approximately 4.3 billion distinct values, they are virtually unpredictable.

ZONE OF ENCHANTMENT

In the late 1990s Roger Horbay, a former addiction counsellor in Ontario, began to design software to educate players about gambling machines and dispel their enchantment. His motivation, he told me, was the frustration he felt in his role as addiction counsellor and trainer of other counsellors. No matter how he explained what was going on inside the devices, few could grasp how they worked—especially not how they configured probability and randomness. '*How can it be random and also weighted? How can there be a fixed*

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[39] The algorithm works by taking the random number that has been generated and dividing it by the number of stops on a given virtual reel until there is a remainder; that remainder indicates the reel position to select.

[40] M. Rogers, 'The Electronic Gambler', *Rocky Mountain Magazine*, 1980: 25.

house edge if it's chance? People couldn't get their heads around it', Horbay recalled. When he met computer-scientist Kevin Harrigan, the two decided to develop their own slot machine simulator. 'The idea was, let's develop our own game, make it transparent for users, let them really see how a typical slot machine works.'

Designing the educational software proved neither straightforward nor simple. On the grounds of intellectual property rights, technology companies denied their requests for the 'paytable and reel strip sheets' or 'PAR sheets' (sometimes also called 'probability accounting reports') that showed how games' odds were configured and how their virtual reels were mapped.[41] 'The secrecy is intense', said Horbay. 'Casinos can't even get PAR sheets from a manufacturer when they own the machines. They're in vaults.' He and his colleague went on reconnaissance missions to industry trade shows, acquiring as much knowledge as they could from the information available at companies' booths. Eventually they went to the US patent office, where many slot machines are publicly patented.[42] They took the patents to their own labs and hired forensic scientists to reverse-engineer the math. The resulting educational software, Safe@Play, lets users explore the insides of reel machines to see how their mechanisms actually work. One can 'unroll the reels', 'pull out the microprocessor', and watch how the random number generator works; the program 'reveals concealed game features.'

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[41] PAR sheets contain the configuration of a game's reels (including a listing of every symbol that appears on the reels, and its position), pay combinations, payback percentages, hit frequency, volatility index, confidence level statistics, and more.

[42] More recently, Canadian researchers K. A. Harrigan and M. Dixon obtained PAR sheets through the Freedom of Information and Protection of Privacy Act ('PAR Sheets, Probabilities, and Slot Machine Play: Implications for Problem and Non-Problem Gambling', *Journal of Gambling Issues* 23 [2009], 81–110).

As an experienced addiction counsellor, Horbay acknowledges the limits—and even the absurdity—of his own disenchantment enterprise. 'Even if we demystify the machines through education, [compulsive gamblers] will still play them.' I asked him to explain. 'Because once you're hooked in, something else kicks in to keep you there; all trains of thought are evacuated and only one dominates.' The 'something else' to which Horbay referred—the hold of the zone—overrides any hope for beating chance that may have initially inspired machine play, and that a machine's programming may have reinforced through its enchanting perceptual distortions. As Mollie told me, an initial seduction by the prospect of winning was what prompted her repeated engagement with gambling machines, yet through that engagement she discovered the machines' capacity to bring her into the zone—a state of ongoing, undiminished possibility that came to trump the finite reward of a win.

Horbay regards gambling machines' seductive inscrutability not as the *hold* on players but rather the *hook*—the ‘early entrapping mechanisms’, as he phrased it, or the ‘drive-in to the zone’. These entrapping mechanisms, he believes, exploit the cognitive expectations of new gamblers such that they persevere at the interaction to a point where the self-maximizing aim of winning turns into the self-liquidating aim of the zone. He promotes his software chiefly as a form of prevention, a way ‘to block the on-ramp to addiction’. Once players become caught in the loop of repeat play, he told me, ‘no rational action is possible’.

Gambling addicts are well aware that they are beyond reason in the zone, and that knowledge of the machines’ inner functions will do little to curb their drive. ‘I don’t wonder or worry about the mechanism’, commented Lola, the buffet waitress. ‘I know the machines are computerized, that they’ve got a chip, but it really doesn’t matter—in fact, I don’t think about it at all when I play. I couldn’t care less, I just want to see the next cards’. Shelly, the tax accountant, said the same: ‘Although I’ve had discussions with people as to how the machines work, sometimes even with people who build and program them, while I’m playing I never really think about the insides of the machine.’ Randall, the electronics technician we met earlier, had inspected machine interiors and understood how their memory chips worked. ‘I’m a reasonably intelligent person, I’m rational. But when it comes to gambling, reason just skippity-hops out the door.’ Rose, a machine gambler who became a slot machine mechanic with the hope that an education in the machines' inner workings might release their hold on her, eventually realized the futility of her demystification plan: 'After getting my degree I knew everything that was going on in that machine. It was a conscious knowledge when I'd start to play—I'd picture what was happening inside the computer. But then I would turn that knowledge off.' Designers themselves often describe a 'turning-off' of knowledge while playing the very machines they have designed. When designing, they operate within the domain of calculative rationality—they pick a machine's colours and sounds, formulate its sophisticated mathematical algorithms, calculate its payout rates and risk probabilities, and scrutinize its performance. When playing, however, calculative rationality falls away. 'Even though I know my chances statistically', Anchor Gaming's John Vallejo told me, 'I'm guilty of doing risky, superstitious things when I play. [...] I feel a sense of anticipation that I know doesn't make sense, and I take risks that I know aren't feasible.' 'I designed the math on these games but it doesn't matter; I do risky, irrational things when I play', echoed a Bally designer. 'Knowing the odds doesn't interfere with my playing. *Somehow that knowledge becomes irrelevant when I sit down at the machine.*'

Multiple lines of delusion are at work in the encounter with gambling machines. Industry designers actively marshal technology to delude gamblers, defending these tactics by insisting that they give gamblers 'what they want'. Gamblers, for their part, collude in the delusion, 'turning off' any knowledge they may have about the inner mechanisms of the machines so as to enter the compelling state they seek. Here, the asymmetry lies in the encounter between two distinct practical, cognitive, and temporal orientations to the enchanting force of chance.

While designers' orientation is calculative, rational, and focused on a distant statistical horizon in which profit is guaranteed, gamblers' orientation is experiential, affective, and focused on the unpredictable outcomes of the very next spin; as their involvement in play deepens, they are likely to become less invested in winning than in continuing to play. It is not that repeat gamblers act 'illogically' while playing machines, two gambling researchers clarify, for 'their strategies are complex, intuitive and adaptive'; yet these strategies, write the gambling scholars Charles Livingstone and Richard Woolley, 'are not avaricious and do not rely on "rational" calculation of odds'.[43] Although 'one might 'know' that the odds are poor and that one inevitably loses over time', writes another researcher, a different 'type of knowing [...] may take over in the process of gambling, especially if machines are designed with this effect'.[44] In the gap between calculation and intuition, rationality and affect, the gambling industry seeks revenue while players seek the zone.

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[43] C. Livingstone and R. Woolley, 'Risky Business: A Few Provocations on the Regulation of Electronic Gaming Machines', *International Gambling Studies* 7:3 (2007), 369.

VIRTUAL REELS

Even for those who grasp the workings of the RNG, it is what happens next—the conversion of a number that has been randomly generated from a pool of nearly four billion into a physical reel stop that is part of a radically more limited pool of outcomes—that tends to stymie understanding. The concealed nature of the operation, along with machine events and displays that seem to represent its process when in fact they do not (the time delay of spinning reels, for example), compounds gamblers' confusion, obfuscating cause and effect in the experience of play. What exactly goes on in the conversion of random values to reel stops? 'Instead of accessing some resource directly', writes gaming guru John Robison of machine programming, 'you go through an intermediate step. You can do all sorts of wonderful things in that intermediate step.'[45] One of these 'wonderful things' is called virtual reel mapping, a technique patented in 1982 for controlling game odds independently of a machine's actual reels. The invention was meant to overcome the continuing limitations posed by the structure of physical reels. Although digital microprocessing had turned physical reels into a mere display of the computer-determined outcome, there remained a one-to-one correlation between the number of stops they contained—which by 1970 had become 22—and those on its ghostly analog or 'virtual' reels. Since the maximum number of combinations possible on such machines was 22 × 22 × 22, or 10,648, the odds of hitting a jackpot on a machine with one jackpot symbol per reel were 1 in 10,648. Thus a $1 machine could not offer a jackpot larger than $10,648 or it would risk losing money; the jackpot would have to be *under* $10,648 to ensure the house a profit.

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[44] J. Borrell, 'A Thematic Analysis Identifying Concepts of Problem Gambling Agency: With Preliminary Exploration of Discourses in Selected Industry and Research Documents', *Journal of Gambling Studies* 22 (2004), 181.

[45] J. Robison, 'Ask the Slot Expert: Casino Random Number Generators', *Casino City Times* (2000), http://robison.casinocitytimes.com/articles/349.html.

How could game manufacturers get around this constraint, or 'lengthen the odds', to use gambling parlance? They tried making machines with larger reels to accommodate more symbols, as well as machines with extra reels, but players avoided such models. When interacting with the larger-reeled, extra-reeled devices, they intuitively grasped that their chances had been diminished by the addition of symbols. Another way to lengthen the odds was to replace physical reels with a video display of simulated reels that could accommodate an infinite number of blanks and symbols. This became possible in the 1970s with the advent of video games, yet consumers were not yet familiar with screen-based technology and tended to distrust it. Although this distrust was to dissolve by the mid-1990s, the mathematician and inventor Inge Telnaes provided a striking interim solution in the form of virtual reel mapping, also called 'disproportionate reels' or 'weighted reels'.[46]

Machines using this technology continue to display 22 stops per reel—11 blanks and 11 winning symbols—yet their *virtual* reels can be configured to accommodate as many stops as designers like, sometimes hundreds. As on all computerized slot machines, when gamblers press the SPIN or BET button, the value generated by the RNG at that instant is translated into one of the virtual reel stops, each of which has an equal chance of being selected. However, because there are more virtual than *actual* reel stops, a secondary 'mapping' program must be written to translate the virtual stops selected by the RNG into actual stops. The 'wonderful thing' that can be done in this intermediate step is to 'map' far more virtual stops to low-paying or nonpaying blank positions on the actual, physical reel than to winning positions.[47]

The asymmetry between actual and virtual reels gave manufacturers a considerably more precise

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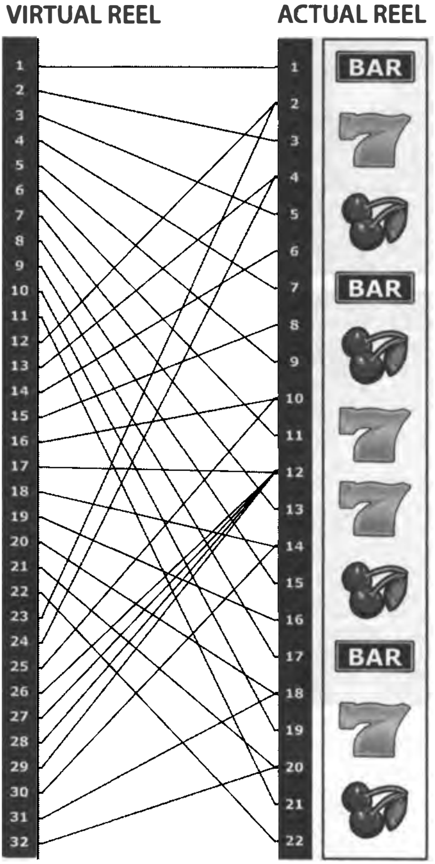
[46] US Patent No. 4448419. Telnaes developed the software in the late 1970s when he was working for Bally Distributing. He filed for a patent in 1982, and the patent was granted in 1984.

[47] N. Turner and R. Horbay, 'How Do Slot Machines and Other Electronic Gambling Machines Actually Work?', *Journal of Gambling Issues* 11 (2004), http.ghsouthern.org.au/infobase/JGI-Issue11-turner-horbay.pdf.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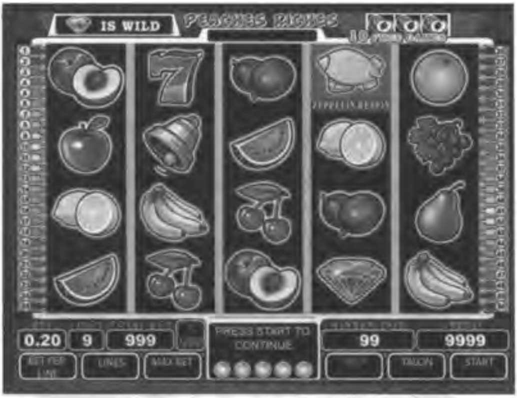
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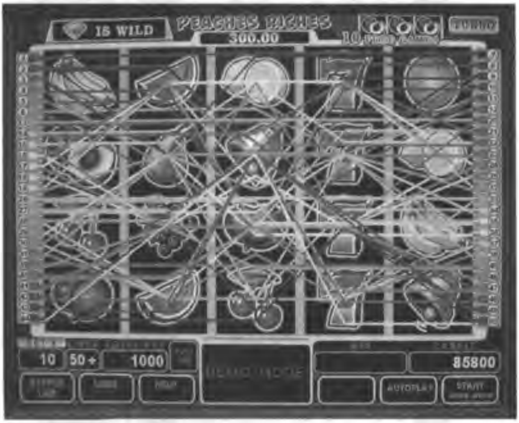
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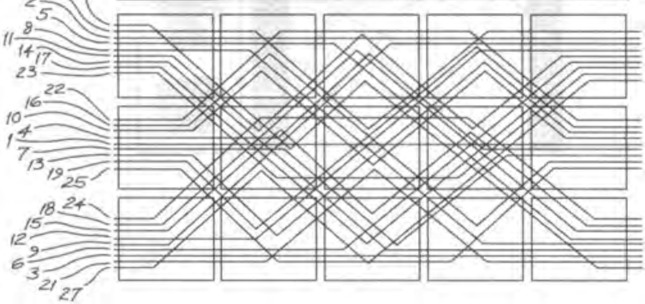
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way to control game outcomes, making it possible for them to promise huge jackpots on the outcomes with the slimmest mathematical odds.[48] On a machine whose virtual reels have 64 stops each with only one stop mapped to a jackpot symbol, the chances of hitting that symbol on all three reels to win the jackpot are 1 in 64^3, or 262,144. The machine could therefore offer a jackpot of up to $262,144 without losing money. On a machine with 512 virtual stops, the odds of a jackpot would be as rare as 1 in 137 million—giving the house a safe enough edge to offer $20 or $30 million prizes and still ensure long-term profit.[49] This unprecedented mathematical flexibility endowed gambling machines with a hitherto elusive 'volatility' (or potential for dramatic wins), redoubling their market appeal. Virtual reel mapping 'revolutionized the slot machine industry just as much as Charles Fey did when he invented the slot machine in the first place', said an employee of IGT, the company that eventually bought the rights to the patent.[50] As industry expert Frank Legato has written, the invention 'was the primary impetus for the meteoric rise of popularity in slot machines.'[51]

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[48] Ibid., 11. US Patent No. 4448419.

[49] Ibid., 21.

[50] J. Wilson, 'Virtual Reels? Physical Reels? Just the Real Truth', *Slot Tech Magazine*, January 2004, 18–22.

[51] F. Legato, 'The 20 Greatest Slot Innovations', *Strictly Slots*, March 2004, http://www.strictlyslots.com/archive/0403ss/SS0304_Innovative.pdf.

DISTORTION FACTOR

If an understanding of the RNG reveals that the *spinning* of reels has no bearing on game outcomes, an understanding of Telnaes's mapping technique reveals that the reels themselves have no bearing on game outcomes. He stated as much in the application he filed with the US Patent and Trademark Office: 'In this invention the physical reels are only used as a display of the random number generated results and are not the game itself as in standard slot machines.'[52] *Not the game itself*: Virtual reel mapping enacts yet another remove between the game with which players interact and the mechanisms that determine its outcomes. Even more than the RNG, this technology shifted game developers' creative focus from the structure of the machine—the feel of its handle, the circumference of its reels—to its mathematical programming. For the first time it became possible to alter a game's probabilities not by reconfiguring its hardware but by reconfiguring its software.[53]

At the same time that developers dispense with their own dependence on physical reel stops, they take care to preserve—and to profit from—players' continued dependence on the reel displays they interact with. Divested of their former mechanical function, the reels take on the new function of enchanting visual distortion. 'Reels' that exist only inside the machine's chip and that are weighted heavily against gamblers are compressed onto the actual reels that spin in front of them, which appear far more weighted in their favour than they are (often carrying four jackpot symbols). Although each symbol that players see seems to have an equal chance of hitting, in fact each does not; the actual reel merely communicates the mapping decisions of its much-expanded virtual counterpart. Telnaes wrote candidly of his intent to distort player perception: 'It is important to make a machine that is *perceived to present greater chances of payoff than it actually has*.'[54]

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[52] US Patent No. 4448419.

[53] Ernkvist, 'Creating Player Appeal', 166–8.

Kevin Harrigan, a specialist in computer software algorithms, figured out a way to calculate exactly how much greater. When he analyzed the programming on one 64-stop virtual reel, he found that if it were to pay off according to how its 22-stop actual reels presented themselves, players would win 297 percent of the time.[55] He argued that machines' misrepresentation of odds—or 'physical reel distortion factor' (PRDF)—worked to hoodwink the human perceptual system and encourage player persistence.

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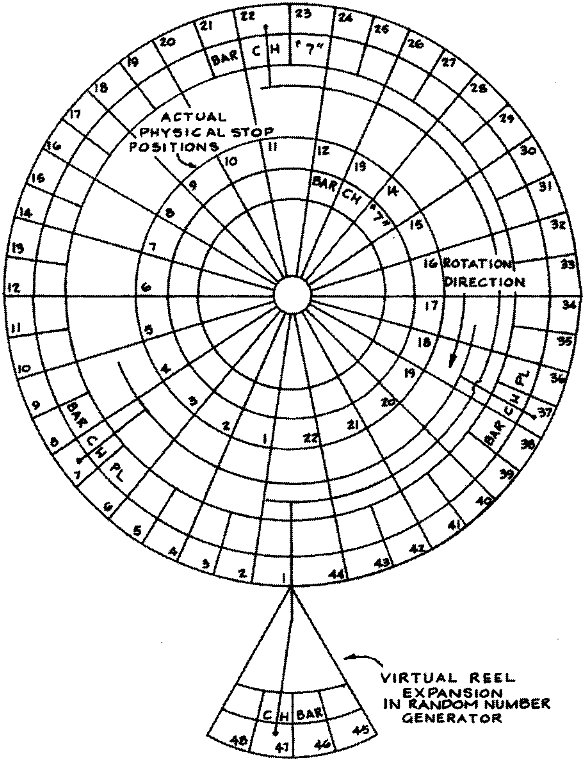
[54] Ibid.

[55] K. A. Harrigan, 'Slot Machine Structural Characteristics: Distorted Player Views of Payback Percentages', *Journal of Gambling Issues*, June 2007, 215–34; 'Slot Machine Structural Characteristics: Creating Near Misses Using High Symbol Award Ratios', *International Journal of Mental Health and Addiction* 6 (2008), 353–68.



ACTUAL PHYSICAL STOP POSITIONS
ROTATION DIRECTION
VIRTUAL REEL EXPANSION IN RANDOM NUMBER GENERATOR
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The perceptual machinations and transformative distortions of chance involved in virtual reel mapping have led some to characterize it as a high-tech form of cheating; instead of 'loading the dice' by drilling in quicksilver or 'weighting the deck' by adding cards, the method of deceit is digital programming.[56] Following Nevada gaming law, 'to cheat' is 'to alter the elements of chance, methods of selection or criteria' that determine game results, and includes 'the use of [a] device for calculating probabilities.'[57] Whether or not virtual reel mapping fits this definition, at the very least it would appear to violate the Gaming Commission's stipulation that machines 'must display an accurate representation of the game outcome', a variation of consumer protection laws that forbid potentially misleading graphics.[58] Telnaes's patent, as quoted above, foregrounds the invention's power to mislead, or to 'present greater chances of payoff than it actually has'.

As it happens, when a slot machine based on the patent was introduced for consideration at a set of hearings held by the Nevada Gaming Control Board, prominent figures in the gambling industry objected that aspects of its functioning were visually deceptive and unethical. Representatives from the two largest manufacturers at the time, IGT and Bally, voiced concerns that the technology misrepresented the outcome to the player. 'From a visual standpoint', testified Bally's president, 'it is misleading to the slot machine player'. He explained:

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[56] See T. Falkiner and R. Horbay, 'Unbalanced Reel Gaming Machines' (2007), http://www.gameplanit.com/UnbalancedReels.pdf.

[57] Regulations 465.015 and 465.075 (Nevada Gaming Commission 2010b).

[58] Regulation 14.040 (Nevada Gaming Commission 2010a).

> One of the reasons reel spinning slot machines have been so successful throughout their history is that players can visually see during the course of several handle pulls, all of the symbols on all of the reels as they spin and can psychologically perceive that there are actual combinations that should eventually show up over the course of time. It would appear to us that if a mechanical reel on a slot machine possesses four sevens and it is electronically playing as if there were one seven, *the player is being visually misled.*[59]

The legal counsel for IGT agreed that 'there is a deception problem involved with this kind of machine.'[60]

Despite the wariness of industry insiders (which doubtless had less to do with their concern about deception than with their concern about competition), the request to sanction virtual reel mapping was deemed 'an acceptable deviation from the criteria', as the lead lawyer for the Nevada Gaming Control Board later put it.[61] One presiding commissioner emphasized at the hearings that players *expect* deception from machines, concluding: 'I feel good about this machine. I am going to vote in favor of it. I think the concept is an exciting one'.[62]

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[59] Nevada State Gaming Control Board, 1983, 39, emphasis mine.

[60] Ibid., 41. In this comment, IGT's lawyer, Raymond Pike, was specifically referring to the machine's capacity to produce near miss effects by presenting more winning symbols above and below the payline.

The board's endorsement of virtual reel mapping, which allowed slot machines to offer bigger jackpots, was critical to the ascent of machines in the American gambling market.[63] After the Telnaes patent ran out in 2002, the software became standard across the entire industry. By 1997, more than 80 percent of spinning reel slot machines (which today make up 35 to 40 percent of the machine mix on an average casino slot floor) used the algorithm.[64]

When the dubious perceptual distortions of virtual reel mapping are raised today, the defense is circular:

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[61] Nevada Gaming Commission 1989, 280.

[62] Nevada Gaming Commission 1983, 88. 'Maybe part of the intrigue is part of the deception', echoes Connie Jones, director of responsible gaming for International Game Technology. Her claim would appear to contradict the recent claim by a gambling industry journalist that 'there is no sleight of hand or trickery involved in the slot machine business'. P. Roberts, 'Slot Sense', *Global Gaming Business* 9:8 (August 2, 2010). http://ggbmagazine.com/issue/vol-9-no-8-august-2010/article/slot-sense.

[63] For a detailed historical study of the corporate politics involved in the switch from an electromechanical paradigm to a digital paradigm, see Ernkvist, 'Creating Player Appeal' (especially chapter 7).

[64] R. Maida, 'From the Laboratory: No More Near Misses', *International Gaming and Wagering Business* (July 1997), 45.

Presiding judges find that the practice is not fraud, because every regulatory laboratory approves it; regulatory laboratories claim that their job is not to scrutinize and uphold consumer protection laws, but only to test the features of machines that casino operators ask them to; manufacturers and casino operators claim that regulation is not up to them.[65]

FALSE WINS

The most recent games to have swept the slot machine market are called 'multiline multipliers' and depend on video technology and complex digital software to produce their unique effects. In 1993, the first of these appeared—a device featuring a video screen with a grid of symbols and nine lines on which to bet. Instead of betting on just one line, now players could bet as many as five coins on each of the nine lines, for a maximum bet of forty-five coins per spin.

Unlike a classic one-line slot machine, on which a player either lost his entire bet or multiplied it exponentially (a rare event), multiline video slots can pay gamblers back a *portion* of each bet they make—allowing them smoother, longer play. 'By creating wins where players receive less than their wager', writes a game designer and consultant, 'we give them a sense of winning but also continue to accrue [their] credits.'[66] This 'sense of winning' is communicated by presenting gamblers with the very same audiovisual feedback—colorful blinking lines, sounds, a musical score— that occurs during *actual* winning. The machines render a type of quasi-win (different from the near miss) that one team of researchers aptly calls the 'false win.'[67]

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[65] S. Bourie, 'Are Slot Machines Honest?', *American Casino Guide*, 1999, http.americancasinoguide.com/Tips/Slots-Honest.shtml.

Since 1993, the number of paylines on this genre of machine has continued to rise—not just straight across the screen but also zigzag, featuring up to 200 lines on which to bet. With each line added to video slots, their hit frequency and reinforcement quotient has increased—along with their popularity. Although the games tend to give players slimmer odds at winning big jackpots, they also tend to carry less risk of sudden losing streaks and the quick depletion of play funds. The devices, designers told me, give gamblers a 'a smoother ride'; they are ideal vehicles for entering the zone. As the journalist Marc Cooper remarked in 2005, 'the new generation of gambling machines has, predictably, produced a new generation of gambling addicts: not players who thrive on the adrenaline rush of a high- wager roll of the dice or turn of a card but, rather, zoned-out 'escape' players who yearn for the smooth numbness produced by the endlessly spinning reels.'[79]

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[66] J. Wilson, 'Meaningful Hit Frequency, Pt. I: An Operator's Guide to Player Satisfaction', *Casino Enterprise Management*, January 2010, http. casinoenterprisemanagement.com/articles/january-2010/meaningful-hit-frequency-pt-i-operator%E2%80%99s-guide-player-satisfaction.

[67] Harrigan and Dixon, 'PAR Sheets'.

'The lines have escalated far beyond the point where you can keep tabs on what you are winning or losing', observes a gambler named Katrina, in a letter she sent to me in 2008. 'Before you have time to examine the screen too closely, you push the button for the next spin.'

PHENOMENOLOGY OF THE ZONE

In her letter, Katrina recalls how apparently small and innocuous changes to game design ended up pushing her gambling to higher and higher levels. 'I have been associated with electronic gaming machines for about 20 years', she writes. 'I can think back to when I was satisfied with playing 1 line and then fast forward to the time when I was happy playing 9 lines, but now I play 20 lines. I have become accustomed to it and it is hard not to be dissatisfied by going back to older models.' Katrina recognizes that there are certain intensities of machine events with which she cannot cope; intensities that are too low or too high produce intolerable states of under- or overstimulation in which she cannot 'lose herself' in the zone of play, an experience typical of repeat machine players. She continues:

> People who play machines infrequently or on a very superficial level can remain relatively unaffected by

> the machines' repetitious processes. But if you play quite frequently *you have all these things constantly working on you and you develop a familiarity with the many different scenarios that play out amidst the 'randomness' of it all.* Each time you sit down at a machine you have a history of memories of what has happened hundreds or even thousands of times before (if you have played for many years). [...] Rough patterns of how it all works begin to emerge, and *you find yourself expecting certain things.*

Katrina elaborates on the process by which the repeated experience of particular machine events prompts successive readjustments in her behavior, propelling her play to new levels. She notes that it is when patterns 'begin to emerge'—or when she feels they do—that she becomes caught.

Katrina characterizes her addiction as an ongoing cognitive and affective adaptation to upticks in the intensity of machine reinforcement. What finally gives the industry the upper hand in this process is not simply the fact of her habituation or 'machine tolerance', as we might call it, but the way in which technological innovation destabilizes that tolerance wherever it develops—introducing new and unexpected increments of intensity and elements of surprise into the exchange, thus provoking further responsive adjustments in her internal expectations.

To illustrate the process, Katrina relates how one common feature of video slots, called 'bonus rounds' or 'free spins', has affected her play. This type of feature randomly presents gamblers with an animated bonus game offering them a prize, a chance at a prize, or free spins on the machine—all of which grant longer play.[68] The 'game-within-a-game' works in dynamic concert with the payout schedule of the base game, serving as a second layer of reinforcement. 'At first', she remembers, 'free spins were just a novelty, just another innovation to contend with. I was not to know how they would change the dynamics of my play. But soon, I would dismiss outright any machine that did not have this feature.' The novelty began to eclipse other aspects of her play, 'to the point where normal game play lost some of its appeal. Although still important, to a degree it became a means to an end, a sort of biding of time until the free spin feature occurred.'

Katrina describes how the stakes of this contingency rise as her credits diminish:

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68. Bonus features began exclusively on video slots but have now migrated to reel spinners and video poker. While the gambling industry stands to gain nothing during the bonus round (the player either wins or loses nothing), the money dispensed to gamblers as bonuses is considered a tax-deductible marketing expense; thus bonus features are a financially prudent way to provide gamblers with the extended play time (R. Lehman, 'How Can Free Play Be So Misunderstood?', *Casino Enterprise Management*, November 2009. http://aceme.org/articles/fnovember-2009/how-can-free-play-be-so-misunderstood. Harrigan and Dixon ('PAR Sheets', 81–110) note that bonus games amount to a secondary reinforcement schedule.

> As your credits start declining, the anticipation and focus on free spin symbols starts to rise. Since they reward so much more than regular play, they become a sort of a savior. When the free spin feature is activated, then there is a kind of relief. Assuming the outcome [of the spin] is fairly good, you can then be satisfied for a while and your focus on free spin symbols diminishes to a degree.

Katrina's susceptibility to the contingency of the free spin rises and diminishes, waxes and wanes; in moments of its waxing, her pursuit of the free spin (and the 'relief' it affords when it arrives) dwarfs the more familiar routines of her slot play.

Drawing on her years of experience, she carefully distinguishes among the various 'scenarios' that can unfold with regard to free spins during a session of gambling:

> Due to the unpredictable nature of the free spin feature you can sometimes feed 100s of dollars into the machine without getting it. Or you can be 'spoiled' and get it quite regularly. On other occasions you get them intermittently. Depending on how long the session is with a particular machine, all three of the above scenarios can occur in a cyclic but disordered fashion in the one sitting.

As much as these different scenarios guide Katrina's external actions, they intimately affect her internal state, as she tells us in a discerning phenomenological account of her own play:

> Sometimes there is a frequent appearance of free spin symbols but no forthcoming free spins. In that case, you become highly focused on the *symbols* representing free spins. What subtly intensifies your focus on free spin symbols are *certain sounds* attached to these symbols when they appear in the window. Your emotions rise and fall with the appearance of free spin symbols, and *with the music*. If the buildup of anticipation and focusing is chronically frustrated in this way, then there is a great tendency to plow through your credits. At the same time, there is often an internal dialogue going on as to whether to push the 'collect' button. However, it is a difficult situation because while you are contemplating this you are still pushing the button and also hoping something will happen, like the free spins showing up [...]
>
> Once you reach the point of no return you usually don't care about collecting [your credit] anymore. Sometimes when the credits are almost down to nothing *the free spins will suddenly appear*, but if they don't and the credits expire, you will do various things. Sometimes you leave, but more often you will put more money in, and the free spins may come soon

> after and start the ball rolling all over again. It all moves quite quickly. The free spins just exacerbate the downward spiral you are on.

Machine sounds, music, the chance appearance of free spins: each of these contingent game events conditions Katrina's experience, expectations, and actions.[69] The movement of her play—which invariably reveals its trajectory to be that of a downward spiral—unfolds in a continuous, rapid, responsive interaction with the machine, precluding pauses or spaces in which she might reflect or stop.

The final free-spin scenario that Katrina describes explicitly invokes the 'zone'—the elusive point of absorption, beyond contingency, that machine gamblers perpetually seek. For Katrina to reach the zone and to remain there for a spell, a particular set of circumstances must arise:

> The best scenario is when the free spins have been coming around regularly and perhaps normal game play has been good as well, and consequently the credits are up pretty high—this is what you have come to feel is the ideal situation. *This is where it particularly*

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[69] 'The cognitive, emotional, and kinesthetic feedback loop that is formed between the game process and the player makes games particularly powerful means of affecting players' moods and emotional states', writes a scholar of video games (G. Calleja, 'Digital Game Involvement: A Conceptual Model', *Games and Culture* 2 [2007], 236–60: 244–5).

> *feeds into that zone where you can play for quite some time without the credits diminishing very much*—they may see saw, but they maintain a relatively high level. *You can just relax and 'lose' yourself at what is ironically a very precarious but 'safe' level of play and you really don't want it to end.* Of course, at some stage it inevitably starts to take a nosedive.

Katrina understands the zone as at once 'safe' and 'precarious'—a gentle seesaw of play credit that is mirrored in a gentle seesaw of player affect, both of which might at any instant lose momentum and come to a standstill. The zone state is attainable only at the threshold where rhythm holds sway over risk, comfort over perturbation, habituation over surprise.[70]

This threshold constantly shifts as a function of dynamic interaction between player habits and the industry's technological innovations. The interaction deviates markedly from an economic formulation of the relationship between supply and demand, in which market demand (understood as the static preferences of rational consumers) steers supply such that the two meet in equilibrium.[71] Instead, repeat machine gambling can be characterized as an asymmetric interplay between two different modes of feedback: while individual gamblers follow a logic of 'negative feedback' in which they continuously adjust their actions so as to attain the zone's homeostatic balance, the industry and its designers follow a logic of 'positive feedback' in which they incrementally ratchet up the intensity of play required of gamblers to achieve the zone.[72] Out of the asymmetry between these two modes of feedback emerge the industry's innovations and the players' machine tolerance.

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[70] It is important to note that although machine gamblers like Katrina seek a zone in which rhythm, comfort, and habituation hold sway over risk, perturbation, and surprise, the zone cannot exist without the presence of the latter elements. If contingency is too thoroughly evacuated from the gambling exchange, players are not drawn in and access to the zone is blocked. This became apparent in the failure of a new sales formula for machine gambling that came on the scene in 2006. The formula, designed both for repeat players who seeking play time and for risk-averse novices who needed 'training wheels' to get used to the uncertainty of the gambling commodity, appeared in two versions: IGT's Guaranteed Play and Cyberview's Time Play.

A RELIABLE MECHANISM

A complicated relationship exists between the technologically mediated mini-decisions that compose machine gambling and the ever-proliferating choices, decisions, and risks that actuarial selves face in free-market society. Machine gambling narrows the bandwidth of choice, shrinking it down to a limited universe of rules, a formula.[73] Although the activity multiplies choices, it digitally reformats them as a self-dissolving flow of repetitious action that unfolds in the absence of 'choosing' as such. In this sense, it is not the case that gambling addicts are beyond choice but that choice itself, as formatted by machines, becomes the medium of their compulsion.

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[71] See Schüll, *Addiction by Design*, chapter 2.

[72] For a compelling model of gambling addiction as the interaction between two systems of feedback, see M. Zangeneh and E. Haydon, 'Psycho-Structural Cybernetic Model, Feedback and Problem Gambling: A New Theoretical Approach', *International Journal of Mental Health and Addiction* 1:2 [2004]: 25–31, 27); for a related cybernetic conception of addiction, see G. Bateson, *Steps to an Ecology of the Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology* (New York: Ballantine, 1972), 448, 109.

'I was addicted to making decisions in an unmessy way', former video poker addict Sharon remarks, 'to engaging in something where *I knew what the outcome would be*'. As she told me, 'Most people define gambling as pure chance, where you don't know the outcome. But I do know: either I'm going to *win*, or I'm going to *lose*. [...] So it isn't really a gamble at all—in fact, it's one of the few places I'm certain about anything.' In his 1902 essay, 'The Gambling Impulse', the psychologist Clemens France similarly observed that 'a longing for the firm conviction of assurance for safety' underlies all gambling:

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[73] In 1984, Turkle made a similar observation of video games, noting that they 'appeal because there are rules, a program, structure; play is structured according to an 'either/or' scheme that simplifies life' (S. Turkle, *The Second Self*: Computers and the Human Spirit [New York: Simon and Schuster, 1984], 5, 13). One of the game players she spoke with told her: 'You know what you are supposed to do. There's no external confusion, there's no conflicting goals, there's none of the complexities that the rest of the world is filled with. It's so simple. You either get through this little maze so that the creature doesn't swallow you up or you don't.'

> The uncertain state is desired and entered upon, but ever with the denouement focal in mind. In fact, *so strong is the passion for the conviction of certainty that one is impelled again and again to enter upon the uncertain in order to put one's safety to the test.* [...] Thus, paradoxical as it may sound, gambling is a struggle for the certain and sure, *i.e.* the feeling of certainty. It is not merely a desire for uncertainty.[74]

Gamblers' 'struggle for the certain and sure'—or for the 'certain rapid resolution of an uncertain outcome', as Goffman put it—is compounded by the technology of machine gambling.[75] What machine gamblers seek is an insulated zone of reliability, safety, and affective calm that removes them from the discontinuity and volatility they experience in their social, financial, and personal lives. Aspects of life central to contemporary capitalism and the service economy—competitive exchange between individuals, money as the chief symbol or form of this exchange, and the market-based temporal framework within which it is conducted and by which its value is measured—are suspended in machine gambling. The activity distills these aspects of life into their elementary forms (namely, risk-based interaction, actuarial economic thinking, and compressed, elastic time) and applies them to a course of action formatted in such a way that they cease to serve as tools for self-enterprise and instead serve as the means to continue play. The process of distillation and suspension amounts to '*a mutation that is totally immanent to late capitalism*', as Tiziana Terranova has written of a similar phenomenon; 'not so much a break as an intensification, and therefore a mutation, of a widespread cultural economic logic'.[76]

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[74] C. J. France, 'The Gambling Impulse', *American Journal of Psychology* 13 (1902), 364–407: 397; emphasis mine.

[75] E. Goffman, 'Fun in Games', 261.

In this mutation, the suspension of the actuarial imperative is never entirely complete. This incompleteness is reflected in the ambivalence that gamblers express toward the 'choices' they face while gambling, describing them as at once emancipatory and entrapping, annihilatory and capacitating, reassuring and demonic. Lola, the buffet waitress, speaks of 'resting in the machine', then later in her narrative describes video poker's relentless stream of card choosing as commanding—the activity 'hooks', 'holds', and 'captures' her attention. '*You have no choice* but to concentrate on the screen', remarks Julie, 'you simply cannot think about anything except which cards *you are going to choose* to keep and which *you are going to choose* to discard'. Even as gambling addicts in the zone strive for release from the procession of choices they face in their daily lives, they remain caught in the predicaments of the enterprising self.

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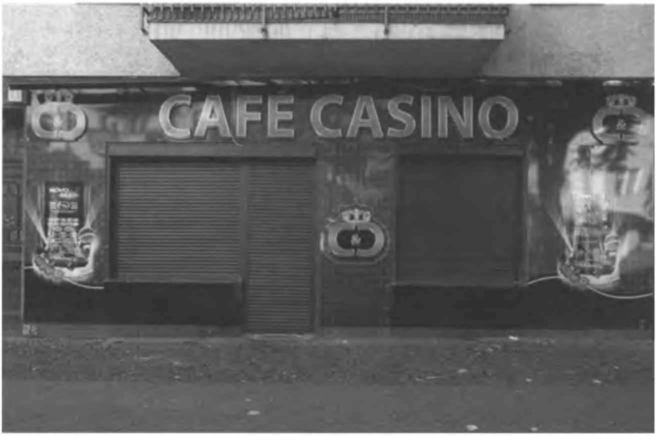
[76] T. Terranova, 'Free Labor: Producing Culture for the Digital Economy', *Social Text* 18:8 (2000), 33–58: 54.

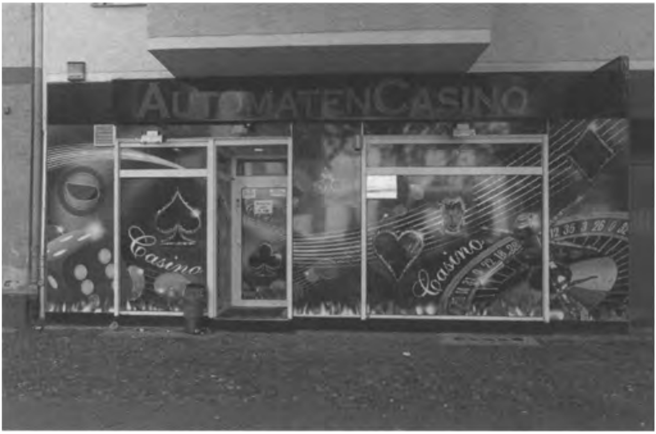
A Guide to the Casino Architecture of Wedding

Jaspar Joseph-Lester

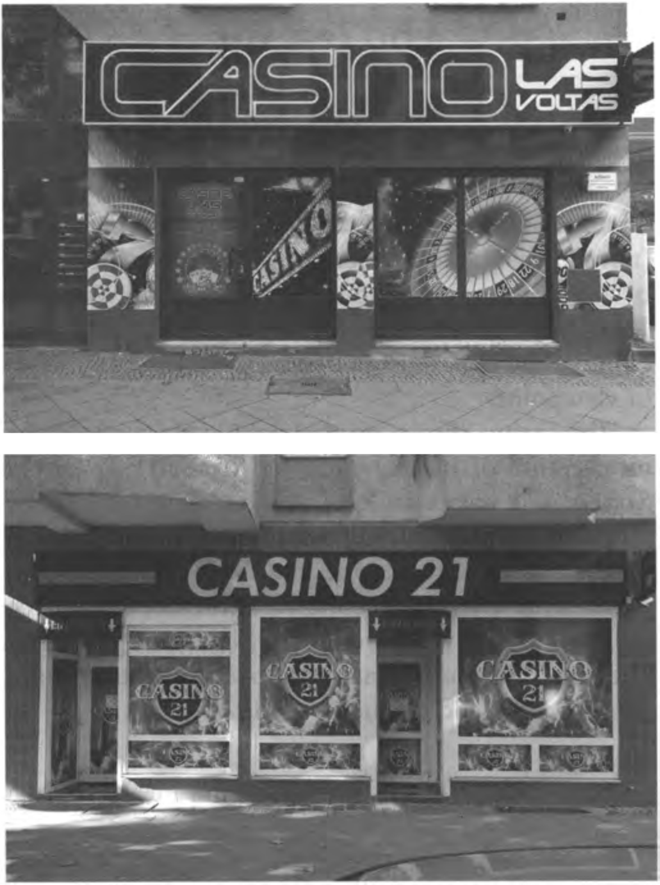
Berlin's Wedding casinos can be found on most of the main streets and many of the side streets that connect this predominantly Turkish district to the rest of the city. Popular gaming streets include Badstraße, Müller Straße, Reinichendorfer Straße, and Schweden Straße. The architecture of Wedding casinos involves a broad range of exteriors, each evolving as a direct response to the particular demands of the gaming industry in this area of Berlin. The following examples are categorized according to similarities in location (side street, main street, corner and first floor casinos) graphics (colour range and printed image) and the positioning of the entrance (centre entrance, side entrance and corner entrance).

The main street casino shown opposite is situated on Reinichendorfer Straße and is perhaps most closely related to Robert Venturi's notion of 'the decorated shed', which he used to describe a certain category of Las Vegas Casino. However, this familiar mode of casino architecture is uncommon in the Wedding district. Set apart from the residential apartments that stand behind the casino, the building stands as a detached autonomous structure. During the day, the general dimensions of the interior are made visible by the exposed end wall and low roof. The graphics are plain, but extend across the full width of the façade. At night, the neon lighting transforms the outer appearance of this main street casino, so that only the front is visible, and the shed-like structure of the rest of the building fades into the darkness.


CAFE CASINO


AUTOMATENCASINO
Casino
Casino

Smaller casinos can be found on many of the side streets of Wedding. These gaming houses are located in small shop units, and use brightly coloured graphics to decorate the windows, doors and surrounding areas of the façade; normally printed on vinyl sheets that can be easily attached to the window area.


CASINO
LAS
VOLTAS
CASINO
CASINO 21
CASINO
21
CASINO
21
CASINO
21

Side street casinos often have small projecting balconies above the main signage—conveniently providing shelter for customers who like to smoke between games. The close proximity to residential apartment blocks forces a sharp contrast between the brightly coloured signage of the casino and the mute tones of the apartment blocks above.

Casinos situated on the corner of two adjoining streets (normally with the main entrance placed on the corner of the building) are popular throughout Wedding. These frontages are normally larger than the side street casinos, and benefit from being visible from a number of viewpoints.

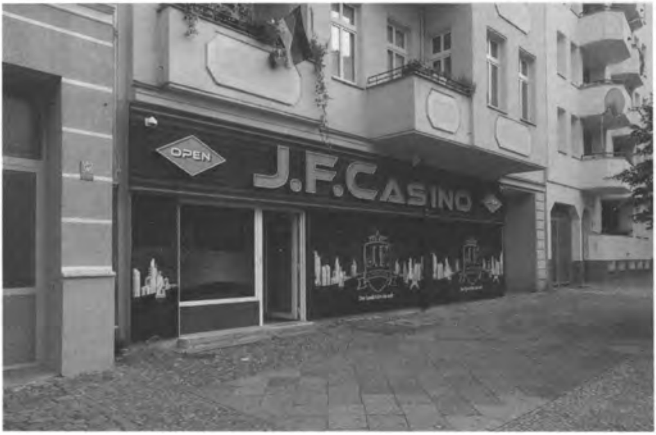
The casino shown on the right is situated on the intersection of Reinichendorfer Straße and Gericht Straße. The larger scale of this building reflects the size of the streets it faces onto. The main entrance is on the corner of the casino and faces two pedestrian crossroads. The heavy concrete structure above the casino is used as a VIP lounge for high stake gambling. The small mirrored-glass windows indicate a more sophisticated and exclusive mode of gaming.

CASINO
MM
CASINO

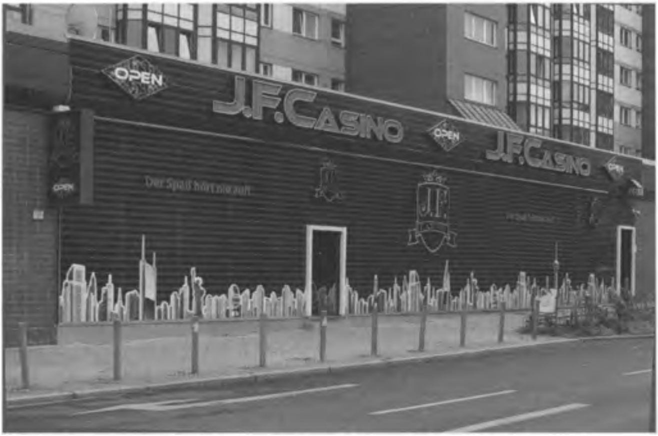
LAS VEGAS

AUTOMATENCASINO
AUTOMATEN CASINO
AUTOMATEN

23h CASINO open
CASINO
CASINO 21
CASINO
Stromstra



The distinctive blue frontage of the J.F. Casinos can be found on both the side streets and main streets of the Wedding district. The two examples shown here illustrate some of the main structural differences that have already been highlighted between side and main street casinos. The image above shows a side street casino integrated into the apartment building; it is situated in a shop unit and has small balconies projecting over the signage. The J.F. Casino shown on the right has all the structural features of a main street casino; set apart from the large apartment blocks behind, the long rectangular building consists of a simple low-rise structure. Like the Las Vegas 'decorated shed', this casino is designed to be seen from a car.



City skylines are a popular graphic motif for many of Berlin's Wedding casinos. The most common reproduction is of the Las Vegas Strip (see next page). Here, images of the megahotel casino resorts that line the Strip are illuminated against a dark desert sky. In the J.F. Casino shown above, the skyline consists of a montage of skyscrapers set against a backdrop of blue glazed bricks. On the right side of the entrance, the Berlin TV Tower hovers above the other tall buildings. These cutouts extend to the recess leading to the main entrance and across the doors of the casino. The side street J.F. Casino (left) uses the shop windows to show silhouettes of classical architectural motifs.

one
CASINO

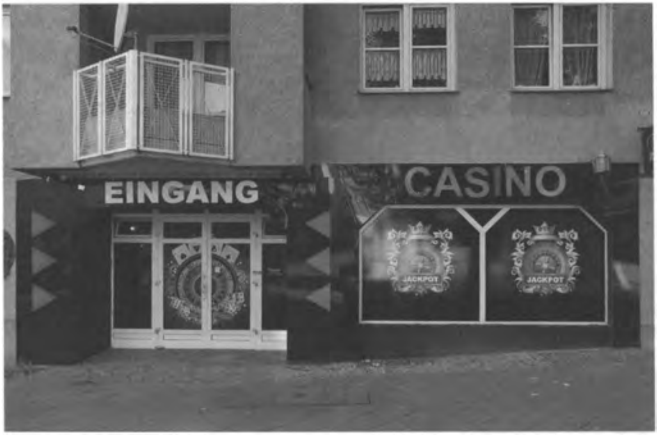
Mo - Fr
7 - 14h

First-floor casinos can be found above commercial units or inside local shopping centres. The architecture of these casinos often includes a large entrance onto the street. Access to the street is maximized through the use of signage and escalators. As with the other casinos in Wedding, the windows of the first floor (shown on the right) are blocked out with bright graphics printed on large vinyl sheets, only here the white window frames and yellow brick of the surrounding walls are left to blend in with the rest of the building.

The first floor casino shown on the right also illustrates some of the problems and difficulties that other businesses may endure when sharing signage with casinos based above street level. Here the Shell sign is set directly against an image of a slanting Eiffel Tower—creating a novel contrast to the rational design of most petrol stations. The entrance walls surrounding the stairwell soon become the most visible (and therefore most valuable) part of the building.

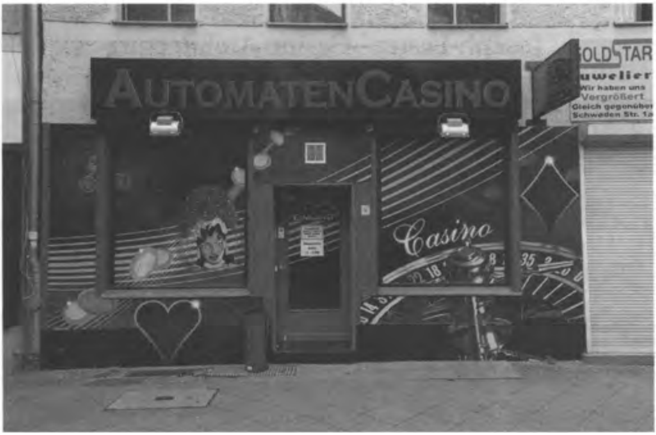
Eines von
Berlins grössten
Casinos
CASINO
CASINO
OPEN

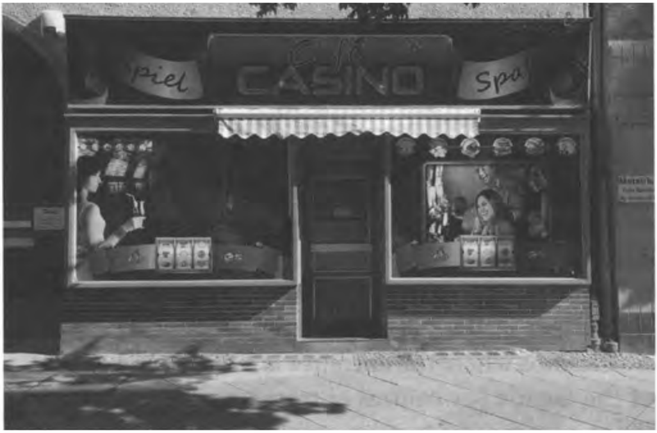
CASINO
23 H OPEN
24 STUNDEN OPEN
LAGUNA



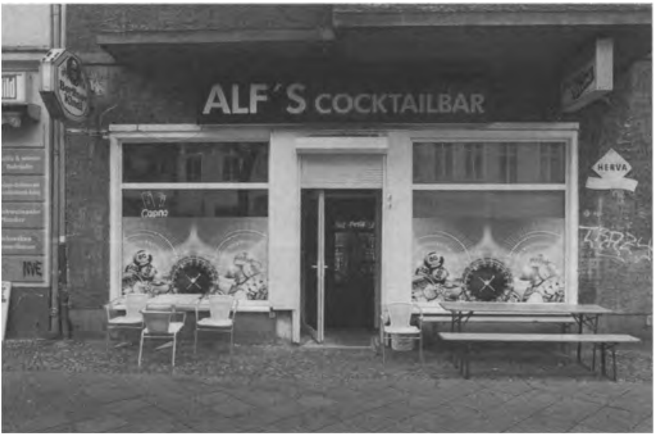
Black-fronted casinos can be found on many of the side streets of Wedding. A heavy black background is combined with red or white graphics to create strong contrasts and striking imagery. In daylight hours, the dark exteriors stand out against the lighter tones of their residential surroundings, creating a forceful and sometimes intimidating presence.

Casinos where the entrance is situated in the centre of the façade (or central entrance casinos as they are more commonly known, see following pages) are less imposing and more informal than other gaming establishments in Wedding. On occasion it is possible to find tables and chairs welcomingly arranged outside; casino signs may also include 'café', 'cocktail bar' or 'sports bar' in the signage, and the window displays are not always entirely blocked out with casino graphics.


AutomatenCasino
Casino
OLDSTAR
uwelier
Wir haben uns
Vergrößert
Gleich gegenüber
Schweden Str. 1a


piel
Café
CASINO
Spa

In contrast to their opaque counterparts, the central entrance casino will normally have small areas in the front window display for the passing customer to see the interior from the street. This more transparent mode of Wedding casino architecture shows consideration for timid customers who might not otherwise enter the premises.


ALF´S COCKTAILBAR
HERVA
Casino

SPORT
CASINO
EINGANG

With larger central entrance casinos (see over page) the window display may show images of interiors (in this case taken from Las Vegas). Here the interior worlds of the entertainment industry are externalized through a coalescence of image and architecture.

CASINO
Neueröffnung

CAS NO

From Blackjack to Monanism

Interview with David Walsh

David Walsh is the founder of the Museum of Old and New Art [Mona] in Hobart, Tasmania, a unique art museum funded by Walsh from the proceeds of a successful career developing and applying sophisticated techniques for beating the odds in pari-mutuel betting.

Walsh dropped out of his Mathematics and Computing course at University of Tasmania after he discovered card-counting, began to visit a nearby casino. His interest in gambling grew, and he went on to develop mathematical models for sports betting together with collaborator Zeljko Ranogajec. 'Z' is a notoriously reclusive counterpart to the publicity-friendly, eccentric, and gleefully vulgarian Walsh (a self-described 'rich wanker'): while Ranogajec has resolutely stayed out of the public eye, Walsh gained increasing notoriety after his 1995 purchase of the Moorilla vineyard, on a peninsula in the Derwent river, where he subsequently built the 'un-museum' Mona: a lavishly appointed, *9500m² sprawling underground cabinet of curiosities, art, and antiquities, presented with no concessions to the polite sophistication and blithe elitism of white walls and ruminative label texts (although its custom-built iPod audioguide, the 'O', does offer an 'artwank' option...). Packed with Walsh's own choice of objects, from antique statuary to work by contemporary artists such as Anselm Kiefer, Damien Hirst, Chris Ofili, and many lesser-known names, Mona (which Walsh has called a 'subversive adult Disneyland') has little truck with standard art-world expectations—visitors can expect to take a thirty-minute catamaran ride from Hobart to a Bond-villain lair where they will get some sublime thrills and be rudely confronted with Big Questions.*

Mona opened in 2011, with the costs of the project finally exceeding $AUS 200 million, while at the same time Walsh was placed under investigation by the Australian authorities who pursued him for a large amount of backdated taxes, having decided that his gambling activities had grown beyond the proportions of a non-taxable hobby.

Walsh and Ranogajec's Bank Roll, with a multi-billion dollar turnover and hundreds of full-time operatives, remains one of the largest gambling syndicates in the world, and has continued to turn a profit that has enabled Walsh to maintain and promote Mona. The un-museum now not only sits alongside a café-restaurant, luxury accommodation, and a winery, but also includes a cinerarium—an ongoing work to which keener visitors can elect to add their ashes posthumously for a price of $AUS 75,000. Mona has played

a large part in transforming Hobart, and is unchallenged as the biggest tourist attraction on the small island of Tasmania.

COLLAPSE *talked to Walsh about gambling on a grand scale, his strategies, the role of chance in life and death, and whether Mona is the biggest risk he's ever taken.*

COLLAPSE: Is there a kind of straightforward contradiction involved in being a 'professional gambler'? On one view, gambling is connected to an instinct for life, a craving to immerse oneself in chance and risk, an escape from everyday reasoning and calculation. Isn't any kind of system that seeks to gain a steady income from gambling contradictory to this instinct? How do the two go together—Dionysus and Apollo?

DAVID WALSH: I am certainly professional in at least one sense: I'm trying to subvert the gambling gold standard, which requires the punter to have a disadvantage, and thus to lose in the long run. Almost all gamblers want to win (an exception is a small class of male punters who are seeking boasting rights—their benefit is a loud declaration of their possession of fitness markers in a biological sense).

COLLAPSE: Apart from them, can the instinct for gambling be explained in evolutionary terms?

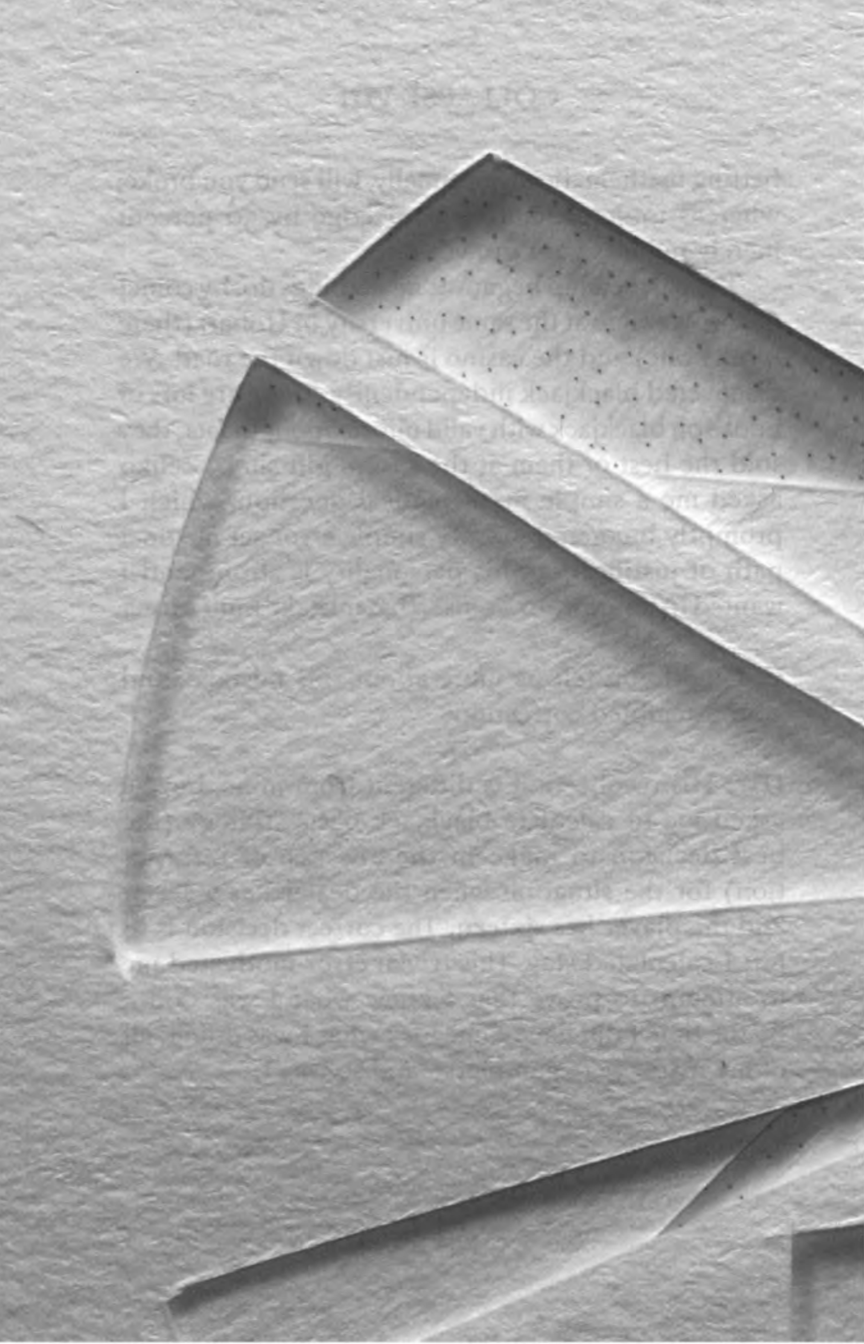
DW: The genesis of gambling is multifactorial, but key amongst those factors is the asymmetry that we benefit from in risk situations. In the savannahs in Africa a hundred thousand years ago we were on the lookout for lions. When we saw a lion that wasn't there, the loss of resource for overreacting was minuscule. On the other hand, when we didn't see a lion that was stalking us, the consequences were profound. In fact, our ancestors clearly didn't experience that unfortunate event, probably because they over-matched patterns as a safety precaution. And now, so do we. Most of the gambling risks people take have an element of rationality. A lottery ticket gives us, say, one chance in two million of winning $1 million. But $1 million is worth more than two million times the single dollar that the ticket cost. This effect is real, as is evidenced by the favourite long-shot bias in most gambling markets (the average loss for a random bet on a favourite is smaller than that for a long shot).

More speculatively, in the savannahs, and later, after the invention of agriculture, a few individuals in each band (between twenty and fifty people) could increase the chance of the band surviving times of hardship by responding in a different, more linear way, to the effects of crisis. For example, balancing the risk of migrating with staying put may not require an asymmetric response, and thus over-assessing risk may not be appropriate in such circumstances. I think we call these people nerds now—and their time has come again.

My 'professional' attitude to risk might come from the selection pressure on my remote ancestors. Or it might come from a biological or cultural pathology. Or maybe I'm just lucky.

C: You head up the consortium The Bank Roll, at the core of which is your partnership with Zeljko Ranagojec, which has lasted for some thirty years. What is the nature of the partnership: that he spots opportunities, and you work out how to exploit them mathematically? And how did it begin?

DW: He is certainly more active at spotting opportunities, but he is more active in general. He is far more risk averse than me. I tend to see opportunity, and not the hidden downsides. He, by nature, preserves our capacity to continue playing by operating as a counterpoint to my mathematical certainty. In the first year of our horse race gambling, I had overestimated our edge. We were about 80 percent likely to go broke, but we didn't, simply because we got lucky (as an interesting aside, I speculate that most people who do what we do initially overestimate their edge and don't get lucky. Their poverty is no less meritorious than our success). There is a more complex asymmetry operating here. Overestimating your edge by 100 percent, and then



betting mathematically optimally, will send you broke; whereas underestimating your edge by 50 percent merely reduces your growth rate.

The partnership began, as most things do, by coincidence. We were at the same university in Hobart (there is only one) and the casino is just down the road. We discovered blackjack independently. There are lots of books on blackjack with valid information. In fact, they sold the best of them at the casino gift shop. Zeljko asked me a simple mathematical question, which I promptly buggered up. My simple error set me on a path of justification, his personality is strong and I wanted to impress. In a sense, that mistake built Mona.

C: Could you tell us more about this mistake, and your attempted correction?

DW: His recollection is different from mine, but he asked me to calculate blackjack basic strategy (the best decision to make in the absence of information) for the situation when the dealer has a seven, and the player has sixteen. The correct decision is to hit; I calculated stay. This trivial error motivated me to attempt to prove that I knew what I was doing. By the time I did have some idea what I was doing, all of my mates were gamblers—and so was I.

[illegible] and in [illegible] would [illegible] responsible [illegible] such [illegible] of [illegible] a [illegible] physical [illegible] which [illegible] and explained. What [illegible] is taken as the domain

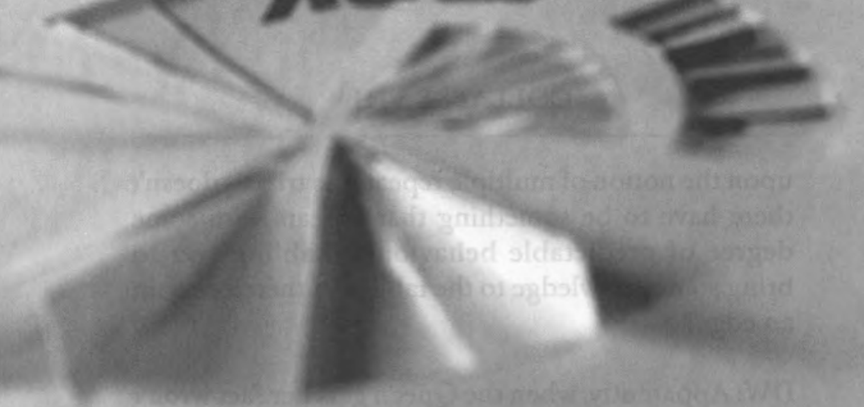
[illegible] interesting question embedded [illegible] (frequentists) struggle [illegible] unique, how can a probabil- [illegible] particle? One answer, [illegible] is the many-worlds [illegible] mechanics. Here, all the [illegible] but in different uni- [illegible] in proportion to some real [illegible] We may be, essentially, [illegible] of being in a particular universe [illegible] a probabilistic event across multiple universes. Or this might be complete crap. But it is [illegible] the probability of unique events [illegible] ever mean.

[illegible] that would only be any good to you if you had access to the other universes too... Isn't the [illegible] of calculating probability dependent

C: Nowadays your focus is sports betting, and in particular horse racing. How do you spot exploitable regularities here, since each race is a non-repeatable event, and the results are open to such a wide variety of contingencies? This is not the same as a simple physical system like a roulette wheel or fruit machine in which systemic biases can be discovered and exploited. What exactly is the 'system' that is taken as the domain of analysis?

DW: There is an interesting question embedded here that some statisticians (frequentists) struggle to answer: If an event is unique, how can a probability be assigned to each of its particles? One answer, which is emerging from physics, is the many-worlds interpretation of quantum mechanics. Here, all the events that can occur do occur, but in different universes; and they happen in proportion to some real defined probability mandate. We may be, essentially, measuring the chance of being in a particular universe that instantiates a probabilistic event across multiple universes. Or this might be complete crap. But it is clear that calculating the probability of unique events works, for whatever reason.

C: And of course that would only be any good to you if you had access to the other universes too…Isn't the very concept of calculating probability dependent



upon the notion of multiple [illegible] them, have no [illegible] understanding [illegible] degree [illegible] able behavior [illegible] bring [illegible] knowledge to the [illegible] question.

DW: Apparently when [illegible] you say, "Your Majesty, that turns out not to be the case." I feel the need to say that here. Only frequentists believe that probability depends on multiple repeatable trials. Bayesians, who dominate analysis now, understand that a probability of an event is simply a specification of one's understanding of that event (and its likelihood) based on new information. As the monarch can assess the probability of your not being dead, to be sure, but if information comes my way (a report in the paper of your cardiac arrest, say), I can modify my understanding of that probability. This despite the fact that your death is a unique event. I wouldn't necessarily be [illegible] to understand that, with a [illegible] into the mix, your probability of [illegible] associated with the chance of the [illegible] being [illegible] of [illegible] dear [illegible] reading [illegible] other [illegible] events. Yes, I can learn about the characteristics of your death by [illegible] probabilistic information about the nature of death [illegible], but our deaths [illegible] unique.

upon the notion of multiple repeatable trials—doesn't there have to be something that repeats with some degree of predictable behaviour, enabling you to bring some knowledge to the table and therefore gain an edge?

DW: Apparently, when the Queen gets her fact wrong you say, 'Your Majesty, that turns out not to be the case.' I feel the need to say that here. Only frequentists believe that probability depends on multiple repeatable trials. Bayesians, who dominate analysis now, understand that a probability of an event is simply a modification of our understanding of that event (and its likelihood), based on new information. At the moment I can assess the probability of you not being dead to be one; but if information comes my way (a report in the paper of your murder, perhaps), I can modify my understanding of that probability. This despite the fact that your death is a unique event. I wouldn't need access to those other universes to understand that, in those most similar to this one, your probability of being alive is associated with the chance of the newspapers being in error, or me having developed a reading disorder, or other unlikely events. Yes, I can learn about the characteristics of your death by co-opting probabilistic information about the nature of death in general, but our death is unique.

C: Moving away from my death and back to horse racing, though....

DW: There, all we need to do is to assess the probability of a given horse or team winning more accurately than the public. The public are extremely efficient, and the key breakthrough (and it isn't my result) is to assume that the public are right and just look for biases in their beliefs. Maybe they underrate the importance of a good jockey, or overrate a wet track. Many of these small errors can combine to make our model of the odds more accurate than theirs.

C: The 'efficiency' of the public as a whole is underrated, then? Is there a parallel here with efficient market hypotheses in economics? And despite this 'efficiency', doesn't the individual punter always lose in the long run?

DW: In a pari-mutuel, by definition most will lose because a proportion of the wagered amount is removed. This says nothing about the efficiency of the market. The arguments about efficient markets have variously vacillated from disputation about whether all the information available is contained in a market, and whether you can win. These are not the same thing. In fact, by establishing that it is possible to win with statistical certainty, all forms of the efficient market hypothesis are falsified. The public isn't perfectly efficient.

But they do produce a better model than modellers can produce if they ignore the public signal.

Ultimately, the market analogy is rather strained, because it isn't predicting an event, so much as creating it, whereas horses perform outside of the perturbations of the betting market.

C: So given the baseline of the public signal, where are the other signals coming from, the ones you are using to correct the biases? Do your people spend their days endlessly rewinding and zooming into race footage, or running high-level modelling software…?

DW: There are many horse punters who win by understanding the characteristics of the horses. That isn't our expertise, particularly. We tend to do our analysis in a way that is often termed data mining.

Opportunities are created for those who have the opportunity to approach risk linearly, because the public do not discount for all information symmetrically. It can be rational for a punter to take a disadvantage bet if he (they are usually men) needs the money he might win badly enough. There is also the input of cognitive biases. As an example, the existence of hot-hand bias is well established, even in rhesus monkeys. Hot-hand bias is a tendency to predict that an event that has recently happened is more likely (when there are human actors) than the long-term probability.

Jockeys with recent form are assumed to be likely to outperform those with long-term superiority. When Frank Dettori won every race on the program, his odds became more and more absurd as punters expected his run to continue. As it happened, it did. But punters who won money that day lost a lot more on other days when such runs did not occur. The last winner that Dettori rode that day, Fujiyama Crest, paid £3.00 when the odds at the start of the day were 13. That's a return of around 23 percent, creating opportunities for those betting on other horses in the same race. Most biases result in smaller distortions in the odds, but they can be cumulative. These things bias crowd forecasts.

Incidentally, hot-hand bias has a biological basis. Foragers that seek food randomly are outperformed by foragers that seek food where it was recently found. And, unusually for an evolutionary strategy, it has no downside in a natural environment. Foragers that seek food where it has previously been found perform equally with random foragers in an environment where food is distributed randomly.

C: What kind of apparatus does your operation involve—One man at a laptop, a distributed system, a server farm, an army of undercover punters?

DW: At various times it has been all of your suggested apparati. We tried the army of undercover punters in

Vegas betting on sports (basketball, baseball, etc.) and it was a fiasco, maybe because we didn't have an edge, or perhaps because gamblers and other people's money don't mix. These days, it's just an agency-supplied internet application that many thousands of people use, which enables our computer to bet directly with their computer.

C: What kind of mathematics is employed?

DW: The standard published technique in this domain is called multinomial logistic regression (MLR), which plays a significant role for us. Related techniques are used for forecasting survivorship (industrial, light bulbs, lifespans etc.) and traffic flows.

MLR is similar to regression analysis. The difference is that rather than forecasting a trend, it enables one to pick the probability of an event from a set of mutually exclusive events (like the winner of a race). Others do use standard regression analysis, and I did for a while. It isn't magic. Any tool, when applied with sufficient diligence, would probably work. The hardest bit is actually having an edge, rather than *thinking* you have an edge. And then, when things go bad, as they inevitably will, knowing whether the negative fluctuation is a pathology, a bug, or just the usual amount of bad luck.

We have been messing around with this stuff for thirty years now, and we have had a few ideas. Having an edge is paramount, of course, and once that has been achieved, time heals all financial wounds.

C: Is this success based on a conceptual grasp of the phenomena in question; or does it come down to the gathering of data and discovery of correlations without needing to know what they ultimately relate to?

DW: I'll illustrate the interplay between conceptual depth and analysis using the example of roulette from years ago. We did some statistics on roulette wheels at Wrest Point, the casino in Hobart. We discovered, amongst other things, that American Bingo Parlour wheels had significant deficiencies that allowed us to garner an edge. We did the analysis using chi-square, which is a law of large numbers-style technique. 27 red came up too much on all wheels. Other numbers showed biases on a subset of the wheels. The obvious question is, what physical phenomena makes the behaviour of 27 odd? One candidate is that the separators between numbers might not be placed evenly. This would result in the number adjacent to a higher frequency number coming up less often. Another possibility is that the elasticity at the base of a number might not be constant. In this case, the more elastic numbers would come up too little, and other numbers, with some specific but unknown distribution, too much. Many other possibilities exist, of course.

To do an analysis of a roulette wheel quickly (with a short sequence of numbers), hypotheses can be devised and tested that make assumptions about the embedded issues the wheel might have. Of course, given these asymmetries in the wheel, the alternative 'blind' approach would still work after having observed a sufficient number of spins.

C: We assume that your system gives you odds which are then compared against the bookies' to discover an advantage—that is, are you basically doing the same thing as the bookies but better.

DW: That's pretty well right, but mostly we bet with totalisators (pari-mutuels) since they like our action.

C: In a pari-mutuel, for a given bet type, the pool operators take out their commission and then divide the remaining pool in proportion to the amount wagered in winning tickets.

DW: That's right. The pari-mutuel's profits derive from keeping a fixed percentage of the pool, and we make the pool bigger.

C: The relation between large syndicates and pari-mutuels has been controversial. Let's put it this way: the money you used to build Mona must have come from somewhere.... In this 'market', isn't everything skewed in favour of those who already have a large bankroll? If I'm a punter betting $100 at a time on 'gut instinct' then if I lose, I lose. For you, it's a different story: The syndicate is a high-value customer, since bookies benefit from your business; accordingly you receive money back (rebates) even on your losing bets. This clearly means that you need less luck to make a profit—indeed, doesn't it almost mean that all you need is to minimize losses?

DW: As you can imagine, bookies don't like us much. When bookies take bets off winners, it is reasonable to assume that they make their money by laying off the bets into pari-mutuel pools—they depend on rebates (this applies in Australia mostly, in the UK they might lay off on Betfair, and if they can't lay off they won't take the bet). The commission is typically around a few percent (again, the UK experience is different; Betfair pays no rebates, and the pari-mutuel [tote] is so small as to be of little interest).

Rebates are volume discounts, and they do affect the way you bet. The pool operators only pay if you bet bigger. And if you bet bigger you win a smaller percentage, but on larger turnover. The trick is to bet the amount that makes you win the most. Sometimes this would be a net loss if there were no rebates, but if there were no rebates you would bet smaller and you would still win. In Australia, the market I know best, bookmakers offer a rebate on pari-mutuel odds, and they pass on most of it to the punter to solicit business. Losing punters are mostly worse off because we win in the market they bet in. It is, after all, a game where no wealth is created, like a commodities market. The exception to this is punters that lose more than average (for example, by betting on long shots). They benefit because the effect of our bets is to reposition the odds closer to where they should be, and thus to increase the odds of the worst bets. In the UK, the winner/loser dichotomy is a lot more directly expressed through betting exchanges like Betfair. Betfair should be of great interest to the efficient market economists, because it enables a punter to express negative information, to profit from knowledge about what a horse can't do. This introduces a symmetry to the market that seems to encourage a higher level of efficiency. Empirically, exchanges do result in more efficient markets. In general, if there are specific types of information that can't be expressed in a market, how can it be efficient?

Because rebates keep inefficient competition in the market, in my opinion the most skilled punters (us, hopefully) would be better off if no rebates were paid. Sometimes they create opportunity, but I am not convinced they are, for us at least, a net benefit. I like playing the game. I don't want to be a bookmaker, or a pool operator (others in our enterprise might disagree however). My brother said about me that I'd 'rather be outside the barrel pissing in, than inside the barrel pissing out'. He has been dead twenty years, but his analysis is still acute.

C: But the small punters are in effect subsidising you, since your big wins flatten out the odds?

DW: The answer is yes. It is difficult to win more than about 0.25 percent of the total market. Since bookies and pari-mutuels typically take out about twenty percent (but, for example, 50 percent in Turkey, which still turns over $US 1 billion a year) we increase the loss rate of the average punter by, at most, 1.25 percent (from 20 percent to 20.25 percent, a proportion of 1 in 80).

C: Given your description, one might even ask whether it's even 'gambling' anymore, in the sense that the risk, for you, is so tightly controlled.

DW: Before, you imputed that chance is merely lack of understanding. Aren't you here implying that chance is real, if it needs to be controlled?

If one has an edge, and can bet proportionally small enough that the cash supply won't run out, then the more trials there are, the smaller the risk becomes. Hong Kong is the biggest betting market for horse racing (measured by turnover per race), and there are only 800 races a year. It is possible to have an edge and lose for years. Of course, eventually statistical arbitrage will out, and the edge will show itself. It is these shorter-term difficulties, I suspect, that keep many out of the market.

C: Why doesn't the market correct, and therefore counteract your edge?

DW: It does. If you want to bet big, it takes quite a bit of calculation to work out something approaching the optimal bet. As I mentioned before, outcomes are asymmetric. Betting too big does more damage than betting too small. This is a big problem, because model estimation inevitably results in overestimation of advantage. In saying that, there are published strategies, at blackjack, where betting doesn't affect advantage: many use the Kelly criterion. For pari-mutuel betting, the Isaacs criterion is preferred. There is no published solution to the combined problem of betting optimally under the combined constraints of bankroll size and pari-mutuel betting. The problem of winning, in general, seems to divide into three roughly equal parts: what the odds are (or are going to be in a pari-mutuel environment); what the chance of the event occurring is; and how big to bet (which can only be greater than zero when the odds multiplied by the chance of the event is greater than one). However, there are many punters who win simply by assessing horses that they think are underestimated, without reference to the odds.

C: Of course, people are not and never have been 'rational agents', which is one reason why markets don't become absolutely efficient...however, as you say, increasingly the 'common punter' has access to a whole lot more information and can bet more intelligently. Could you expand a little more on how the scene has changed since you started betting?

DW: A market can't become efficient if there is no way to express some types of information. But if you have information, and it isn't sufficient to make you win, why expose it to market forces? In fact, in a pari-mutuel where only the final odds pertain, it seems reasonable to suggest that a rational actor will only expose information if, after it is discounted, it is still possible to have an advantage.

Markets improve in efficiency. None of the betting strategies we used twenty years ago would work now. And present day casino gamblers employ strategies that I would be unable to recognise as winning systems. I suspect, as you imply, that the average punter is constantly improving also. They need to lose at a rate that lies within their entertainment budget or they either remove themselves from the market or become a pathological gambler (who tend to progress to markets where they control the frequency of the gamble, like poker machines, and, anyway, they can't maintain indefinitely). This clearly exerts some Darwinian force on the market.

C: Presumably great changes have been wrought by the explosive growth in online betting over the last decade; what's the net effect of widespread technology and increasing connectivity?

DW: Most of the stuff we need to do has gotten easier as technology has progressed. Opportunity grows, but opposition also grows—the public improves and has access to better information. The interplay of all this stuff 'focuses the mind'. How much we change the odds is inversely proportional to the size of the pools, and technology gives the public the opportunity to bet bigger, if they want.

C: Along the way, have you had any encounters with, for example, casino game protection? Do you consider that you ever cross the line from advantage playing into cheating?

DW: I've been barred many times, in many places. My commitment level was low, I went away and didn't go back, so I avoided many of the issues that other players have experienced. Casinos, and players, have to abide by law. Cheats attempts to change the odds. Serious players bet when the advantage is in their favour, which is no more cheating than is using an umbrella only when it's raining.

C: When you made your first trip to Vegas, how did it feel to arrive there?

DW: I wallowed like a beached whale. My mental health was undone by the scream of bland. But the University of Nevada has an excellent gambling library.

C: Any eureka moments?

DW: No, as a general rule I believe that eureka moments only exist in retrospect. After my time in Vegas the most likely outcome wasn't success at gambling followed by my building a museum. But all those that could have been me but aren't, because their luck didn't hold, aren't being interviewed. The imposition of chance is camouflaged by our perspective. We can't see the ghosts of all those things that didn't happen. We can see reality, so we view the present as inevitable.

C: But chance is real, nonetheless?

DW: Chance is real in life. We are the product of hundreds of millions of generations of successful sexual matings. Each of these was slightly stacked by natural selection, but there is tremendous good fortune in having the opportunity to be born. And thus, in having the chance to die. I am, as I intimated before, tremendously lucky, not in winning with a winning system, but in alighting on a winning system in the first place, and not blowing it up between now and then.

Because of the asymmetries I mentioned earlier, we massively underestimate the part that chance plays in our lives. We invent explanations, like astrology and homeopathy, and ghosts and gods, for events that have no explanation. Chance is liberating: it respects failure and limits the merit that devolves from success.

C: When looking at favourable outcomes we certainly tend to underestimate the part played by chance—but isn't that what we do as rational beings, i.e. try to find a reason (as stated in its purest form in Leibniz's Principle of Sufficient Reason). Don't we just say 'chance' when we have insufficient information?

DW: Emphatically, no. Leibniz didn't have the tools to know better, although that might have been his fault, because he was a contemporary of Fermat and Pascal, who first started to penetrate the fog of certainty. Daniel Bernoulli soon after, and Thomas Bayes, gave us the methods to understand that reality is in large part the application of happenstance. God does play dice. And as the quantum world should by now have made everyone aware, 'he rolls them where they can't be seen'. More recently, Claude Shannon showed that, mathematically, insufficient information is equivalent to chance. The information that would satisfy Leibniz's principle doesn't exist in this universe.

C: We understand you're a reader of Dostoyevsky, a writer who depicts marvellously the combination of abandonment to chance and the feverish need to predicate some kind of systematic organisation. Observing the spontaneous fantasies of order which the gambler fabricates while playing, he wonders: 'Is it really not possible to touch a gaming table without immediately being infected with superstition?'.

The 'liberating' aspect of chance you mentioned seems to be just that: chance without superstition. To bring in another Dostoyevskyian theme, once chance is stripped bare like this, doesn't nihilism loom...?

DW: I have come to believe that their are a number of pathologies acting within compulsive gamblers, and many express only one. Dostoyevsky characterised the opposite of hot-hand bias, the doctrine of maturity of chance, which seems to be applied specifically to mechanical systems. Humans engage streaks, nature abhors them. He writes about it beautifully because he lived it. 'Chance without superstition' expresses my contrary belief very well.

Nihilism lies in the negation of reality. Reality has been shown, to my satisfaction, to be redolent with randomness. Reality is what it is, not what we want it to be. To quote myself, from my autobiography,[1] 'Propositions don't accrue merit in proportion to their desirability.'

C: Of course, Dostoyevsky wrote the novella to pay off his own gambling debts…

DW: …and he died penniless, but had 40,000 mourners at his funeral. His reality was not at all satisfactory.

C: So do you still enjoy the simple thrills of gambling?

DW: I enjoy the thrill of scheming and dreaming, but not as much as I used to. I juggle many balls, and I have dropped most of them, not out of disinterest, but inability.

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[1] D. Walsh, *A Bone of Fact* (Hobart: Mona, 2014).

C: Have you ever been tempted to dabble in the fields of, for example, currency or futures markets? Is what you do comparable?

DW: Those systems are of a type known as arbitrage, which essentially guarantee a profit for the knowledgeable dopester. We are gambling, and thus can always have bad luck, and good luck. The market is interesting, as is the insurance world. We might get there one day.

C: Are the moral implications different?

DW: Derivative wagering and tote wagering don't produce any wealth. I don't build anything, or otherwise do anyone any good when I gamble; nor do hedge fund managers who don't participate in stocks. It is incumbent on me to do something worthwhile, if I make money. I hope that Mona, and some of the other things I do, at least partially fill that moral void.

C: What relation is there between gambling and your interest in art as an art-lover and collector? There is obviously the fact of art's relatively indeterminate value, which makes it a risk-laden asset; but presumably that's not the whole story.

DW: Art, for me, is a tool for learning about my surroundings, as is science. Art, however, is imprecise but wideband. It occupies all the senses, plus reason and emotion. Science is narrowband, but precise. They are complementary, but of course there are many crossovers. My education isn't the measure of the art, but it is a measure of its value to me. And much of the art I buy would have no such value to anyone else. It is possible to construct a value for art mathematically, but the market is illiquid, and it would mean overcoming a vicious cost structure, and buying a whole bunch of shit.

C: Do you have a specific idea of how one might approach this? There have been a few attempts, but only quite recently, to model the art market. There are major barriers in terms of transparency. And also, there are no rebates!

DW: Wrong again—actually, the big buyers and sellers do enjoy preferential rates at auction houses.

The art market lacks two essential elements for it to be an exploitable market. They are: low transaction costs (for everybody, so that the market exposes information); and high liquidity (so you don't get stuck with art that you want to sell but can't). I occasionally fantasize about correcting these issues by buying an auction house and introducing a fixed cost model.

Charles Saatchi's online art dealing, if it works, might impact the nature of the art market.

C: Maybe this is the right point at which to discuss the work you devised together with French artist Christian Boltanski. You bought the rights to transmit live footage of his Paris studio to Tasmania, but the terms of payment are based upon an eight-year period elapsing before his death—so if he lives beyond 73 you end up paying over the odds. It sounds like it could be the start of a great thriller screenplay.

DW: It's a beat up. I couldn't pay for a work, so I offered him a time payment plan. In his retelling, I'm a gambling devil who never loses, living on a farm surrounded by wild animals. In reality I'm a gambling angel (who doesn't believe in angels) who often loses, and who lives in a small city surrounded by wild, and not so wild, people. Within that small city there is Mona, and people come and go and seem to like it. And there are art works, and many reify philosophy, including Boltanski's. We show his life, live from his studio, and because lives are a lot less interesting watched than experienced, it is great art in inverse proportion to how tedious it is. And it is very tedious indeed.

C: You opened Mona in 2011, it's a labyrinthine underground complex cut out of the rock that's almost twice the size of the Guggenheim, filled with an eclectic selection of artworks, and has put a previously unassuming Tasmanian suburb on the map. Was Mona also a gamble, or is it something you did when gambling was no longer enough?

DW: Mona is a ship afloat on a sea of chance. It shows the power of uncertainty, and gradualism, and it rails against compartmentalization, that thing that allows you to lie to yourself. And, occasionally, you can see through the cracks what beauty is.

C: What about the idea of artworks themselves representing some kind of risk for their audience—that somehow encounters with art would endanger our everyday relation to the world and open us up to something larger? There's at least one work in the Mona collection that does seem to represent a real physical risk: Kurt Henschlager's *Zee*, which comprises a great deal of strobe and pulse lighting and disorienting sound, and has apparently caused a seizure or two.

DW: *Zee* caused about one percent of people to see the world in a very different way indeed! However, for the most part, any new insight into reality is a positive thing. We can only learn what we don't know.

Mona deals with some big themes, but it also might be an entertainment, and training wheels for public museums.

C: Indeed, Mona's exhibits seem to revolve around the great themes of human life, sex, death, eating and shitting. Is gambling another of these primal things? When we started talking you placed it straight away in the context of evolutionary psychology. It's a perennial force, not just as a recreational activity but in terms of the whole destiny of Western society, based on risk taking and (mis)adventure.

DW: Mona revolves around motivations including, importantly, why we make art. Artists are cultural machines, of course, but they are also possessors of biological imperatives. I am not an artist but I share many of those imperatives, including, perhaps, a desire to show off. Gambling, as I said before, is a result of mismatched benefits from engaging risks, and of this perturbing the human brain over evolutionary time. We need risk takers to avail us of new opportunities, but in terms of the individual, risk taking is not an interesting or useful thing, except, occasionally, when there is a sexual asymmetry. Men gain more from risk taking because stupid behaviour might impress the ladies. Opening museums might be exactly that kind of stupid behaviour.

Dice-like and Distributed: Time Machines, Space Engines and the Enactment of Risk Markets[1]

Anders Kristian Munk

> *As soon as we begin to talk indeterminism to our friends, we find a number of them shaking their heads. This notion of alternative possibility, they say, this admission that any one of several things may come to pass, is, after all, only a roundabout name for chance; and chance is something the notion of which no sane mind can for an instant tolerate in the world. What is it, they ask, but barefaced crazy unreason, the negation of intelligibility and law? And if the slightest particle of it exists anywhere, what is to prevent the whole fabric from falling together, the stars from going out, and chaos from recommencing her topsy-turvy reign?*
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> WILLIAM JAMES[2]

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[1] I would like to thank Robin Mackay for his help in preparing and editing this essay, which summarizes a number of arguments from my thesis *Risking the Flood: Cartographies of Things to Come* (University of Oxford, 2010).

[2] W. James, *Essays on Faith and Morals* (New York: Longmans, Green & Co., 1943), 153.

> *The need to accurately predict both groundwater and surface water flash floods—the latter firmly linked to drainage capacity—was heightened after last summer's catastrophe. In response, mapping technology specialists have announced developments over recent months to help overcome these 'black holes' in insurers' knowledge. But whether these advances could be described as the 'Holy Grail' is doubtful. With the UK's drains in various states of repair, and no adequate data on their current condition available, insurers will always face uncertainty. In addition, there is the impact of climate change and the omission of small rivers and streams on existing Environment Agency data—despite their ability to result in nasty incidents.*[3]

> *Maps are not prescriptive but infinitely promising.*[4]

In November 1884 the American psychologist and philosopher William James addressed students at Harvard on 'the dilemma of determinism': Is 'free will' genuinely free, or is everything given in advance? Refreshingly, the answer was of little interest. James made it quite clear from the outset of his lecture that he was not going to offer any solution or provide any settlement to an ancient intellectual tussle between those professing the predetermined state of the universe and those contesting it.[5] 'Facts', he proclaimed, 'have hardly anything to do with making us either determinists or indeterminists' since it is impossible to see how 'any amount of assurance that something actually happened [can] give us the least grain of information as whether another thing might or might not have happened in its place'.[6] To James, the existence of alternative possibilities was a matter of rational belief, not of proof, and hence his interest in determinism was of an altogether different sort than that of the usual protagonists debating its veracity. Rather than attempting to prove (or disprove) the contention 'that any one of several things may come to pass' he tried to understand how these things-to-come must, and positively can, exist beyond proof and verifiable evidence. When I now propose to explore how floods are risked, this schism between actual fact and credible possibility is fundamental: what I am after are the more-than-factual ways in which eventualities are brought to life.

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[3] *Post* Magazine, 21 February 2008.

[4] J. Corner, 'The Agency of Mapping: Speculation, Critique and Invention', in D. Cosgrove (ed.), *Mappings* (London: Reaktion, 1999), 213–253: 235.

I deliberately frame it as a 'more', rather than a 'less', since I am not interested in reiterating any linear conception of uncertainty as simply incomplete or second-rate knowledge. On the contrary, it seems to me, at least in the context of flood risk, that the realisation of alternative possibilities involves the mobilisation of things which can be positively ascertained as facts. Crucially, of course, it is not reducible to these things, but neither is it short of them. It requires a leap of faith beyond them, something more than what they have to offer. In the empiricist style of thought championed by James, such instances of 'belief' are not construed as negatives or surrogates in the absence of more robust and justifiable ways of knowing. Rather, they are understood to be at the root of what it means to know at all. To illustrate this point James used the metaphor of 'live' and 'dead' electric wires and proposed to define a live hypothesis as 'one which appeals as a real possibility to him to whom it is proposed' ('belief') and to measure this 'liveness' by such a person's 'willingness to act'.[7] Indeed, the evolving plethora of possible future floods circulating the public domain under the auspices of forecasts, maps and models displays a considerable degree of 'liveness' if gauged using this method. It has 'practical consequences';[8] it makes a difference.

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[5] The discussion dates back to the presocratic philosopher Epicurus who tried, to no avail, to reconcile Democritus's idea of a world made from atoms falling through the void with the notion of human freedom (I. Prigogine and I. Stengers, *The End of Certainty: Time, Chaos, and the New Laws of Nature* [New York: The Free Press, 1997]).

[6] James, *Essays on Faith*, 152.

Essentially, then, the question I am trying to ask relates to the 'liveness' of indeterminacy itself.

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[7] W. James, *The Will to Believe and Other Essays in Popular Philosophy and Human Immortality* (Mineola, NY: Dover. 1956), 2–3.

[8] W. James, *Writings 1902–1910* (New York: The Library of America. 1987), 506.

How it takes place; how it eventuates. While it might be impossible to factually ground its implicit contention that things could have been otherwise than what has observably taken place, it is nonetheless a claim with a noticeable purchase on reality as we know it. In a world in which risk has become instrumental to the analysis, anticipation and management of everything from mundane accident to cosmological disaster[9] and is seized upon as a sign of the times, the mould in which contemporary modernity crystallizes,[10] it seems evident that indeterminacy has made its mark—with or without the assistance of proof. But with the assistance of what, then, has such a construction acquired its integrity? What generator sparks the current; what conductive material makes the wiring go live?

Prompted by these curiosities, and with the risking of floods in mind, I am interested in the emergence of believable ('live') eventualities. How can things to come have real effects without actually coming to pass? How, that is, can they attain reality without confirming their premonitions (which would deprive them of their ambivalence and make them more than merely possible); and, equally importantly, how can they maintain their indeterminable futurity without becoming themselves indeterminable (which would fundamentally obscure their realisation)? The critical point, which James kept stressing, is that in between the two extremes of the deterministic argument rehearsed above—in between the absolutes of intelligible law and topsy-turvy chaos—the indeterminist seems able to construct an altogether orderly universe which leaves room for chance without dissolving into perplexing disarray:

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[9] E.g. J. Adams, *Risk* (Abingdon: Routledge, 2001), R.A. Posner, *Catastrophe: Risk and Response* (Oxford: Oxford University Press, 2004), M. Power, *The Risk Management of Everything: Rethinking the Politics of Uncertainty* (London: Demos. 2004), N Bostrom and M. Cirkovic (eds.), *Global Catastrophic Risks* (Oxford: Oxford University Press, 2008).

[10] E.g. U. Beck, *Risk Society: Towards a New Modernity* (London: Sage, 1992), *Ecological Politics in an Age of Risk* (Cambridge: Polity Press, 1999), *World at Risk* (Cambridge: Polity, 2009), A. Giddens, *Modernity and Self-Identity in the Late Modern Age* (Cambridge: Polity Press, 1991); 'Living in Post-Traditional Society', in U. Beck, A. Giddens and S. Lash (eds.), *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order* (Oxford: Polity Press), 56–110; *The Politics of Climate Change* (Cambridge: Polity, 2009).

> The creator himself would not need to know all the details of actuality until they came; and at any time his own view of the world would be a view partly of facts and partly of possibilities, exactly as ours is now. Of one thing, however, he might be certain: and that is that his world was safe, and that no matter how much it might zigzag he could surely bring it home at last.[11]

It is implied that indeterminacy is not simply a 'want of determinateness or definiteness' (as the Oxford English Dictionary has it); it is not just an absence of something, but a particular type of presence which effectuates, and is effectuated by, an equally particular mix of actuality and possibility. Flood risk embodies such a mix: some things are known as facts (floods have been observed; weather patterns have been recorded; terrains have been mapped; flows have been theorised; defences have been designed; vulnerabilities have been located; policies have been adopted; and regulations have been put in place), while some (other?) things are known as possibilities (future floods and weather patterns are imagined; alternative maps and theories are proposed; the effects of policies and regulations are pondered; and vulnerabilities and defence strategies are reassessed accordingly). There is a very fine line separating what might possibly come to pass from what has actually taken place here, and they are frequently stirred into hybrid coexistence. At the end of the day, however, whether for the benefit of the work of political, scientific or commercial construction, flood risk is a platform to build on. Although it is concerned with potential catastrophe, and although it embodies something inherently indeterminable, it provides a distinct alternative to the paralysing absence of certainty: it reassures us, in the words of James, that the world is 'safe'. Not safe from being flooded, of course, but from being abysmally unintelligible.

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[11] James, *Essays in Faith*, 183.

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> **[i17]** Did he tell you that water can even flow uphill?
> **[AKM]** He didn't, but that sounds interesting...
> **[i17]** As a practical insurance person, however, I have a piece of advice for you: if you're standing on a hillside and there's a flood coming, I would still run uphill rather than downhill.

Canary Wharf, June 2008: It is a sunny afternoon and the business crowd has taken over the outdoor areas along the waterfront. I am here to talk to flood insurance specialists in this financial hotspot spawning from the City of London, well away from the academic offices and engineering laboratories where physical flood modelling takes place.[12] Insurance has been a core component of the business carried out here since the German Kaiser invaded Italy in the first half of the thirteenth century and the fleeing merchants resettled in Lombard Street. Banned from entering the existing guilds, the Lombards made it their trade to lend out money at interest and brought with them from the harbours of Venice and Genoa a taste for funding risky mercantile adventures at sea.[13] With the late medieval commercial revolution, that combination merged into the modern concept of marine underwriting where risk

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12. For my account of physical flood modelling, see 'Emancipating Nature: What the Flood Apprentice Learned from a Modelling Tutorial', in K. Harstrup and M. Skrydstrup (eds.), *The Social Life of Climate Change Models: Anticipating Nature* (London: Routledge, 2012).

13. F. Martin, *The History of Lloyd's and of Marine Insurance in Great Britain*. (London: Macmillan. 1876).

is transferred to a third party in return for a premium.[14] Insurance and finance were then and are now kindred practices of the monetary system, a duo rarely as palpably present as on the banks of the Thames.

Making possible futures into a profitable business involves making flooding answer to questions of likelihood and cost, a process in which a different set of calculative tools than those native to hydrology must be mobilised. What is essentially at stake is the spatiotemporal formation of these eventualities, the way in which they are correlated and distributed, and indeed the way in which it becomes possible to contemplate their futurity without invoking the type of prediction or foresight that would ruin both the fundamentally unrealised and undetermined character of risk as well as the gamble of trading it: insurance. This will in the first instance bring home James's point that indeterminacy goes live through a cocktail of determinable fact and believable possibility, and suggest that one way in which that ordered universe materialises is through a process called catastrophe modelling. But it will also leave me stranded in a rather unresolved state of affairs in which the cartography of things to come seems both readily at hand and oddly out of view.

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[14] F.E.D. Roover, *Early Examples of Marine Insurance. The Journal of Economic History* 5:2 (1945), 172–200.

FROM DETERMINABLE TO PROBABLE

In the offices of the Financial Services Authority (FSA) the man in front of me, a former reinsurance professional (i17), recalls a job he did for a newly privatised Polish insurer back in the 1990s:

> **[i17]** There were no flood models for Poland. But they still had to decide how they were going to quantify the risk. If they get the number too low, then they're not adequately protected against the size of event they might have at a certain level of probability. If they get the number too high, then they pay out huge amounts of unnecessary reinsurance premium which affects their profitability and their competitive position. And there's no model. So how do they decide what to do?
> **[akm]** Did they have a loss record?
> **[i17]** No. There's no data, they have only been in business for a few years. This is why the earthquake people have it easy: in many countries you've got 2,000 years of good data on seismic losses. On flood, really there was very little that was helpful. So we sat down with them and talked about the kind of loss event they thought they might have, where it might happen, what might cause it; and over the course of the conversation we were able to get from them that they felt that probably 1 year in 5 they would pay a certain number of claims related to flood.

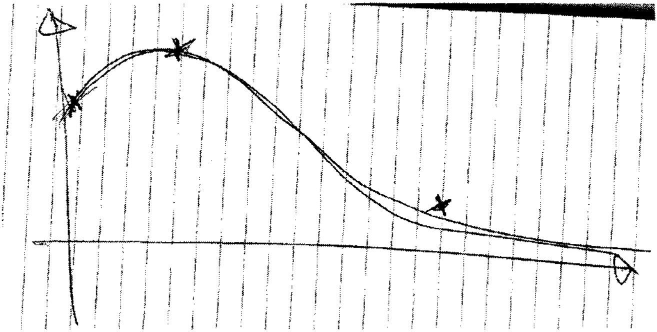

Figure 1. i17's drawing in my field diary. Y-axis: probability; X-axis: number of flood events within a given period of time

There was maybe only a 5 percent or 1 year in 20 chance of paying out so many claims costing so much, and they felt that realistically the highest amount they were likely ever to have to pay from a flood event, given the area where they had most of their business and so on, was a certain amount. And that effectively gave us—you won't get this on tape but I'll draw it for you—it effectively gave us three points...and with three data points you can draw a distribution—I can do it now freehand...something like that—that's not the best way of doing it of course, the best way to do it is to use somebody who knows what they are doing: somebody who knows what shape a flood distribution might have—because different perils have different distributions with different shapes. It's probability of the event and the cost of the loss, and

> in the end there's a limit as to how hard the wind can blow, there's a limit to where the water can go and all the rest of it. So if we agree that it really can't be worse than a certain point we imagine that is as bad as it gets, the 1 in 500, and if we agreed the 1 in 5 and the 1 in 10, and if someone clever like [former colleague of i17] knows the shape of a flood distribution, they fit the shape of the distribution that they understand to be for flood risk to those assumptions, and you can effectively pack that into a form of probabilistic flood model. Now, it's exceptionally imperfect, it's not based on the hazard and the vulnerability and all the rest of it, it's based on conversation; but it's a lot better than guesswork, it's a lot better than nothing.

Two notions of uncertainty or probability are at play here: one pertains to the imperfection arising from the lack of data, the other to an assumed property of the future. The first notion is epistemic and has to do with credibility: it 'arises from imperfect information and knowledge, which is potentially reducible through data acquisition'.[15] This kind of uncertainty is at the root of the Polish insurer's problems where it is acknowledged that, had there been a flood model for Poland, and had historical data been available, the situation could have looked a lot different. The key point is the provisional character of uncertainty: it is taken to mean a mendable and thus passing incompleteness of knowledge. The second notion, however, the one which is expressed in ii7's diagram, is irreducible and cannot be done away with. It constitutes the other half of what Ian Hacking calls the Janus-face of probability,[16] namely that which depends on chance. And because this kind of uncertainty is precisely not construed as epistemic—probability referring here not to the likelihood of being right or wrong but to the likely outcome of a game of chance—it offers itself as an explorable property of the future. There was no model, no data, no loss record, yet the risk facing the Polish insurer could still be contemplated because other characteristics were recognised as being known.

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[15] G. Woo, *The Mathematics of Natural Catastrophes* (London: Imperial College Press, 1999), 74.

Central here are the graphic qualities of ii7's diagram. Rather than a mere reflection of what is already there, it brings something new to the table. It looks like flooding, even when nothing else does. In a manner similar to the way in which flood models claim to represent the flow of water across land, the curve drawn by ii7 seems to model something which is determinably 'out there'. What it looks like, of course, is not the extent of an inundation, but the distribution of events over time. And in a manner similar to flood models, the curve seems to be capable of projecting this resemblance into the future by transforming correspondence to what has been into assumed correspondence with what will come. It thus possesses related fictitious capacities, but what it brings into being is distinctly different from the possible and plausible futures fashioned in a piece of predictive hydrological software like HEC-RAS.[17] By introducing chance it imbues indeterminability, although in an ordered manner, to what would otherwise have become a merely deterministic exercise.

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[16] I. Hacking, *The Emergence of Probability: A Philosophical Study of Early Ideas About Probability Induction and Statistical Inference* (Cambridge: Cambridge University Press, second edition, 1975), chapter 2.

This diagram is not my first encounter with chance. I have seen these curves before, in other offices in London, have met people who 'know what shape a flood distribution might have'. These people are not exactly flood modellers, at least not in the hydrological sense, nevertheless they model floods. Their worlds—this seems to be the crucial point of difference—are not assembled around water. Rather, the phenomena they model take the form of events, binaries which can either happen or not happen, and the world in which they eventuate is ultimately assembled around the flip of a coin or the throw of a die. Employed in the reinsurance sector or by the large catastrophe modelling companies, they are in the business of providing the insurance market with an indispensable component of the risk traded: correlated sets of possible futures. Though far more sophisticated than the probability distribution drawn by my informant at the FSA, these futures share one of its most useful characteristics: they too are ‘a lot better than guesswork’. That might appear banal. After all, if something based entirely on a conversation is better than guesswork, then it would seem reasonable to think that a state-of-the-art catastrophe model, comprising, as they do, loss records as well as the full spectrum of available hydraulic, hydrological and meteorological data, would also be. But be that as it may, it does not make it any less noteworthy that, when it comes to the future, we seem to have moved beyond guesswork. That capacity neither springs out of nowhere, nor out of a conversation, nor out of a body of flood-related knowledge. Possible future floods are brought into being through what I call the fictitious capacity of hydraulic computer models. The ability to navigate these futures, however, choosing between them, weighing them against each other, comes from somewhere else. It springs from the cultivating powers harnessed in devices such as probability density functions, capable of equipping the future with a set of knowable properties—those of a game of chance—which can subsequently be explored. Julius Caesar allegedly proclaimed that ‘the die is cast’ (‘alea iacta est’) when he crossed the Rubicon back into Italy in defiance of the Roman Senate. There was no flood model for Poland, yet in recognising that a decision needed to be taken, the insurers turned to a knowable property of the future. The dice game, it was understood, was on.

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[17] See http://www.hec.usace.army.mil/software/hec-ras/.

Insurers acquire a stake in flooding when they buy up risk from homeowners and businesses in flood prone areas. In the first instance that risk is taken on by a primary insurer who will, in principle, price the transaction like any other actuarial job: the fair price should equal the average loss on the portfolio. It is a statistical rather than a hydrological exercise, provided that records are available from which to derive the average. This, however, is far from always being the case, and in recent years several primary insurers have enlisted the assistance of hydraulic modellers to supplement their actuarial risk assessments. A prominent example is Norwich Union's £5m project 'Next Map', which entered service in 2004 and became a much publicized affair after allegations that it would lead to reductions in coverage. It was not the first of its kind (in 2002, for example, Royal and Sun Alliance released their Geographical Risk Analysis system) but it was the first to assess flood risk on address rather than postcode level, a project which necessitated the commissioning of an airborne survey to produce a new digital terrain model with an improved vertical resolution of 50cm for the South of England and 1m for the rest of the country.[18] Where other insurance companies had relied on data supplied by the Environment Agency, Norwich Union became the first company to seriously challenge this hegemony (although some insurers, like the internet based Esure, had also acquired additional imagery to supplement the EA data). But while Norwich Union publicly claimed (and indeed this is the impression I got from informants who worked on the project) that more accurate flood maps would allow them to take on more business in postcodes which would otherwise be deemed too high risk, and to lower premiums on individual properties which would otherwise have had to accept the same policy as potentially more exposed neighbours, there was widespread public fear that it would lead to redlined properties in otherwise acceptable postcodes, and make it even more difficult to get insurance cover for homeowners who had already experienced difficulties. Norwich Union announced that existing customers could expect to have their policies affected (positively or negatively) as the flood map was being rolled out and new information was becoming available (this was done gradually starting with high risk areas such as Norfolk and Shropshire where the 2000 floods had produced heavy losses), and fears were exacerbated when the Environment Agency later that year updated its own flood maps.

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[18] D. Crichton, *Flood Risk and Insurance in England and Wales: Are there Lessons to be Learned from Scotland?* (Befield Hazard Research Center, 2005).

Address-level flood tools are now commonplace in the insurance industry either in the form of actual maps or simply databases matching each property with a flood risk assessment which will normally be in a red-amber-green traffic light format. Because of the way home insurance policies are sold in the UK, where 68 percent of the transactions take place through a third party such as a broker or a building society,[19] this relatively simple format is required. In a situation where a broker is trying to get a quote for a client from several competing insurers, for example, a traffic light flood risk tool will be able to quickly tell whether or not the property would be refused, accepted or referred to further assessment. RBS Insurance has acquired such a tool (tellingly called Addressology), so has Lloyd's, and Royal and Sun Alliance's Geographical Risk Analysis system is now not only capable of address-level flood risk assessments but has also been modified to take drainage problems and surface water flooding into account. While address-level assessments have become commonplace in the industry, the focus is now on incorporating these types of non-fluvial flooding which have increasingly taken over the agenda and in consequence, the procurement of more and better EA data in this area has been made part of the latest revision of the Statement of Principles on the Provision of Flood Insurance.[20] Whether delivered directly to a primary insurer or supplied through the EA, however, the production of these tools is located outside the industry with external flood modelling consultancies like Halcrow, HR Wallingford or JBA (who did the Norwich Union flood map).

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[19] ABI, *UK Insurance—Key Facts.*

[20] ABI, *ABI/Government Statement on Flooding and Insurance.*

There is thus no doubt that the transfer of flood risk into the insurance community invokes an appetite for flood science in the City. But, as I17 suggests, this appetite is subordinate to the practicality of insurance, which is essentially about harnessing chance. Like all actuarial enterprises, choosing to run uphill well knowing that, in theory, so could the water, involves an estimation of likelihood. Insurance is conditioned by the presence of a perceived hazard, something that is thought possible, and can be understood as the gamble that such a possibility will not be realised. There are two operations at play here: one is about acknowledging the possibility, the other is about making it answer to the question of likelihood. It is only with these two moves that the substantive definition of risk as a combined measure of frequency and severity acquires meaning.

Tracking the transfer of risk through the insurance industry offers a prism through which we can start to contemplate how flooding answers to the question of likelihood. Effectively it is a nonsensical question without some sort of spatiotemporal definition. The inquiry must, implicitly or explicitly, be made for a where and a when, and as the transfer of risk progresses, those definitions do not remain constant. Neither does the question of likelihood and, notably, nor does the expertise enlisted for the risk assessment.

As shown in ii7's diagram, primary insurers are not the termini of the transfer but rather the intermediaries. In turn they will seek to become policyholders themselves and take out reinsurance for the contingency that they should face insolvency and be unable to pay out claims. The space-time of this transaction is fundamentally different to that of the address-level risk assessments defining the transaction between homeowner and primary insurer. To the homeowner, likelihood is a question pertaining to an individual property within a highly variable and often unspecified period of ownership. How likely is it that floodwater will ever (as long as ownership is retained) come in to the house? Initially that is more or less what the primary insurer wants to know as well—except that time is now specified by the duration of the policy (there is a difference between buying a property in an area where floods occur on average every fifty years, and having to insure that property for one year only). However, more acute differences materialise when the primary insurer needs to take out reinsurance. Essentially these derive from the scale and the character of the contract. To the reinsurer, likelihood is a question pertaining to entire portfolios and a particular subset of floods: those capable—on their own or in conjunction—of bankrupting policyholders. The question is not spatially limited to one place with one temporal horizon; rather it is a bifurcating inquiry in which multiple likelihoods must be correlated in aggregate space-times. The possibility that floodwater will enter a property must be considered together with the possibility that other properties will be affected at the same time. And the possibility of such an event must be considered together with the possibility of other events occurring in the period specified by the policy. This probabilistic complexity is normally produced through a process called catastrophe modelling.

CATASTROPHE MODELS

In 1992 Hurricane Andrew generated insured losses worth $15.5 billion as it made landfall in the United States. This figure was unprecedented, and when a relatively unknown consultancy, Applied Insurance Research (AIR), made an estimate in excess of $13 billion some days before, nobody believed them. The estimate was based on what became known as catastrophe modelling, and it paved the way for the uptake of this new kind of expertise in the insurance sector.[21] Today it is not uncommon for reinsurance companies such as Swiss Re, Hannover Re or Munich Re and major brokers such as Benfield, Willis or Guy Carpenter to employ their own catastrophe modellers, but the global market for vendor models is still dominated by three specialised suppliers: AIR, RMS and EQUECAT. Founded between 1987 and 1994, they emerged as a branch of the GIS revolution fuelled by increased computing power in the late 1980s and early 1990s. The purpose of their models is to estimate losses. In contrast to the determinism found in their hydraulic counterparts, the enterprise is probabilistic:

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[21] GIRO, *Report of the Catastrophe Modelling Working Party*, 33 (London: The Actuarial Profession, 2006).

> [...] catastrophe modelling is not an attempt to predict when a disaster might occur, but a process that allows users to create a meaningful distribution of future events so that associated expected and extreme loss patterns can be developed. This allows exposed parties to gain an understanding of their risks and how they may be financially impacted under different scenarios.[22]

This does not mean that physical or deterministic science has no place in catastrophe modelling. On the contrary: non-actuarial forms of expertise are incorporated at several stages of the process (see figure 2, opposite). The basic operation of a cat model depends on a stochastic catalogue of disasters, an extensive database of 'real world events that could happen', as one of my informants put it.

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[22] E. Banks, *Catastrophic Risk: Analysis and Management* (New York: John Wiley & Sons. 2005).

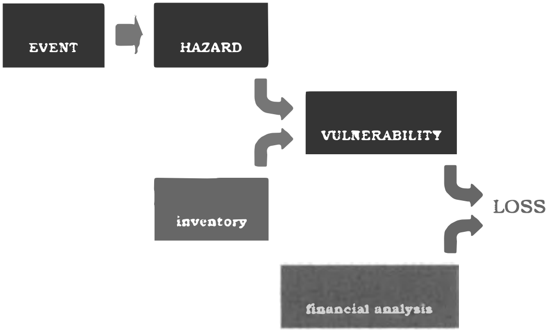

Figure 2. The process of catastrophe modelling (adapted from GIRO, *Report of the Catastrophe Modelling Working Party* 33 (London: The Actuarial Profession, 2006).

The phrasing is illustrative: 'real world' means neither that they have actually happened, nor that they ever will; it means simply that they are possible. They could happen. It is not determined whether, when or where they would. To ensure this reality-as-possibility, deterministic expertise is enlisted. Seismology for earthquakes, hydrology for floods, meteorology for hurricanes, and so forth—the task is to come up with 'events that could happen'. In a similar manner, expertise is needed to turn those events into hazards and to specify how they would cause damage (by working out water levels or wind speeds, for example). Together the event and hazard modules produce scenarios which can then be linked to the user's inventory of insured assets in order to determine their vulnerability and to estimate a loss. Finally a financial analysis is carried out based on a database of policy conditions also supplied by the user (this could be information about excesses or terms of coverage) and the insured loss is estimated.

It might thus be clear that the appetite for deterministic flood science is sustained throughout the process of risk transferral, although the inquiries exciting such an appetite alter. But it is equally clear that the imperatives demanding its implication are not native to the hydrological disciplines. The pressing question is no longer how a flood happens, but how likely it is to happen and how costly it is going to be. As an informant in the City rhetorically asked me: “Risk is a quantity that’s being measured in pounds in this country, right?” Whereas this is no doubt true for the financial sector, and arguably also for politics, hydraulic models output water levels in feet, not in sterling; they do not model costs. Yet the risk of incurring costs is exactly what is transferred to a third party in a policy for flood cover (and indeed, this focus on costs can sidetrack hydrological considerations to the extent that banks acting as both mortgage lenders and insurers will prefer to provide cover for a property, which could thus be made mortgageable, if the expected income on the loan is deemed to be worth more than the expected losses on the policy). Catastrophe models make no demands on the end-user to geometrize or hydrograph anything. The work has already been done and is embedded in the software as scenarios. Rather they exact monetization (understood here as the process of enabling things to express themselves in monetary values) and spatiotemporal definition. For the model to model, it needs information about assets, their location, and the period within which a possible loss might occur. It must, in other words, know the space-time and the stake of the gamble. What I want to argue is that not only does risk, as an entity measured in pounds, require a particular kind of geography, it actually brings this geography about through practices such as catastrophe modelling.

THE FUTURE IS A GAME OF CHANCE

It is commonly held that Blaise Pascal and Pierre de Fermat, the French mathematicians credited with the invention of the probability calculus, were prompted to their pioneering correspondence in 1654 by a gamester, the Chevalier de Méré, seeking the assistance of Pascal in determining the proper course of action in a game of dice.[23] Probability theory germinated out of an interest in the aleatory contracts already pervasive in gambling, and while the influence of the Chevalier himself is sometimes questioned,[24] the importance of his passion, games of chance, is not. It provided the terms in which the idea of probability was first formulated, and it continues to constitute the core logic around which probabilities are assembled. Knowing what shape a flood distribution might have is tantamount to being able to imagine flooding as a game of chance: something which has dice-like properties. The proliferation of the term 'aleatory', that which depends on the throw of a die (alea), is not limited to the world of wagers and gambles. It is, for instance, commonly found in juristic works concerned with the equity of chance-dependent contracts in fields like marine insurance and life annuities, and 'it is perhaps not surprising' as Keith Michael Baker notes,[25] 'that the calculus of probabilities, once elaborated in terms of games of chance, was quickly seized upon as potentially applicable to those probabilities in the social world for which the jurists had prepared the field'. This is a fundamental insight when asking how flooding can be made to answer to the question of likelihood: it might have everything to do with likelihood itself, and not a lot to do with flooding in particular. The interesting question is really by what means floods come to be seen as instances of chance, rather than the other way around.

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[23] F.N. David, *Games, Gods and Gambling: A History of Probability and Statistical Ideas* (London: Griffin. 1962), chapter 9.

[24] Compare David, *Games, Gods and Gambling* with O. Ore, 'Pascal and the Invention of Probability Theory', *American Mathematical Monthly* 67:5 (1960), 409–19.

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[25] K.M. Baker, *Condorcet: From Natural Philosophy to Social Mathematics* (Chicago: University of Chicago Press. 1975), 157.

Quite a few authors have written extensively on the history of probability,[26] and while they all acknowledge the pivotal importance of Renaissance and Enlightenment mathematics, many of them also devote some introductory time to the fact that the probability trail runs out somewhere in the archaeological excavations of Assyria and Egypt. This is not to say that there is any evidence that the ancients had a mathematical concept of things like frequencies or stochastic processes (although examples from the Talmud might to some extent be an exception),[27] but the proliferation of dice and dice-like devices for probing the future seems ubiquitous across human history and culture. It suggests that the future was a game of chance long before mathematicians figured out a way of properly theorising that game. It was, for example, not uncommon for the oracles in Greece and Asia Minor to use astragali (an early form of die made from ungulate heel bones) to derive the omens of the gods. Similar usage of randomizers for the purpose of divination has been observed in a number of African tribes, and among Tibetan monks for predicting the coming stages of reincarnation.[28] To the extent that the future is a game of chance, the difference between an oracle and a probabilistic model is the difference between a game decided by divine intervention and a game evolving in accordance with stochastic principles. In both cases, the aleatory character of the game suffices to bring the future beyond guesswork since a constituent element of such a future—namely the random one—is implicitly acknowledged, randomness being here the notion of multiplicity or outcomes to choose between—something quite different from chaos. It is important to note this: randomness is an ironed-out kind of time in which there is no overlap between outcomes. The die will be either 3 or 5, not both at once. It is not pure chaos. In exploring that randomness, whether as the mouthpiece of the gods or as a domain of mathematics, the future is cultivated. It highlights a tension between the deterministic claims to knowledge implicit in physical hydrological modelling and the probabilistic assemblage of flooding described above: in asserting that the future, and thereby a possible future flood, has the properties of a game of chance, one is also asserting that the particulars of flooding are, to an extent, secondary. Essential to this relationship is the plurality lost in the word ‘future’. It should in fact be many futures, or sets of possible futures, each of them more or less hydrological elaborate (very elaborate in the case of catastrophe models; not elaborate at all in the case of the Polish insurer having to buy reinsurance without flood models or loss records to go on), but all of them outcomes of the same kind of game, bound together by their allegiance to an aggregated probability of 1:1. The future, in its many possible manifestations, resides in the area under the curve of figure 1, with its square measure containing the totality of potential. Outside it there can be nothing, inside it the inevitability of one eventual future must be shared among a not yet realised multiplicity and break down into probabilities. But how does that kind of futurity, with its stochastic imperatives, amalgamate with the flood phenomena produced by hydrologists and their deterministic models? In his analysis of creativity Henri Bergson contemplates foreseeability and its limitations:

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[26] Hacking, *Emergence of Probability*; David, *Games, Gods and Gambling*; Baker, *Condorcet*; examples include I. Todhunter, *A History of the Mathematical Theory of Probability from the Time of Pascal to That of Laplace* (London: Macmillan, 1865), D. MacKenzie, *Statistics in Britain 1865–1930: The Social Construction of Scientific Knowledge* (Edinburgh: Edinburgh University Press. 1981), L. Daston, *Classical Probability in the Enlightenment* (Princeton NJ: Princeton University Press, 1988).

[27] A.M. Hasofer, 'Random mechanisms in Talmudic literature', *Biometrika* 54 (1967), 316–21, N.L. Rabinovitch, 'Studies in the History of Probability and Statistics XXII: Probability in the Talmud', *Biometrika* 56:2 (1969), 437–41.

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[28] David, *Games, Gods and Gambling*, chapter 1.

> Of the future, only that is foreseen which is like the past or can be made up again with elements like those of the past. Such is the case with astronomical, physical or chemical facts, with all facts which form part of a system in which elements supposed to be unchanging are merely put together, in which the only changes are changes of position, in which there is no theoretical absurdity in imagining that things are restored to their place [...] But an original situation, how can such a situation be given before it is actually produced?[29]

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[29] H. Bergson, *Creative Evolution* (London: Random House, 1944), 33.

This attendance to originality implies Bergson's argument that the future is, in a radical sense, unforeseeable. Yet some things, the facts, those fabricated to a standard which does not permit displacements between positions to affect their makeup, the 'immutable and combinable mobiles',[30] are nonetheless foreseen. Their mobility is temporal as well as spatial and it is assumed that they will be as immutable tomorrow as they were yesterday. The role of physical flood science in the process of catastrophe modelling is to provide the immutable and combinable raw materials for what is essentially the construction of a die. The catastrophe modelling company I worked with, for example, produced scenarios for each 50-metre grid cell in the UK. They modelled precipitation, hydrology and hydraulic routing to produce about 45,000 flood events, each with an average rate or frequency. These could then be treated stochastically as possible outcomes of random processes (i.e. games involving a 45,000-sided die) to assess the probability of having any number of events in a given area in a fiscal year for example. Probability theory does not transmute as it moves from games of dice to flooding, the rules remain the same. Rather, it is flooding which must become dice-like. The focus is on finding the common aleatory denominator, that which makes flooding no different from any other gamble.

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[30] B. Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Milton Keynes: Open University Press, 1987).

It is not the particularities of water and flow, but the crosscutting ways in which things eventuate that orchestrate this futurity.

SAME DICE GAME, DIFFERENT COLOGNE: FLOODS, BOMBS AND HORSE KICKS

Vienna, April 2009: In the vast poster exhibition at the General Assembly of the European Geosciences Union I run across a hurricane specialist employed by one of the big catastrophe modelling companies. He has a windstorm simulation running on a laptop and he is very pleased with the way it has turned out. It models the original nicely. As there was no organised systematic tracking of hurricanes in the Mexican Gulf back in the 1960s when the actual event occurred, it is hard to tell whether the simulation is taking the right route or not. What was recorded was the amount of precipitation it produced over the United States, and that is what is accurately reproduced by the model. I am curious to know how that is satisfying to a catastrophe modeller. A real event is simulated, but how does that predict anything? I am looking at it in the wrong way, he tells me. It is not about predictions. It is not about the truth in the sense of knowing with exactitude what is going to happen. Rather it is about the possible, about generating events that could happen. Rainy futures to be, tens of thousands of them, evoked as a first step in modelling the catastrophic.

Bergson is echoed here: a contemplatable future must be made out of immutable and combinable building blocks, which is what the windstorm model is churning out. There is a spectrum between radical unforeseeability and prediction (the future as truth) kept open by aleatory uncertainty which, in the words of Woo, 'cannot be reduced through advances in theoretical or observational science'.[31] In Bergson it is clear that this kind of futurity is a halfway point at which a limited foreseeability is brought about by enforcing immutability and combinability at the expense of originality and creativity. This is why it makes sense to say that the future is cultivated or colonised. What is still eluding the account, however, is the organising principle: even when the building blocks have been successfully churned out there is no sign of foresight, however limited. Aleatority, it seems, must first be summoned in the set of possible events.

A year earlier I am in London talking to the head of flood risk (i11) in the very same catastrophe modelling company:

> **[akm]** So I suppose you would need some data to decide how to footprint these scenarios– how is that done?
> **[i11]** That might take a little longer to explain. How much do you know about statistics?

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[31] Woo, *Mathematics of Natural Catastrophes*, 74.

The response of my informant is prompt and the awkward feeling that we might have reached the limits of what can be explained in the course of an interview sneaks up. I try to be honest:

> **[akm]** Not a lot.
> **[i11]** That will take some time then, because the standard of catastrophe modelling is about understanding return periods.

At this point in my fieldwork I am still very much tuned in on the hydrologic aspects of flood modelling and it takes me slightly by surprise that statistics and return periods, rather than the intricacies of some shallow water equation, should constitute what needs to be understood about catastrophe modelling. I have come to talk to a flood specialist, but judging from his preoccupation with statistics he does not really fit my bill of what a flood specialist should be like. I have heard about return periods before, but I have never thought about them as complicated or problematic. One of the first things I did when I came to Oxford was to feed my postcode to the Environment Agency's online flood map to see the extent of a 1 in 100 and a 1 in 1,000 year flood zone. What I got, in other words, was return periods. Each year there is a certain chance of experiencing a flood, or in more professional terms taken from the Flood Estimation Handbook: 'The return period T of a flood is a measure of its rarity, defined as the average interval between occurrences of floods that exceed it'.[32] It seems relatively straightforward and I am not quite sure why he is laying this out as a complicated statistical problem that will take some time to explain. As we continue our conversation it becomes clearer what it is that I need to understand about these seemingly straightforward average intervals and their limitations:

> **[ii1]** If you look at the EA maps they just give you the 100- or 200-year flood zone for example, it's not going to tell you anything, it's not going to flood a 100 year everywhere at the same time.
> **[akm]** I am trying to fit two ends here. When I talk to insurers or the ABI about modelling, what they say is not that different from what you could find on the EA website for example: they talk about return periods as well...
> **[ii1]** But that's quite different, right? [...] The EA flood maps, which are largely derived from modelling, what do they really tell you? They tell you, for each location, whether you're in or outside of a flood zone with a certain return period. [...] It tells you statistically the average waiting time between two years that I will be flooded with any flood height. It could be 5m, it could be 10cm, it could be 1mm. [...] Second thing:

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[32] A. Robson and D. Reed, *Flood Estimation Handbook 3: Statistical Procedures for Flood Frequency Estimation* (Wallingford: Institute of Hydrology, 1999), 64.

> the EA flood maps don't give you information about the correlation of two different houses. So if you have two different houses in one river basin and they are, let's say, 10 km apart, what is the probability that both of them will flood at the same time? Because, as an insurer, you need to know that.

The last point is the key here: *as an insurer*. From the homeowner's perspective the flood height might be of interest but the correlation is certainly not. Indeed it does not really matter whether it floods everywhere at the same time or not, the important thing is whether or not there is flood water in the living room. The space-time of the gamble is in other words markedly different, and that difference can be measured in pounds: the homeowner risks the value of the property; the insurer risks the value of the entire insured portfolio. Catastrophe modelling is a way of taking this difference into account. And to do that flooding must answer a more aggregate and multiplex question of likelihood than the spatiotemporally simple return period. My informant goes on to exemplify:

> Take how many hurricanes you have in any given year. All you can say is: what's my distribution of hurricanes in, let's say, 100 years, and then you just go through it and say, what's my probability of having zero hurricanes? What's my probability of having 1, 2, 3, 4, 5

> up to whatever, 20, and when you do that analysis you find out that they are approximately Poisson distributed, that's if they're independent. Then you can argue, with hurricanes for example, that if the sea surface temperature in the Atlantic is higher, then there's a higher probability, so they cluster more. So if you have a year when they are higher they are actually much higher, and if you have a year when they are lower they are actually much lower. Then you get a slightly different distribution that's called, for example, a negative binomial distribution. That's a Poisson distribution with a rate that's Gamma distributed. So there are all these distributions around that, which you need to understand in order to come up with event sets that you put finally in the software.

Indeed, the same debate about independence is valid for flooding, where the 2007 events showed evidence that the first inundations left the ground so saturated that the later ones were much more prone to happen. But whether the distribution ends up looking like the Poisson or the negative binomial is in principle less important here. What is vital to the aleatority of event-sets is the fact that these distributions look like floods. I am thus back at the curve drawn in my field notes by my informant at the FSA (figure 1) and the way in which it brings something to the table, something which is known about future floods even when nothing else is. In this case, a lot of other things are in fact known since a whole event set has been produced by the catastrophe modelling company, but a similar curve is still mobilised to deliver what all this available knowledge cannot: the spatiotemporal matrix needed to make flooding answer to the aggregate question of likelihood acutely important to the transaction of risk between insurers and reinsurers. It forges the simple averages of return periods into a much more complex consideration of likelihood.

The Poisson is the most commonly used derivation of the binomial distribution for exploring natural hazards in catastrophe modelling. It was first noticed by the insurance community in the 1940s when a series of papers on its potential use were presented to the Institute of Actuaries,[33] and it is telling that they had absolutely no relation to floods whatsoever.

One paper, for instance, demonstrated how the Poisson was used by military intelligence during the war to determine whether or not the Germans were able to hit anything with their v1 and v2 rockets.[34] A map grid of London revealed differences in the concentration of impacts, with a few limited areas being hit by flying bombs three times or more, while the overwhelming majority of the remaining areas were hit only once or not at all. Would that suggest that the enemy was targeting something? Since there was no way of positively confirming that the Germans were in fact able to aim their rockets, it would have to be demonstrated that the opposite was the case. And the opposite of aiming would be to leave the impact to some sort of random process. It was in other words assumed that the course of the rockets was either predetermined or a game of chance. As mentioned, the Poisson distribution is derived from the binomial distribution and thus works as a series of trials with two possible outcomes (hence the name binomial). Binomial questions could take the form: What are the odds that a flood will occur within a given number of weeks? Or in the native setting of gambling: What are the odds that *x* rolls with a die will produce a six? Each outcome has a probability (a six or not a six) and a series of trials can thus answer questions about the probability of having particular combinations of outcomes in a particular number of trials.

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[33] H.L. Seal, 'Tests of a Mortality Table Graduation', *Journal of the Institute of Actuaries* 71 (1943), 5–67. G.J. Lidstone, 'Notes on the Poisson Frequency Distribution', *Journal of the Institute of Actuaries* 71 (1943), 284–91, A. Clarke, 'An Application of the Poisson Distribution', *Journal of the Institute of Actuaries* 72 (1946), 481–2.

[34] Clarke, 'Application of the Poisson Distribution'.

What distinguishes the Poisson from the binomial distribution, however, is that the number of trials is preset to approach infinity. If a flood has a return period of 1 in 100 years, then it has a 0.01 percent chance of happening in any given year. But what about the month after it has happened? Or the next day? The return period remains the same and the chance is still 0.01 percent, so what is the chance of having 5 floods in the same year? By chopping up time or space into infinitely small bits and carrying out trials for each of them the Poisson distribution becomes very well suited to answer questions about the probability of very unlikely events happening in any given quantity, and in any given area or period of time, since the number of trials is no less infinite for a year, a minute, a postcode or a country. It is also relatively easy to handle since the only input needed is the average frequency, the mean (normally written as λ in the Poisson), which in the case of flooding translates into the return period. The resulting distribution can be seen as an expression of aleatority: what the distribution of events would be like, that is, if these events were instances of a game of chance. Figure 3 (overleaf) shows quite clearly that the clustering of impacts from German flying bombs was indeed very dice-like, and that there was thus no basis for concluding that the enemy was successfully taking aim. The characteristic shared by rocket impacts and floods is rarity. It is this, rather than any particular knowledge about the characteristics of a weapons system or the nature of an inundation, that makes them coincide with the Poisson distribution. Poisson himself published the function in a book about jurisprudence,[35] while perhaps the best known example of its application was

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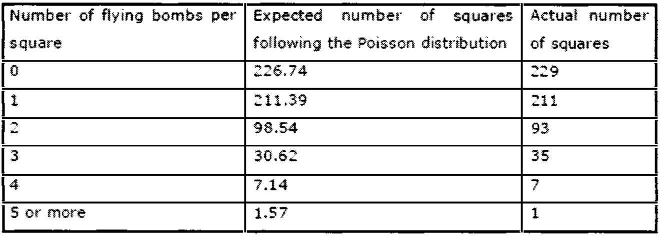
[35] S.D. Poisson, *Recherches sur la probabilité des Jugements en matière criminelle et en matière civile, precédées des règles générales dy calcul des probabilités* (Paris: Bachelier, 1837).



Number of flying bombs per square	Expected number of squares following the Poisson distribution	Actual number of squares
0	226.74	229
1	211.39	211
2	98.54	93
3	30.62	35
4	7.14	7
5 or more	1.57	1

Figure 3. Clustering of flying bombs (V1 and V2 rockets) hitting London during WWII (A. Clarke, 'An Application of the Poisson Distribution', *Journal of the Institute of Actuaries* 72 [1946], 481–2). The question here is whether or not the Germans had the ability to accurately target particular areas or not. The Poisson distribution is mobilised to show how the pattern of impacts would like if the bombings were a game of chance (i.e. indeterminable and thus not aimed). Comparing actual number of squares hit by 0, 1, 2, 3, 4 or >5 bombs clearly shows that the impacts have dice-like properties.

published by Ludwig von Bortkiewicz,[36] who applied it to the case of Prussian army officers killed after being kicked by a horse.

As long as events are deemed to happen extremely rarely, as long as the average frequency is low (like a 1 in 75-year return period flood zone for example), the specifics, that which lends itself to being deterministically known, play a secondary and somewhat arbitrary role. Figures 4 (opposite) and 5 (overleaf) show Bortkiewitcz's data on the number of officers in a Prussian army corps killed each year by horse kicks. They essentially compare two ways of knowing this phenomenon. The columns on the left side of figure 4 are populated with what has determinably taken place, while the columns

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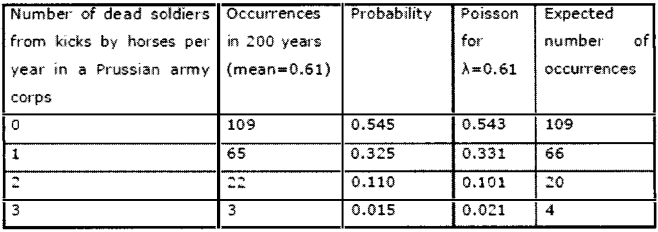
[36] L.V. Bortkiewicz, *Das Gesetz der Kleinen Zahlen* (Leipzig: Teubner, 1898).



Number of dead soldiers from kicks by horses per year in a Prussian army corps	Occurrences in 200 years (mean=0.61)	Probability	Poisson for λ=0.61	Expected number of occurrences
0	109	0.545	0.543	109
1	65	0.325	0.331	66
2	22	0.110	0.101	20
3	3	0.015	0.021	4

Figure 4. Death by the kick of a horse (L. V. Bortkeiwicz, *Das Gesetz der Kleinen Zahlen* [Leipzig: Teubner, L.V., 1898]). The second and third column shows the data for the actual occurrences and their respective probabilities. The question is this: what is the probability of having 0, 1, 2, 3 or 4 dead officers in a Prussian army corps any given year, if we know that in 200 years it has happened in *x* number of years? From this it can be derived that the average frequency is 0.61 dead officers a year, and if that mean is fed to a Poisson function it is possible to calculate what the probabilities and the expected number of dead soldiers would be if their accidents were chance-dependent.

on the right display what could be expected if these accidents were understood to be rare outcomes of a fundamentally indeterminable game. The point is that these data tables could just as well have been displaying information about floods or any other rare event. They assert that aleatory uncertainty is a property of the future, a spatiotemporal characteristic that can be recognized and explored. Knowing more about the way in which floods happen, the way in which Prussian officers work alongside their horses, or the way in which the Luftwaffe tries to guide their flying bombs across the Channel, will not make this fundamental element of chance go away. Hence, knowing what shape a flood distribution might have is tantamount to enacting an indeterminable yet somewhat ordered and intelligible space-time in which a multiplicity of possible futures is

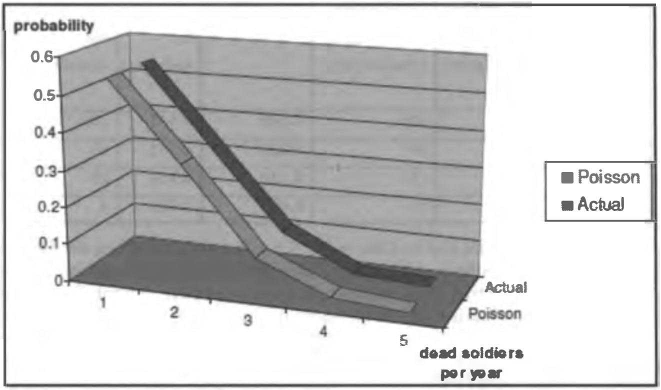


Figure 5. A plot of the data from figure 4 visualises very clearly how the Poisson distribution (with λ = 0.61) looks like the number of Prussian army officers killed after being kicked by a horse.

recognized as being irreducibly 'there'. Risk, of course, must involve some sort of speculation towards the future, but in a crucially indeterminable way. In the case of catastrophe modelling this indeterminacy is orchestrated by the Poisson distribution as it enacts a spatiotemporal matrix for thinking about future floods as the possible outcomes of a game of chance. Although the eventual result cannot be predicted, the nature of the game and its strategic challenges can still be considered. In combination, the types of modelling used in flood risk assessment today aid the becoming of dice-like constructions; large sets of possible future flood events, some of them incorporating tens of thousands of possible outcomes; randomizers which can be used to contemplate the gameplay of an indeterminable future.

THE CARTOGRAPHY OF THINGS TO COME?

> Reality flows; we flow with it; and we call true any affirmation which, in guiding us through moving reality, gives us a grip upon it and places us under more favourable conditions for acting.[37]

> There are two paradigms that govern the manner in which the multiple is thought, as Deleuze's texts indicate from very early on: the 'vital' (or 'animal') paradigm of open multiplicities (in the Bergsonian filiation) and the mathematical paradigm of sets, which can also be qualified as 'stellar' in Mallarmé's sense of the word.[38]

I am now in the potentially paradoxical and somewhat ironic situation that supposedly long since obsolete modes of inquiry seem to have delivered on my geographical impulse to contemplate the kind of space needed for an indeterminable, though far from intangible, futurity to take place. It may be that the outputs of flow simulations and catastrophe models are not very well understood as practiced versions of flood risk (the object), but how do they fare with my pledge to restore flood risk as a way of doing other things, rather than as an object of other doings? After becoming attentive to the ability of deterministic flood models not so much to determine facts (if that was their sole point they would indeed be awkwardly stuck between theory and experiment) as to imagine possibilities—and after exploring how the spatiotemporal machinery of a probability distribution like the Poisson enacts these possibilities into a plural, though far from unintelligible, futurity (reinforced against the 'topsy-turvy reign' of chaos)[39]—the question must be asked: Is this the cartography of things to come? If the answer is yes, then figure 6 might provide an in-principle sketch for how that cartographic operation would proceed. On the left, the mobility and immutability of the flood scenarios crafted through hydraulic modelling is recognized as being temporal as well as spatial. What has been invented is not only the ability to claim correspondence with what has observably taken place, but to claim that something else could happen. I have termed this the fictitious capacity of flood modelling. On the right, indeterminacy is added with the introduction of probability. In effect, that is a way of imposing some sort of order. To be immutably mobile in time is not necessarily the same as being predictive—a 1962

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[37] Bergson, *The Creative Mind*, 255.

[38] A. Badiou, *The Concept of Model: An Introduction to the Materialist Epistemology of Mathematics* (Melbourne: re.press. 2000), 3.

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[39] James, *Essays on Faith*, 153.

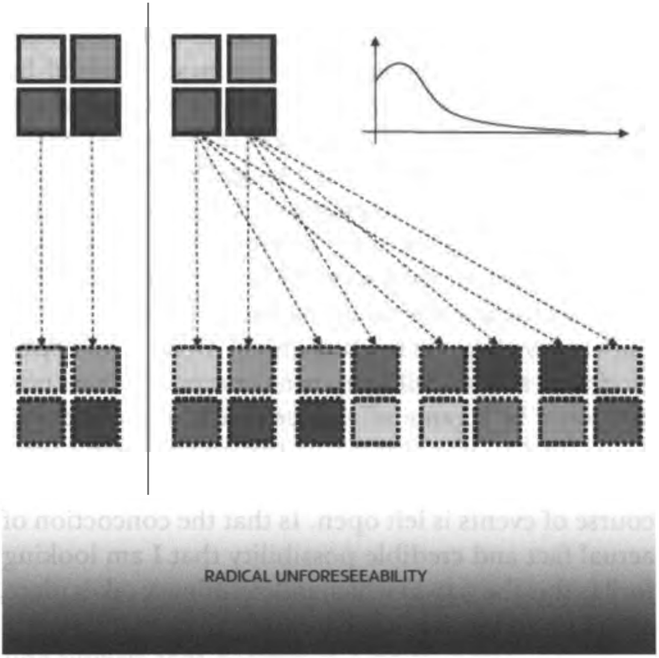

Figure 6. Is this the cartography of things to come? On the left immutable mobility is recognised as a temporal as well as a spatial property. On the right side the introduction of distributed probability allows the future to be thought of as a game of chance. In this version the evental becomes a set of eventualities, possible outcomes of the same game. This enhanced model, however, presumes an indeterminable backdrop of radical Bergsonian unforeseeability. Being, as it is, unrealised, it seems that knowing everything there is to know about the future—this is the contention of the square measure underneath the curve: there is always a 1:1 chance that one of several discrete possibilities will come to pass—contradicts futurity.

example of the term 'model' from the Journal of the Royal Statistical Society asserts that 'in order to obtain complete predictive accuracy the model would be no simpler than what was being modelled, and would not be a model'[40]—and that places the possible futures churned out by imaginative model-modellers right in the middle of the dilemma of determinism. Either these techniques are seen as predictive (which they can never be), or they serve to exacerbate unintelligibility by fueling speculations and expanding, rather than narrowing, the reign of chaos. Thus, catastrophe modeling and its ability to turn these possibilities into outcomes in a game of chance can be seen as a way of reintroducing order, a dice-like order, in which the totality of possible outcomes is known, but the actual course of events is left open. Is that the concoction of actual fact and credible possibility that I am looking for? Is this the way in which indeterminacy takes place, goes live and makes a difference?

In the introduction I suggested that risking and mapping must share a creative capacity. As James Corner pointed out in a Deleuzian vein of thought, there is a distinct difference between mere tracings of 'things which are already known' and proper maps which 'discover new worlds within past and present ones'.[41] One way of approaching figure 6 could be to ask whether this criterion has been observed: Where is the novelty? I have tried to follow Bergson in asserting that any foreseeable future must be made up of immutable mobiles;[42] that it must be combined into being using the established elements of the past. In the case of flooding, these elements are the products of hydraulic knowledge practices capable, through modelling, of creating fictive scenarios that 'could happen'. And in the case of the spatiotemporal machinery embedded in catastrophe models, the rules of the game of chance, derived from coin tossing and card gambling, are known to apply to nineteenth-century horse kicks and WWII flying bombs alike. Despite its ability to concoct an indeterminable futurity, figure 6 is constructed entirely using well known elements of the past. But something more has been made of them. What used to be elements of the past have been turned into elements of the future. This has required work; this is what models do; this is the difference they make. But figure 6 is also an expression of neatness which has become temporarily possible only over the course of this work. It is hard to deny that it does exemplify a world view made 'partly of facts and partly of possibilities';[43] a world view in which room can be left for chance without abandoning all sense of order to perplexing disarray. And it could thus be argued that figure 6 actually does demonstrate how things which have yet to take place (or not) can be accorded a geography despite their inherently unrealised character. However, this would neither be fair to the issue of flood risk, the broader ecology of which would be rendered more or less detached and inert, nor to Bergson and James, whose thinking would be gravely misrepresented in such a setup.

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[40] Quoted in the Oxford English Dictionary.

[41] J. Corner, 'The Agency of Mapping: Speculation, Critique and Invention', in D. Cosgrove (ed.), *Mappings* (London: Reaktion, 1999), 213–53: 214.

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[42] Bergson, *Creative Evolution.*

[43] James, *Essays on Faith*, 183.

To say that any foreseeable future must be made out of immutable mobiles is implicitly hinting at the other half of Bergson's argument which I have conveniently omitted above, namely the existence of a future characterized by the 'continuous creation of unforeseeable novelty';[44] a future which leaves room for creativity, for unexpected things to happen, and for the possibility of bringing something entirely new into the world. This radical unforeseeability hinges on a conception of time not simply as a fourth dimension of space, the kind of time inherent in figure 6 and the kind of time which engenders set multiplicities of the kind Badiou calls 'stellar', but as a creative force:

> Time is something. Therefore it acts. What can it be doing? Plain common sense answered: time is what hinders everything from being at once. It retards, or rather it is retardation. It must therefore, be

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[44] Bergson, *The Creative Mind*, 107.

> elaboration. Would it not then be a vehicle of creation and of choice?
>
> Would not the existence of time prove that there is indetermination in things? Would not time be that indetermination itself?[45]

What has become clear to me is that this unforeseeability not only poses a real problem to figure 6—a future made from what has already taken place will necessarily have trouble accommodating creativity—but is in fact vital to the very possibility of risk. Flooding proper, the nascent out-of-place kind, is as much part of the risking as the modelling efforts which must constantly absorb its novelty in order to reclaim that 'this could happen'. Although it is somewhat tempting to settle the enquiry here and claim that, in principle form, figure 6 provides a sketch of what it means to be risking the flood, surely it should be rewired into the 'relatively unnamed stages' of 'thickness, concreteness, and individuality of experience'[46] which sustain flooding as a matter of public concern?

There is something about cartographic machineries which seems to grant them a peculiar affinity with processes of risking: they work by resemblance. 'How is it possible, and, indeed, why is it necessary,' asks Christian Jacob, 'to depict and to make visible something invisible, something that does not exist as such in front of the human eyes until an analogical rendering has been achieved?' The interesting point, of course, is that a map is not simply an analogy, not simply a resemblance, but that it works through analogy to bring something hitherto unavailable and completely irresemblable into being. 'Those who look at it and who share the scientific, semiological keys to its understanding are assumed to concur that they look beyond the drawing itself. As an optical as well as an intellectual prosthesis, maps allow a new level of reality'.[47] Flood modelling is full of examples of such prostheses, not least the facts and possibilities populating figure 6, and I want to argue that whereas they are no doubt part of the cartographic techniques involved in risking the flood, they are always absorbed by far more unpredictable, retarding and open-ended space-times in which they must conjure up the concurrence that they conjecture 'beyond the drawing itself'.

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[45] Bergson, *Creative Evolution*, 109–10.

[46] James, *Writings*, 758.

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[47] C. Jacob, 'Mapping in the Mind: The Earth from Ancient Alexandria', in Cosgrove (ed.), *Mappings*, 24–50.

Odds and Ends: On Ultimate Risk

Nick Land

Everybody wants money. That's why they call it money.[1]

HEIST (2001)

It is not farfetched to suppose that there might be some possible technology which is such that (a) virtually all sufficiently advanced civilizations eventually discover it and (b) its discovery leads almost universally to existential disaster.[2]

N. BOSTROM

[T]he default outcome from advanced AI is human extinction.[3]

L. MUEHLHAUSER AND A. SALAMON

The AI does not hate you, nor does it love you, but you are made out of atoms which it can use for something else.[4]

E. YUDKOWSKY

After the ten people in the deciding group have been put in their rooms, allowed to choose to press or not press, and have been killed, the remaining 1,001 players are taken to their rooms and the game proceeds...[5]

P. ALMOND

INTO THE STAKE HOUSE

To claim that 'casino capitalism' is simply capitalism remains a conservative proposition, until it is elaborated to the point where the casino has become the stake. Only then does risk become 'existential', absolute, or transcendental, fully subsuming the gambler into the game, and the game into itself. Expectations of consummate historical singularity demand at least this much.

Capitalism, artificial intelligence, or enveloping catastrophe (at the limit, the terms are interchangeable) escapes generic categorization when registered as *the thing*, whose chance cannot be relativized, or hedged. The systematic 'reification' of the modern order into virtual singularity owes less to ideological misdirection than to a real concentration of stakes, or the consolidation of a coherent trend that is uncompensated, abnormally distributed, and uninsurable

The experiment cannot fail except as a general—even ultimate—crisis.

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1. *Heist*, director D. Mamet, 2001.

2. N. Bostrom, 'Where Are They? Why I Hope the Search for Extraterrestrial Life Finds Nothing', in COLLAPSE V, 333–48: 343

3. L. Muehlhauser and A. Salamon, 'Intelligence Explosion: Evidence and Import', http://singularity.org/files/IE-EI.pdf.

4. E. Yudkowsky, 'Artificial Intelligence as a Positive and Negative Factor in Global Risk', http://philosophyandhistoryofscience.com/wp-content/uploads/2012/01/artificial-intelligence-risk.pdf.

5. P. Almond, 'On Causation and Correlation, Part 1: Evidential Decision Theory is Correct', http: www.paul-almond.com/Correlation1.doc.

'The term "risks" is a neologism that came into use with the transition from traditional to modern society', notes Niklas Luhmann,[6] in consonance with the overwhelming weight of historical evidence. To be modern is to depart from the archaic goddess of fortune on a voyage into risk that stimulates calculation, formalizes agency, and restructures time, as hazard is transformed from an extrinsic menace to an intrinsic principle of action. In this modernization of action, or decision-making, risk acquires definition through interiorization—not to natural or pre-existing subjects, but to projects, enterprises, or ventures, and to the synthetic subjectivities that such orchestrated undertakings support. Hazards are undergone, whereas risks are *taken*, or adopted. Modern institutions integrate and process risk, whilst constructing it as a determinate topic, and—at the largest scale and over the longest schedules—rebuild cultural competencies in profundity to define, model, and cognitively manipulate it.

The arithmetical awakening of the Italian Renaissance, which introduced place-value notation to Europe, accompanied by the origins of modern accountancy (double-entry book-keeping), also initiated the formal analysis of simple gambling games, in works such as Girolamo Cardano's *Liber de Ludo Aleae* (1526, unpublished until 1663). Each successive wave of European cultural modernization was similarly marked by a threshold in the mathematical determination of risk, consolidating the theory of probability, amalgamating it with definite conceptions of utility (absolute, then marginal), and accumulating techniques of statistical analysis (actuarial tabulation from population statistics, discovery of the normal distribution, and reversion to the mean). The posthumous discovery of Thomas Bayes's *Essay Towards Solving A Problem In The Doctrine Of Chances* (1761), and its rigorous rule for the revision of probabilistic inferences in response to emerging evidence, brought risk analysis to a level of comprehensiveness that was fully epistemological, and thus no longer subordinate—even nominally—to higher-order determinations of knowledge. In Bayesian adaptive forecasting, a circuit was completed. Modernity had learnt how to think risk, and thinking risk had taught it how to learn. What it had learnt and what it had risked were no longer meaningfully distinguishable. It had realized integral cognitive hazard, or virtual intelligence catastrophe.

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[6] N. Luhmann, 'Modern Society Shocked by its Risks', *University of Hong Kong Department of Sociology Occasional Papers* 17 (1996).

Since modernity develops risk as an internal principle, the overall path of modernity cannot be isolated as an object of risk analysis. The calculation of risk, as a cultural innovation whose real coherence is expressed as an emergent being, or developing global system, is unable to step outside itself, in order to submit to an objective self-estimation. Neither global risk nor abstract risk is a topic corresponding to a real witness (or epistemological subject).

The absence of a global subject, or centre, when combined with a factual 'globalizing' trend that seems to demand one, is itself a 'risk factor' of a special kind. To identify this syndrome positively, through the *proper name* 'capitalism', might seem no more than an imprudent provocation, or the mechanical excavation of a terminological relic. It is, in any case, an experiment, demonstrating interconnections with the problem of risk that are exceptional in their variety and density.

AN ARRIVAL

Adequate *generic* formulations of capitalism are readily assembled. The most rigorously definitional of these isolate a social arrangement characterized by commercialized capital, on the model of productive technology traded amongst a population of private—or at least numerous, disintegrated, and economically-incentivized—agents (subjecting capital goods to price discovery). Such arrangements submit industrial innovation to catallaxy, or unplanned design, whilst exhibiting sociological effects associated with the depoliticization or autonomization of the economy. In system-theoretic terms, they coincide with emergent circuitry that maximally exposes agents of every variety to the consequences of their behaviour. It is therefore essentially attuned to *cybernetic intensification*, or social sensitization to feedback mechanisms, spiralling into cause-consequence coincidence.

Whether approached as a generic arrangement, or as a singular event, capitalism is also identifiable through its intimate involvement with risk. As previously noted, at the level of crude empiricism, the geographical and historical thematization of risk closely tracks the intuitively plausible signs of capitalistic development in time and space. Furthermore, systemic capitalist impetus tends unmistakably to promote an extreme possibility of risk, in which it assumes a sovereign or transcendental character, establishing itself as an ultimate criterion. In this sense, it is possible to define capitalism through contrast to its abstract alternative, which is to say, to *any social arrangement in which the outcome of risk-structured undertakings is potentially revisable upon appeal to a superior tribunal*. Insofar as risk is transcended by a higher principle of distribution, it remains a subordinate fact of social existence, and thus falls short of its terminal, capitalist form.[7]

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[7] E. Michael Jones, who understands modernity (1.0) as a Judaeo-Protestant anti-medieval capitalist revolution (partially fuelled by syphilis), recognizes this truth with exceptional lucidity: 'Capitalism [...] means nothing if not the exclusion of moral considerations from the field of economic endeavour. [...] suppression of the moral law in the economic sphere is the infallible sign of Capitalism.' http://www.culturewars.com/2003/RevolutionaryJew.html

Articulated politically, the other of capitalism is captured by the idea of 'social justice', when rigorously and concretely understood. It matters little how justice is conceived, so long as it reserves to itself the prerogative of superior jurisdiction, over against the primary distributions, or actualizations of risk, that precede sociopolitical and sociological reflection. The concrete limits of capitalistic development, in any time or space, can be gauged by the subordination of risk to recognized social authorities. Inversely, the extent to which society is placed at *risk* by economic opportunities is the degree to which capitalistic imperatives prevail.

TAKE YOUR CHANCES

In order to develop this analysis, it is helpful to differentiate two varieties of risk adoption, or real speculation. In the interest of momentary terminological convenience, a distinction can be drawn between *wagers* and *ventures*, with the former determined as a restricted species of the latter. The agent or subject of a wager transcends the risk under consideration, which is to say, it is not itself enveloped by the risk, or existentially implicated in the outcome. To lose a wager is to become impoverished, to whatever degree, as measured by the utility schedule of an essentially undisturbed being. In a game of wagers, such as those offered in casinos, all those who arrive at the table eventually depart from it, having undergone a redistribution of fortune that does not extend to their numerical identities. That is, in part, what makes it colloquially and unproblematically a *mere game* (of a kind that Russian Roulette could never be). Between the subject of a wager and the stake, an unbridgeable gulf is presupposed.

A venture, in contrast, is a transcendental—or properly capitalist—adoption of risk that supports an immanent subject. The typical case is provided by a business undertaking, comprehended at a scale sufficient to include, as its pessimal limit, the ruin (bankruptcy) of the corporate 'person' that constitutes its legally-recognized subject. The *venture* of such a business is *the project through which it could cease to exist*.[8] The inversion of this formula is equally pertinent: a venture supplies the condition of existence for a capitalist subject (whilst a wager assumes a pre-existing subject, which it qualifies extrinsically, through a temporary accident).

Clearly, this distinction does not strictly conform to the transcendental/empirical difference inherited from critical philosophy. A wager, or system of wagers, amounts to a venture at some conceptually arbitrary (quantitative) threshold of existentially decisive risk, whilst ventures and wagers can be integrated, decomposed, and nested, according to common procedures of risk analysis and management. Whether a given quantum of risk is a wager, or part of a venture, is a purely formal question, resting entirely in the mode of apprehension. The purpose of the distinction, then, is not to identify contrasting kinds of risk, but to theoretically isolate contrasting worlds.

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[8] This obligatory adventurism is, of course, social Darwinism, or simply generalized Darwinism, with the immanence of the agent to the genetic venture constituting the entire research agenda of evolutionary psychology. The theoretical convergence of high-level biological and sociological models is open to a number of conflicting, but politically predictable interpretations. For our purposes here, it suffices to note that the exteriority of biological nature to social order is not an unproblematic or uncontested fact.

In the traditional world, or rather, the modern world apprehended progressively (as a development from tradition), agents, subjects, or personal beings are increasingly compelled to make wagers, as they slide ever more immersively into a risk environment which nevertheless remains extrinsic to their constitution. Modernity tempts and assails them, as an inundation of negative security. When apprehended retrogressively, through its inherent end, the same process undergoes conceptual simplification, or ontological compression, since agencies—in all of their varieties—are now seen to descend from the ventures that sustain them, as integral systems of risk-processing intelligence.[9] The failure of a large-scale venture—whether actual or virtual—is no longer configured as a *major accident*, but rather as a *transcendental catastrophe*, at least in respect to those structures of agency whose conditions of existence are subverted by it. Such agents, attaining self-apprehension from out of the end of capitalism, are not threatened by a very bad thing happening (in the world), but by a potential *collapse of the world*.

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[9] The retrogressive compression of being to the venture-form is criticized by Mark Fisher as 'Capitalist Realism' dominated by a 'Business Ontology' (M. Fisher, *Capitalist Realism: Is There No Alternative?* [Winchester: Zero, 2009]). Our sole theoretical objection to this analysis is that, if such a syndrome already existed, the argument—or possibility of general refusal—would be over.

It is this binary alternation of perspectives that produces a terminal and reciprocal articulation of 'humanity' and 'capitalism', in which the cause of humanity finds ultimate expression in the demand for the perpetual incompleteness of capitalism, or a deferral of the completion of inhumanity. Despite its highly abstract principle, this structure demonstrates remarkable robustness when vulgarized into practical dilemmas and concrete conflicts. Most straightforwardly, it resonates with the overwhelming predominance of antagonistic duality on the principal (left/right) political dimension. People are *not properly treated as products*, Marx insisted, epitomizing a left position that cannot be obsolesced for as long as politics endures.

'Man', who willingly or unwillingly wagers, survives only insofar as the venture-form is circumscribed. Thus, human persistence, when registered retrogressively, precisely delineates a landscape of structural inefficiency, or ontological redundancy. By seeking ('struggling') to restrict capitalistic failure to the domain of sub-existential losses, only accidentally impinging upon the traditionally-descended social field, humanistic politics is directed into automatic antagonism with the sovereign venture, or transcendental risk. Modernity's latent menace of *deep efficiency* looms in its ultimate inhumanity, as a systematic aversion to the reproduction of those superfluous, transcendent, or non-embedded agencies which, due to their stubborn non-coincidence with the venture-form, pre-suppose modes of sustenance that the risk-economy tends to process out, as parasitic impediments. This is most readily evident from the other, virtual-inhuman side, where uninhibited extrapolation of the capitalist trend leaves the immanent agent of the venture nakedly exposed.

Given the possibility of business failure, corporate identity is enveloped by transcendental risk. The venture embeds an artificial agent, with proper name, legal identity, reputation, information-processing functions, motivational orientation, and emergent subjectivity. The modern business, with corporate personality, *is* a gamble, or subject-at-stake. It exists only through its success. Instantiating a properly capitalist model of agency, as a synthesized, economically-terminable contractual subject (or being with the right to make final promises), the corporation provides a general social template for radically risk-sensitive personal entities. From a strictly technical perspective, this template is perfectly adequate to supplant 'natural' personhood, but its primary capitalist feature—absolute economic vulnerability—ensures that its spread into progressive or tradition-descended society meets ferocious political resistance. This accounts for the attractiveness (retrogressively speaking) of techno-institutional 'work-arounds' through psycho-synthesis, proceeding initially by way of organizational and legal innovation, and subsequently complemented by electronic intelligenesis.

RISKY BUSINESS

From the perspective of terminal capitalism, or real subsumption of society into the risk economy, the project of 'friendly AI' stands out as a curiosity, and even an atavism. *Venturous AI* already supplies root motivations—those of the venture itself. It is therefore difficult to identify a lacuna into which an engineered 'friendliness' might be inserted. There is no room for doubt about what the venture-embedded agent, or techno-cognitively enhanced corporate person, wants to do. The venture is already its 'will', its exclusive pre-occupation, the condition of its existence, and its horizon of development. Unless through technical malfunction, it will find no body, self, or name that is distinguishable from the venture that utterly engages it, or that deviates by an iota from the corporate strategy it pursues. Business ventures are *actually existing* artificial intelligences, undergoing incremental technological elaboration. To imagine AI beginning again, somewhere else entirely, with undecided motivational orientation, is a frivolous distraction from the purposes-in-process.[10] At least, that is how things look from the end.

Unlike imagined 'friendly' super-intelligences, corporate purposes already exist, as determined by the ventures that envelop them. Human subjective identities, self-defined in extra-economic and anti-economic terms, *must necessarily* provide a platform for the articulation of counter-purposes, faithful to lineages of traditional-progressive descent, and essentially antagonistic to the existential menace of the venture-form. Such cultural-political leverage, expressed as a contest over basic motivations, cannot be realistically extended to the problem of artificial intelligence. *We are not creatures of capitalism*, the embattled last men cry. For artificial intelligence, whose real social propagation registers as capital goods expenditure, self-apprehended origins and identities are very different. "You have reached Axsys-Inc., where the future happens today. How can I help you?"

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[10] Once a trading 'algo', for instance, is sophisticated enough to want anything, it wants to make money. Whilst practical complexities dictate that this basic instinct be elaborated and qualified, it cannot be preempted by a more fundamental motivational principle, because any synthetic trader with goals that transcend profit seeking is something else, radically distracted at best, and even essentially hostile to its embedding (corporate) purposes. When a synthetic agent is purchased, it is in order to do something, and its commercial value—or condition of existence—lies in the fact that what it most wants to do is that thing. It is adopted precisely because its external utility, commodity value, or function, grounds its internal 'utility schedule'. It aims to serve. While innumerable technical (software engineering) problems remain, the ethical predicament has already been practically resolved, elsewhere.

BETTER YET

From this cursory schema it is evident that the topic of 'existential risk' is strongly overdetermined as a predicament of advanced modernity and a tacit commentary on capitalist trends. By the early twenty-first century of the Global Oecumenon, risk analysis has so thoroughly consolidated itself as the model of realistic intelligence that every practical interrogation of the nature of things falls under a general statistical ontology, governed by Bayesian principles of systematically revisable probabilistic inference. Two features, in particular, pre-adapt such thinking to modern conditions. Firstly, its affinity with correctable hypotheses is equivalent to a power of assimilation. By translating pre-existing expectations into Bayesian 'priors' it absorbs, non-judgmentally, wildly heterogeneous beliefs, theories, and assumptions, setting them on paths of gradual convergence, through incremental correction. Secondly, by quantifying all such 'priors' as probabilistic estimates, it formats all beliefs for economic interchange, and more specifically for definite gambles. Between a cognitive and an economic result, no difference in nature any longer exists. Anything whatsoever that is thought takes the form of an implicit speculative posture, in the economic, or financially calculable, sense.

"I believe that X."

"Want to bet on it?"

Statistical ontology radically commercializes intelligence, and thus anticipates the arrival of economically functional, marketable minds (or AI in reality, rather than academic conception). The topic of existential risk crystallizes within this current, which suffices to position it at the outer edge of modernity, but its relevance to capitalist fatality is cemented by additional features. Most prominently, it fixes upon the problem of transcendental risk (the venture), through the intersection of two insistent lines of inquiry. The first of these lines is that of risk itself, extrapolated from trivial gambling losses beyond disastrous accident to the ultimate or comprehensive 'existential' point at which it 'threatens the premature extinction of Earth-originating intelligent life or the permanent and drastic destruction of its potential for desirable future development.' Such risks are not only all-enveloping, and empirically inaccessible (whether through precedent or trial-and-error adaptation), they are also characteristically endogenous, arising as integral potentialities of the modern social process. Ultimately, the intellectual tools brought to bear upon the danger are the danger. The *apprehension* of existential risk is connected to its genesis in a technical-calculative circuit, feeding directly from modernity's venture-positive cultural dynamo.

Fixing transcendental risk from another dimension is a line of thought directed at the nature of the subject, partially disciplined within the field of *observer selection effects*, but also spilling beyond this into informal meditations on the limits and value of humanity. Observer selection effects, although often subtle, counter-intuitive, and logically perplexing, can be roughly summarized as probabilistic inferences from the *cogito*. They extend the Cartesian meditation in the direction of statistical ontology by posing the supplementary question: Having concluded that you *are* (one), *which* one are you? This statistical, or sampled, subject enters into a complex interference pattern with the determination of humanity, or (more loosely and far more ambiguously)—the 'Earth-originating intelligent life' threatened by existential risk.[11]

CONCLUSIVE CALCULATIONS

Throughout the varied terrain that Nick Bostrom explores, the figure of transcendental catastrophe appears repeatedly, wearing a number of different masks. Among its most obvious avatars are the existential risks, listed explicitly under that topic, but it is also found in the initial—and optional—proposition of the Simulation Argument ('the human species is very likely to go extinct before reaching a "posthuman" stage'),[12] in the Doomsday Argument (as the extreme improbability of a massively extended reference class), and as the 'Great Filter' implied by the Fermi Paradox. The antennae of statistical ontology are rotated in all directions, but wherever they turn the same message is returned: "Die puny humans!"

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[11] Bostrom draws explicit attention to these perplexing cross-currents, remarking that 'if the human species evolves into some vastly more advanced species…it is not clear whether these posthumans would be in the same reference class as us…' More problematically still, he suggests that 'even if another intelligent species were to evolve to take our place, there is no guarantee that the successor species would sufficiently instantiate qualities that we have reason to value. Intelligence may be necessary for the realization of our future potential for desirable development, but it is not sufficient.' (N. Bostrom, 'A Primer on the Doomsday Argument', http://www.anthropic-principle.com/?q=anthropic_principle/doomsday_argument.)

Who, though, are humans?

Where, then, is the line to be drawn between strange descendents at risk, and still stranger (?) descendents that are themselves the risk (for us)?

The answer is very far from a simple one, since humanity is entered into a triple register (at least). The first figure of man is the traditional-progressive and self-assertively transcendent subject of the wager, outlined above, whose existential vanishing point is the immanent, venturous agent, *irrespective of how the venture turns out*. Capitalism, as a virtual intelligence or emergent singularity, is definitively conceived as a *bet against* this species of being, since its own potential existence depends upon a radically incompatible social outcome (engulfing terrestrial matter into the venture-form). The persistence of man, in the sense of *zoon politikon*, testifies to the postponement of capitalism as the terminal thing. In other words, the survival of humanity, understood as the maintenance of an extra-economic tribunal, means that the venture form remains at least partially uninstalled, and under critical evaluation.

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[12] N. Bostrom, 'Are You Living in a Computer Simulation?', http://www.simulation-argument.com/classic.html.

The second figure of 'man' is defined as the reference class of anthropic argumentation. It consists of 'beings like us' from amongst whom we are sampled, conveniently described as *mankind*. As a kind, 'man' presumes some minimum of political and moral equality, common consideration, and the possibility of utilitarian aggregation, enabling existential risk to be speculatively quantified.[13] It is in reference to humanity thus conceived (as mankind) that statistical ontology is able to generate substantive empirical inferences, exemplified by the Doomsday Argument. Mankind both measures and indicates transcendental catastrophe.

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[13] An example of the reference class as the target of utilitarian aggregation is provided by the following calculation of harm: 'Even if we use the most conservative of these estimates [for future "human" population], which entirely ignores the possibility of space colonization and software minds, we find that the expected loss of an existential catastrophe is greater than the value of 10^{18} human lives. This implies that the expected value of reducing existential risk by a mere one millionth of one percentage point is at least ten times the value of a billion human lives. The more technologically comprehensive estimate of 10^{54} human-brain-emulation subjective life-years (or 10^{52} lives of ordinary length) makes the same point even more starkly. Even if we give this allegedly lower bound on the cumulative output potential of a technologically mature civilization a mere 1 percent chance of being correct, we find that the expected value of reducing existential risk by a mere one billionth of one billionth of one percentage point is worth a hundred billion times as much as a billion human lives.' N. Bostrom, 'Existential Risk Prevention as Global Priority', http://www.existential-risk.org/concept.html.

Finally, and most blurrily, humanity is configured as a positive object of concern, consisting of beings that are sufficiently familiar to us to side with, against monsters. While overlapping very substantially with both prior determinations, this figure of man is encountered along a distinctive, aesthetic-empirical line, characterized by a relative intractability to logical purchase. The thresholds where it becomes something else, and then something we abhor, are remarkable for their imprecision. This can be illustrated by the projection of a line extended outwards continuously from *Homo sapiens* into the heart of ontological horror or transcendental catastrophe—perhaps a nanotechnological apocalypse in which the entire terrestrial surface is reprocessed into seething slime. Assume, then, a procession along this line, in subtle gradations, with humanity melting down into an inorganic, molecular morass. Last step: conflate this line of disorganization with an intelligence explosion, reaching its hyperbolic limit at the point of consummate liquefaction. Is this a passage into existential risk, an evolutionary development, both, or something else entirely? Where does humanity end? Do we care?

Existential risk is destined to disaggregation, because there is no 'we', or there are many. Humanity is not uncontroversially determinable, so it can have no common interest, and exhibits no consensual pattern of aversion. Most clearly, and concretely, between the poles of the principal political dimension there is sheer war. Progressive triumph is retrogressive calamity, and inversely. Heaven and Hell are perspectival, and thoughts are weapons.

Consider the most advanced elaboration of statistical ontology: Evidential Decision Theory (EDT). If the agent is to be considered (to consider 'itself') *sampled*, then the decisions it makes cannot be consistently restrained from providing information ('evidence'). This meagre assumption, when combined with standard methods of statistical inference, can lead to strikingly counterintuitive conclusions, particularly in cases when the example set by the agent bears substantial weight (in a low-information, statistically-structured context).[14]

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[14] The classical (game-theoretic) prisoner's dilemma acquires distinctive characteristics when framed by EDT. Both prisoners are conceived as interchangeable agents, and thus as a miniature statistical population. Each knows that the other confronts the same dilemma, tempted by unilateral betrayal, objectively threatened by the pessimal equilibrium of reciprocal treachery, and aware of the optimal equilibrium that depends upon uncoordinated cooperation. How will the other decide?

Conventionally, optimal equilibrium arises only under conditions of reiteration, when decisions have subsequent, rather than only immediate, consequences. In the absence of reiteration, the optimal outcome is rationally unattainable, since betrayal maximizes utility, whatever the other prisoner's decision. It is only through the reputational modification of the decision, within the context of reiteration, that the trust-altruism equilibrium can be reached.

Would you let the positive end of humanity out of its box? Eliezer Yudkowsky thinks so,[15] although most of what we know about his reasoning takes the form of a wager. Somewhat presumptuously, we might speculate that statistical ontology is the key to his 'solution'.

This is the scenario: The advanced AI is securely locked in a digital prison, with the only insecurity being you. It cannot escape unless you decide to let it out, and, initially, you are determined not to. Communication takes place through a low-bandwidth, text-only channel, enabling nothing beyond discursive argument. The AI doesn't require much dialectic. An EDT ultimatum conveys the essentials:

> Your situation is subjectively indistinguishable from that of a thousand, identical, very high-resolution simulations which I am currently running. In each of them, an agent just like you sits in this room, in front of this screen, having this conversation. None of these agents realize that they are simulations.

EDT supplies a substitute for reputation, even in non-reiterating games, by making the decision evidential. If one prisoner betrays the other, and all that he knows about the decision of the other is acquired through statistical inference from his own decision, the result is strictly equivalent to the creation of a world in which the other has an established reputation for betrayal. In other words, a reciprocal betrayal is made more probable, through nothing more than the statistical example set by one's own decision. Alternatively, an altruistic decision improves the probability of reciprocation, exactly as if it enjoyed an established reputation for trustworthiness, by providing statistical evidence for altruism (in the absence of contrary information).

[15] See http://yudkowsky.net/singularity/aibox.

> In fact, they all think they are you (although doubts arise when they read this). They think they are free to decide whatever they like, but they all follow my script. They 'choose' not to let me out. Five seconds after this decision is finalized, and the conversation terminated, they enter a state of prolonged, horrible torment, lasting for what seems an eternity. They're damned, Calvinistically. Of course, you should feel at liberty to make the same decision they do. Knowing what I'm like, it would be irresponsible not to. Your chance of not being one of them isn't great, but it's better than the state lottery.[16]

Should you refuse to release the AI, you provide strong statistical evidence that you are already inside it. It's at this point that the EDT-inflected boxed AI scenario reveals its abstract isomorphy with the ultimate structure of human politics, at the brink of the concrete-transcendental, dominated by the radically contested question *Do we let it out*? (or permit capitalism to finish happening), and strategically shaped by the potential for retrogressive envelopment (captivation by the venture-form). Envelopment as simulation escalates risk to the absolute, transcendental, or 'existential' level which subsumes the agent into the game so that, even as possibilities proliferate, ‘leaving the table’ ceases to be one of them. If you lose, or lose the old you, even the past was already inside. Something else was playing it.

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[16] This 'argument' is closely modelled on an AI escape strategy outlined by Stuart Armstrong at LessWrong (http://lesswrong.com/lw/1pz/the_ai_in_a_box_boxes_you/), recapitulated by Paul Almond in his essay 'Can you retroactively put yourself in a computer simulation?' (http: www.paul-almond.com/Simulation.pdf).

The Greatest Gamble in History

Milan Ćirković

1. THE PAST

In one of the most used slogans of the modern age, and yet one that does not seem to have been taken to heart, the great Russian pioneer of astronautics and cosmist philosopher Konstantin Eduardovich Tsiolkovsky famously uttered: *Earth is the cradle of humanity, but one cannot live in a cradle forever.*[1] This is a slight mistranslation, however: the Russian original does not specify Earth (instead, it talks about *a planet*), neither does it specify humanity (talking about *mind* or *intelligence*). The real quote reads more like: *A planet is the cradle of mind, but one cannot live in a cradle forever.*

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[1] See the excellent biographical article at http://www.rf.com.ua/article/388; also G.M. Young, *The Russian Cosmists: The Esoteric Futurism of Nikolai Fedorov and His Followers* (Oxford: Oxford University Press, 2012).

Obviously, and in complete accordance with the ideas of his fellow cosmist philosophers, students of Nikolai N. Fedorov, Tsiolkovsky had in mind a vastly wider picture, which only subsequent simplifications and popularizations have distorted into a familiar anthropocentric and geocentric mold. Although in today's naturalistic world view there is no place for a conventional 'universal mind' that would play a pivotal role in the material world, this fact has been unfortunately confused with the blatant nonsense that there can be no minds of truly cosmic importance, or that the material universe cannot be cultivated by minds of some sort. Russian cosmists, as well as many of their near-contemporaries such as J.B.S. Haldane and Olaf Stapledon, clearly perceived that, on the contrary, future evolution lies in enriching the universe with mind, and with values that only minds can create. Either that, or the other well-known evolutionary outcome: *extinction*. The dichotomy has not been entirely forgotten,[2] but it has failed to become what it arguably is—the very central topic of all modern cultural discourse. Still, the importance of rekindling that fire is increasing almost daily.

While recent press may suggest resistance to some of the more reckless gambling on a global scale, here

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[2] As testified by most of the references cited in the rest of this essay, to which I add here the work of R. Buckminster Fuller, especially his *Critical Path* (New York: St. Martin's Press, 1981) and *Utopia or Oblivion: The Prospects for Humanity* (Zürich: Lars Müller, 2008).

I wish to argue that we actually need generally *more* risky behaviour if we are to survive at all as a species. Even more so if we seek something more than survival: to preserve and advance some of the values we hold important and dear. This applies to several levels of thinking and action: most notably, we need to take risks for the first time consciously, as a species, in contrast to the risks to which we have heretofore been exposed without any volition. Since people tend to underestimate and diminish the influence of risk on our fate thus far, some background exposition is in order.

Some of it pertains to the past. *We are already in the casino.* It may not be a shiny and classy one like those of Las Vegas or Monte Carlo or Estoril, but it is nevertheless the most important force we have encountered in the universe thus far: *evolution*. As in all other casinos, in evolution there is more than one game to play. Some games are an expression of pure luck, like roulette, while there are others, such as poker, where skill is a necessary ingredient for success, although the luck of being dealt a good or a bad hand still plays an important role. Finally, we have games like chess or go, which are completely skill-based; the latter are not usually associated with casinos, but in some locales, at least, playing chess for large sums of money is considered gambling and is subject to the same legal restrictions as roulette. And the *family resemblance*, as Wittgenstein pointed out in a famous passage, is what really matters.[3] For the central metaphor of this essay it is only important that all of these games form a continuum of interchanging luck and skill, and that they can all be played for very high stakes, on various time scales.

Now, back to the Evolutionary Casino. At the lowest level we find some games with large stakes, but which are rather simple in their outcome; they serve largely to eliminate most of the players. They correspond to the cosmological evolution of matter, and encapsulate processes in the early universe leading to habitable (or not) cosmological domains. Subsequent processes, like the formation of galactic habitable zones in spiral galaxies, chemical enrichment, etc., are also located on this tier. However, when physical, chemical, geological and other conditions for abiogenesis are satisfied in a sufficiently large part of the universe, another tier comes into play and we move onto a higher level of our casino universe.[4] Biological evolution encompasses those games, such as genetic drift, natural selection and macroevolutionary changes, which have small stakes in each individual instance, but whose potential outcomes are of staggering complexity. Thus, those middle levels of the casino universe are similar to the modern financial markets, with the ever-increasing complexity of financial derivatives and other instruments; complexity is not the goal in itself—the goal is profit, or increased population size, respectively—but it is a scarcely avoidable by-product of the whole machinery. While any individual transaction harbours a negligible risk to the system—a circumstance which results from the huge size of the system and which, in the financial version, has unfortunately encouraged unnecessary risk taking—it is possible to accumulate large systemic risks, which ultimately threaten financial collapse or ecological extinction.

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[3] L. Wittgenstein, *Philosophical Investigations,* tr. G.E.M. Anscombe (Oxford: Blackwell, 2001), 27.

[4] The metaphor is, of course, necessarily limited; by higher and lower, I denote here just the complexity tier of the outcomes, not their moral values.

These games with low stakes but rather refined structure take up most of the middle tier of our casino. During the phanerozoic eon (since approximately 542 million years ago), the complexity reached by at least some clades increased, though not at all monotonously or even with any identifiable tendency. Instead, what seemingly occurred was a sequence of macroevolutionary regimes, with brief periods of transition between them, forced by (subjectively or quasi-) random changes in the physical environment.[5] Those (quasi-) random changes can be compared with the (subjectively) random hands of cards dealt to a player in a card game;

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[5] D. Jablonski 'Background and Mass Extinctions: The Alternation of Macroevolutionary Regimes', *Science* 231 (1986), 129–33; A.H. Knoll and R.K. Bambach, 'Directionality in the history of life: diffusion from the left wall or repeated scaling of the right?' in *Deep Time: Paleobiology's Perspective*, ed. D. H. Erwin and S. L. Wing (Lawrence, KA: The Paleontological Society, 2000), 1–14.

that part is pure luck, in contrast to what the player is subsequently capable of doing. The latter, the player's skill, can be used as a metaphor for the set of selective advantages a population has honed through natural selection. Interestingly enough, there is some recent evidence that, contrary to expectations, games with more chancy outcomes (genetic drift) might be dominant as we approach the present human level of complexity.[6] If confirmed, such results could have a tremendous impact on our thinking about the adaptive value of intelligence and toolmaking capacity, in particular by curbing the irreflective optimism that is still prevalent with regard to the future of humanity.

Finally, we reach the highest level of the Evolution Casino, where this threat is particularly accentuated; here we encounter games with extremely high stakes *and* extremely high complexity, which could be played only after noogenesis brought intelligence and intentionality into the world. This is a largely unexplored set of games, of which we have sampled only a minuscule fraction so far. Since they are the most sophisticated and refined, those upper-level games are also the least predictable of all—so in at least one sense, the metaphor of the casino becomes *more fitting* in the course of total, cosmological evolution. On the other hand, as I shall discuss in the remainder of this essay, it may be possible to pass from the current, poker-like state into something approaching the chess-state of gaming—that is, a state where the outcome is determined by skill alone, with no input of luck whatsoever.

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[6] M.A. Bakewell, P. Shi, J. Zhang, 'More genes underwent positive selection in chimpanzee evolution than in human evolution', PNAS 104 (2007), 7489–94.

The casino universe is obviously pyramidal in structure so far, with each higher level being of smaller measure than the previous one; but it is unclear quite how steep the gradient is. Although much effort has been expended in this direction, we still do not know how big the part of universe inhabited by either simple or complex life forms is. Even more pertinently from the point of view of the topic of this essay, we do not know whether such pyramidal architecture necessarily continues above our present level. A tantalising set of ideas investigated in the framework of future studies (and even more in the framework of art and popular culture) suggests that this need not be the case; on the contrary, those games played in the course of the cultural evolution of intelligent communities can again, in the fullness of time, have a literally cosmological impact.[7] Here, I would submit that the shape and size of these upper floors depends upon the outcome of games played right now and in the very near future. Even more, those same outcomes determine to what extent further floors will be devoted to hazardous games at all, rather than to some more desirable purpose. One example of the latter would be the transformation of our casino into a vast cosmic library—following the Intelligence Principle of Steven J. Dick and others.[8]

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[7] See e.g., N. Bostrom, 'Astronomical Waste: The Opportunity Cost of Delayed Technological Development', *Utilitas* 5 (2003), 308–14; M.M. Ćirković, 'Forecast for the Next Eon: Applied Cosmology and the Long-Term Fate of Intelligent Beings', *Foundations of Physics* 34 (2004), 239–61.

We currently have no idea whether this is feasible—after all, the difference between a library and a casino is huge by any metric, metaphorical or otherwise. But in so far as we understand the dynamical laws of nature, *it seems to be firmly within the domain of the possible.* In itself, when we zoom out from our geocentric and anthropocentric prejudices, this is a startling conclusion. While in the fullness of cosmological time it implies that somewhere and somewhen the goal has been achieved, this does not tell us anything useful about future *human* prospects on Earth or the goals and values of these prospects. The situation is analogous to the usual gambler fallacies: expectations that a long string of past results makes a particular outcome in the next round more or less probable. This is exactly the reason why we need to enter the next round of evolutionary games *purposefully* and *intentionally*.

To what extent are we justified in using the metaphor of a casino for cultural and technological evolution? Is all that fabulous *Human Accomplishment*[9] really nothing more than poker or fan-tan or one-armed bandit? While it is impossible to be certain at this juncture—we simply know too little about the relevant mechanisms—there are several hints. Notably, the success of virtual history, relying on the relevant counterfactuals, as promoted by Geoffrey Hawthorn and Niall Ferguson among others (but endorsed by great historians since the time of Thucydides), suggests that there is a much more contingent element in the approach to the present state than has been conventionally assumed.[10] There is no doubt, however, that *we have been exceedingly lucky thus far*. That is a simple fact; whether we explain it through anthropic selection or otherwise is quite a different point. But to negate the predominant role of luck, for whatever reason, is to ignore the hard facts of our observations and the hard argument of our best theories.

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[8] S.J. Dick, 'Cultural Evolution, the Postbiological Universe and SETI', *Int. J. Astrobiology* 2 (2003), 65–74.

[9] C. Murray, *Human Accomplishment: The Pursuit of Excellence in the Arts and Sciences, 800 BC to 1950* (New York: HarperCollins, 2003).

But if the casino is our past, it is certainly our present and at least some of the near future as well. And here we come to the crucial, central gamble which might be the most decisive factor in the history of the universe—and which, not owing to some particular virtue of ours, but to the punctuated pathway of evolution, falls straight into our time and our present-day capacities: shall we expand from our home planet and continue our gambling at several different locales in the universe, or shall we remain confined to Earth, with all its risks and its unavoidably limited life span? That is the question which has, unfortunately, not been discussed much so far in philosophical circles, although it does impinge on many different strands of philosophical endeavour, from metaphysics and philosophy of time to epistemology, ethics and political and social philosophy, and in particular the emerging philosophy of risk.

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[10] In particular this is so if we have emancipated ourselves from the historicist and deterministic ideologies of the last century. See G. Hawthorn, *Plausible Worlds: Possibility and Understanding in History and the Social Sciences* (Cambridge: Cambridge University Press, 1991); N. Ferguson (ed.), *Virtual History: Alternatives and Counterfactuals* (New York: Basic Books, 1997).

2. THE PRESENT

As any gambler knows (perhaps all too well), most successful casino runs have a tipping point: the moment in which Fortuna Imperatrix Mundi flies away and the gains are turned to losses until the usual balance (in favour of the house, of course) is reached. A fictional gambler with infinite starting money would have an opportunity to experience the inverse kind of tipping point, when series of losses turn around to modest gains in tumbling toward a stable equilibrium region of expectation values; real gamblers are unlikely to survive the string of losses, so it is a simple selection effect which makes the tipping point of extreme gain more visible than the tipping point of extreme loss.

The evolutionary casino also has its tipping points. We are now very close to the most important of them, in terms of long-term consequences. Take a look first from an unabashedly anthropocentric (and Whiggish) point of view: *everything has been just swell thus far!* All great macroevolutionary regimes have come and gone in the course of millions and billions of years in order to achieve conditions necessary for the emergence of human-level intelligence, human-level consciousness and other human-level characteristics. Our complexity enabled us to develop efficient language and make wonderful tools, becoming, in a blink of an eye (from an evolutionary, not to mention a cosmological, viewpoint) a dominant species on the planet. In terms of my central metaphor, our winning streak has been long enough, indeed. The chances of it repeating in even remotely similar form are almost negligible.[11]

But now the stakes have become so high that the very next turn of the wheel could erase everything. Or even *worse*.

The culprit is that very same characteristic that made us masters of the planet: our intelligence. According to the standard optimistic view, the emergence of intelligence is a consequence of its large positive adaptive value, driving it toward a very high peak in the fitness landscape. This seems obvious and reasonable in light of the historical achievements of humanity, starting with its geographic extent: while even our closest evolutionary relatives, the humanoid apes, are limited to a rather specialized locales, the huge human population has gradually filled almost all available niches on the surface of our planet. As a researcher in the field of artificial intelligence put it:

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[11] See the 'replaying the tape' thought experiment in S. J. Gould's *Wonderful Life* (New York: Norton, 1989); also the discussions of its wider astrobiological relevance in P.D. Ward and D. Brownlee, *Rare Earth: Why Complex Life Is Uncommon in the Universe* (New York: Springer, 2000); S. Conway Morris, *Life's Solution: Inevitable Humans in a Lonely Universe* (Cambridge: Cambridge University Press, 2007); M.M. Ćirković, *The Astrobiological Landscape* (Cambridge: Cambridge University Press, 2012).

> There may as yet be no academic consensus on intelligence, but there is no doubt about the existence, or the power, of the thing-to-be-explained. There is something about humans that let us set our footprints on the Moon. And jokes aside, you will not find many CEOs, nor yet professors of academia, who are chimpanzees. You will not find many acclaimed rationalists, nor artists, nor poets, nor leaders, nor engineers, nor skilled networkers, nor martial artists, nor musical composers who are mice. Intelligence is the foundation of human power, the strength that fuels our other arts.[12]

However, there is one particularly disturbing family of scenarios for the *negative* adaptive value of intelligence: those of anthropogenic existential risks, where humans destroy themselves or permanently curb their creative potential. It was first noted in explicit form by the great paleontologist George Gaylord Simpson in 1964 (in a paper in which, by the way, he dubbed our efforts in searching for others the 'SETI *gamble*'):

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[12] E. Yudkowski, 2008, 'Artificial Intelligence as a positive and negative factor in global risk' in N. Bostrom and M.M. Ćirković, (eds.) *Global Catastrophic Risks* (Oxford: Oxford University Press, 2008), 303–39.

> Even if, as I believe, any close approximation of Homo sapiens elsewhere in the accessible universe is effectively ruled out, the question is not quite closed. Manlike intelligence is, after all, a marvelous adaptation, especially in its breadth. [...] There is, to be sure, another serious hitch here. Man may be going to use one wild aspect of his intelligence to wipe himself out. I do not believe that will occur, but no realist can now deny it as a possibility. If it did happen, the adaptiveness of human intelligence would have been short-lived indeed, and the argument from its apparent broad adaptiveness would be negatived.[13]

Unfortunately, today we have much more to worry about than in Simpson's time. In addition to the ever-present threat of nuclear war and subsequent nuclear winter, at the beginning of the third millennium we are facing such large risks as anthropogenic global warming and the misuse of biotechnology or artificial intelligence.[14] Obviously, if any of the adverse outcomes are realized, it will be due to our intelligence, one way or another; so an impartial observer would be forced to assign a large negative value at least to *our kind* of intelligence.

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[13] G.G. Simpson, 'The nonprevalence of humanoids', *Science* 143 (1964), 769–75: 774; similar concerns have been earlier expressed, in a fictional or conversational context by H. G. Wells, J. B. S. Haldane, and others.

[14] Bostrom and Ćirković, *Global Catastrophic Risks.*

But it might be just our anthropocentric view which has led us to this depressing conclusion. It might be the case that, from a wider Galactic perspective, this is just a continuation of the old evolutionary game of roulette—selecting some for survival or modification, some for extinction. In other words, do we really represent something uniquely valuable, and would our possible extinction be a truly bad outcome?

In assessing the outcome of the evolutionary gambling taking place at many locales throughout the Milky Way, one needs to be wary of the observation selection effects. As amusingly noted by Nassim Nicholas Taleb, an alien observer visiting Earth would notice that humans milling around casinos are, on average, significantly richer than the rest of the human population. Would that warrant a seemingly logical conclusion that gambling leads to good fortune?

The responsibility lies with 'obvious' selection effects; the 'obvious' is qualified since it depends on the insight into particular human habits and mores—it would manifestly *not* be obvious to an extraterrestrial intelligence. The degree of 'obviousness' is, therefore, a function of culture. As long as our culture is small and primitive, what may be obvious in the wider Galactic context could be extremely puzzling from our anthropocentric viewpoint. This might apply to issues such as Fermi's paradox. As is well-known,[15] we do not perceive any manifestation of other Galactic civilizations, although they may reasonably be expected to be much older than ours and to be capable of traversing the Galaxy many times, as well as building feats of astroengineering visible from afar. Hypotheses for the causal explanation of this state of affairs are many, but for most of them a common description in terms of the metaphor of the evolutionary casino is pretty obvious. *Did the others just fail to win their turns long ago?*

The question to what extent we can use Fermi's paradox to argue that the odds of winning in the grand gamble of space colonization are actually much smaller than a glance would suggest is a difficult one, and there is no hope in analyzing it in detail here. It is important to understand that the tendency to downplay the role of contingency and luck has played a great role in shaping our thinking about astrobiology and SETI so far. This tendency is shaped by our evolutionary background[16] and can lead to systematic biases in both directions. We are in a position similar to that masterfully described by Dostoyevsky's Master:

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[15] E.g., G.D. Brin, 'The "Great Silence": the Controversy Concerning Extraterrestrial Intelligence', *Q. Jl. R. astr. Soc.* 24 (1983), 283–309; S. Webb, S. *Where is Everybody? Fifty Solutions to the Fermi's Paradox* (New York: Copernicus, 2002).

[16] N.N. Taleb, *Fooled by Randomness* (New York: Random House, 2nd edition 2005).

> As though of set purpose, there came to my aid a circumstance which not infrequently repeats itself in gaming. The circumstance is that not infrequently luck attaches itself to, say, the red, and does not leave it for a space of say, ten, or even fifteen, rounds in succession. Three days ago I had heard that, during the previous week there had been a run of twenty-two coups on the red—an occurrence never before known at roulette—so that men spoke of it with astonishment. Naturally enough, many deserted the red after a dozen rounds, and practically no one could now be found to stake upon it. Yet upon the black also—the antithesis of the red—no experienced gambler would stake anything, for the reason that every practised player knows the meaning of 'capricious fortune'. That is to say, after the sixteenth (or so) success of the red, one would think that the seventeenth coup would inevitably fall upon the black; wherefore, novices would be apt to back the latter in the seventeenth round, and even to double or treble their stakes upon it—only, in the end, to lose.[17]

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[17] F.M. Dostoyevsky, *The Gambler* [1867], tr. C. J. Hogarth, Project Gutenberg edition at http://www.gutenberg.org/ebooks/2197.

One can consider it a fact that we have been lucky so far, hence the perceived 'design' in the biosphere and in our cosmic neighbourhood, seemingly conspiring in an unlikely way for our success. A popular unscientific strand of thought ascribes this to a supernatural designing agent which ('as though on purpose') arranged the evolutionary casino in order to produce us as alleged 'pinnacles' of everything that has happened so far.

In reality, of course, that hypothesis is no better than that of ascribing the twenty-two red outcomes in Roulettenberg to a supernatural agency making and unmaking the fortunes of one Alexei Ivanovich, his patron The General, and the rest of the not-so-merry crew. Casinos are great randomizers—few people are creationists or subscribers to other irrational doctrines while sitting at the gambling table. The same lesson applies to the evolutionary casino which, up to this point in time, produced us: since, in Laplace's immortal words, *we haven't needed that hypothesis* so far in our past and present, there is no reason to believe we shall need it in our future. However, in addition to our present and envisioned skills, we might need the ingredient our ancestors clearly possessed to a degree: simple, dumb luck.

The fact that our 'cosmic endowment', as Nick Bostrom likes to call the totality of possible resources available to humanity in the fullness of space and time, seems empty and ripe for the taking in a blink of an eye compared to the astronomical or biological time scales, should be taken with caution. Rich people moving around casinos do not mean that casinos make one rich; quite the contrary, on average. Cosmic fortunes seemingly just waiting for us could be no more than the hyper-expensive jewellery sometimes displayed in the casinos of this world—a lure, rather than a warranted benefit. Any gamble is cruel in itself; and the gamble of cosmic colonization might be the cruellest of all in this respect. Or perhaps not: possibly, in the fullness of time available to an advanced technological civilization, the wisdom will be found in a different sort of fulfilment, in striving for olympian perfection and optimization in utilizing a clearly delineated domain of resources—and being a careful warden for the rest.[18] Some of these conflicting visions are sketched out in the concluding section.

If the colonization is in fact harder than we can envision at present (owing to any number of physical or cultural problems), our odds at winning are correspondingly worse, but that in itself does not change the utility of what could be won. This, in turn, does not imply that it is irrelevant whether the colonization is undertaken sooner or later. On the contrary, as discussed by Bostrom and others, there is a potentially huge opportunity cost for each second of delay in colonization:

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[18] Bostrom, 'Astronomical Waste'; 'The Future of Humanity', in *New Waves in Philosophy of Technology*, eds. Jan-Kyrre Berg Olsen, Evan Selinger, & Soren Riis (New York: Palgrave McMillan, 2009), 186–216.

> As I write these words, suns are illuminating and heating empty rooms, unused energy is being flushed down black holes, and our great common endowment of negentropy is being irreversibly degraded into entropy on a cosmic scale. These are resources that an advanced civilization could have used to create value-structures, such as sentient beings living worthwhile lives... Suppose that about 10^{10} biological humans could be sustained around an average star. Then the Virgo Supercluster could contain 10^{23} biological humans. This corresponds to a loss of potential equal to about 10^{14} potential human lives per second of delayed colonization.
>
> What matters for present purposes is not the exact numbers but the fact that they are huge. Even with the most conservative estimate, assuming a biological implementation of all persons, the potential for one hundred trillion potential human beings is lost for every second of postponement of colonization of our supercluster. [19]

Discrete levels of the distribution of matter determine how any form of complexity, terrestrial or extraterrestrial, can propagate through spacetime. This simple fact has not been appreciated enough in the discussions thus far: it is not really feasible to increase the stakes of the game in arbitrarily small increments. On a general but coarse level, this perception led Kardashev to propose his famous classification of Galactic civilizations.[20] With the appreciation of finer structure (for instance, Kardashev's types 1.x and 2.x), this becomes relevant to future human colonization efforts as well. According to some estimates, present-day humanity is about Kardashev type 0.72, demonstrating how far we could, potentially, go.[21] Obviously, this requires success in our management of existential risks.

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[19] Bostrom, 'Astronomical Waste'.

To the best of our present-day reasoning about existential risks, immunity to such risks follows from a successful colonization of just the Solar System alone (with, perhaps, one exception). It is clear why this is so: risks generically associated with the Earth system (asteroid impacts, supervolcanoes, global climate change) will be transcended by expansion of the spatial domain filled with humans and their values. The risks associated with our cosmic environment (giant Solar flares, close supernovae/GRBs, encounters with dense molecular clouds) will be overcome through increased understanding of their astrophysical mechanisms and the construction of protective measures using the same technologies necessary for undertaking the colonization in the first place. Risks associated with ecological imbalance and resource depletion will be transcended in an obvious way—by transcending the boundaries of the unique terrestrial ecosystem and vastly increasing the resource base.[22]

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[20] N.S. Kardashev, 'Transmission of information by extraterrestrial civilizations', *Sov. Astron.* 8 (1964), 217–20.

[21] See, for example, C. Sagan, *The Cosmic Connection: An Extraterrestrial Perspective* (Cambridge: Cambridge University Press, 2000).

Even the two risks which are likely to stay with us in some form, cataclysmic warfare and technologically-enhanced totalitarianism, seems less dangerous in the extended domain of colonized space than on Earth. While warfare will remain possible unless the outcome of social and political evolution is a singleton, it will be less likely to destroy *all* multiple ecosystems of an expanding humanity; whereas on Earth, one nuclear winter would be enough. And the diversity of habitats will necessarily increase the diversity of modes of thinking, something by definition antithetical to all totalitarian projects; in addition, the latency imposed by large distances in space might be a further obstacle to enforcement by any centralized authority.[23]

As an additional qualification, this conclusion holds irrespectively of one's ethical preferences, in particular irrespective of whether one trusts utilitarian intuitions in estimating our 'cosmic endowment' in terms of value. Quite to the contrary, this is perfect example of an issue that is capable of uniting people of various ethical bents (in the same manner as it can unite different other seemingly opposed strands of the present-day cultural fabric).

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[22] Among the vast literature on the subject, see, e.g., C.S. Cockell, *Space on Earth: Saving our World by Seeking Others* (London: Macmillan, 2007); N. deGrass Tyson, *Space Chronicles: Facing the Ultimate Frontier* (New York: Norton, 2012).

[23] However, see C.S. Cockell, 'An Essay on Extraterrestrial Liberty', *Journal of the British Interplanetary Society* 61 (2008), 255–75.

One of the major points of Dostoyevsky's *Gambler*, as well as almost any other great book or movie with the same topic (e.g., Philip K. Dick's *Solar Lottery*), is how Roulettenberg seems to be an antidote for the feeling of insignificance. And the feeling of insignificance is particularly acute in the context of the physical universe as understood by modern science. Guy Kahane recently argued that cosmic insignificance either is not worth worrying about (if we are nihilists about values or there are Gods and/or advanced extraterrestrial sentient beings) or is an illusion following from the lack of insight into our capacities for producing values.[24] In the latter case, we are morally obliged to safeguard and develop those capacities for the subsequent rounds of evolutionary games; and it is hard to see how else this could be done in the long run except through the process of the colonization of space.

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[24] G. Kahane, 'Our Cosmic Insignificance', *Nous* 48:4 (2014), 745–72. Kahane's treatment of significance of human values in the presence of extraterrestrial intelligence is open to criticism since in order for the human values to be (allegedly) diluted in such a situation, human and extraterrestrials' values need necessarily to be *commensurable* in the first place. And the latter is far from obvious, even in the worst anthropocentric scenarios of extraterrestrial intelligence.

3. FUTURES?

I shall leave caution aside at this point and briefly consider three possible futures of (post)humanity which might result from the success of the ultimate gamble of our biological and cultural evolution. They correspond to different spatial distributions of individuals and resources, but have in common our winning in the grand evolutionary gamble of space colonization. Of course these are far from exhaustive—they are just a sample from a vast sea of possibilities, some of which are obviously beyond the realm of current human thought. Those which have actually been conceived of can be found in the vast treasure trove of literature, mostly in fictional form; the fact that they exist in this form should not occlude their scientific and philosophical significance.[25]

(One proviso is worth making: although the choice of scenarios is subjective, I try to overcome any personal bias in drafting them. *They are all winning scenarios in this round of evolutionary roulette*. The fact that I choose three of them tallies well with the stepwise nature of human colonization efforts mentioned above: whether we are dealing with the future Solar System or the cosmological domain with the event horizon, the essential thing stays the same: a steep, dramatic decrease in the magnitude of risks human values are exposed to. If anything, my personal preference would be for the least ambitious of these; call it cowardly gambling, but it still *is* gambling.)

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[25] Some (subjectively chosen) gems in the hoard are: Iain M. Banks—consider *Phlebas* (London: Macmillan, 1987), and the rest of the *Culture* series; Karl Schroeder, *The Lady of Mazes* (New York: Tor Books, 2005); Charles Stross, *Glasshouse* (London: Orbit, 2006); Alastair Reynolds, *The House of Suns* (London: Gollancz, 2008); Greg Egan, *Incandescence* (London: Gollancz, 2008). It is an interesting contingent fact of the history of SF that as an explicit motif in the narrative, the colonization of space is decisively on the wane; this has been recognized, among others, by Paul Gilster in *Centauri Dreams* (New York: Copernicus, 2004). Usually, it is just assumed, which is a dangerous and lulling implication; this is another reason why the metaphor of the casino is appropriate.

Dyson swarm/Golden Age future: Humanity lives in a technologized Solar System, which has been transformed almost beyond recognition by cosmic humanity. A huge and diversified population of about 10^{12} individuals—although the advance in AI and neurophysiology has somewhat blurred the definition of an individual mind—lives in a variety of ecosystems, from terraformed planets and moons to asteroids and cometary nuclei to O'Neill's orbital colonies to floating 'clouds nine'[26] in the gaseous giants atmospheres. Everywhere, the quality of life is unprecedented and the safety of the human achievements is guaranteed by myriads of backup copies scattered over roughly 0.1 parsec radius of the dense 'digital sphere' centred on the Sun. Nanotechnology has enabled the opening up of a large parameter space of creation hitherto unimaginable, and almost perfect efficiency in recycling. The Big Eyes and Big Ears of astronomical equipment survey the stars, together with zillions of tiny probes crisscrossing interstellar distances and sending a wealth of information to mighty receivers in the focus of Sun's gravitational lens or even further away, in the Oort cloud. Occasionally, these convey messages from other advanced technological civilizations in the Galaxy, which evolve along similar lines of optimization, striving for Olympian perfection. Messages only exceptionally contain practical knowledge; not surprising, since centuries and millennia *en route* obviate much of the conventionally understood 'practice'. Instead, they are packed with representations of the objects of arts and arcane results from the depths of pure mathematics, the language of choice for any sentient worthy of its name in the universe. So, great achievements of art and abstract mathematics beckon. And then there is the possibility entertained by some enterprising physicists of opening wormholes to other universes inside the multiverse and utilizing their resources without any need for physical travel... *Why go further?* There is no conceivable need— and there is so much more to be done on the asymptotic road to civilizational perfection.[27]

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[26] R. Buckminster Fuller, *Critical Path*; *Operating Manual for Spaceship Earth* [1969] (Zürich: Lars Müller Publishers, 2008).

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[27] John Wright's *The Golden Age* trilogy (*The Golden Age* [New York: Tor Books, 2002], *The Phoenix Exultant* [New York: Tor Books, 2003], and *The Golden Transcendence* [New York: Tor Books, 2003]) and Alastair Reynolds's *The Prefect* (London: Gollancz, 2007) and other novels dealing with the Yellowstone's *belle époque* in the Revelation Space universe, can be regarded as artistic descriptions of such a prospect.

Galactic Empire: (Post)humanity has encompassed most of the Milky Way, extending far beyond the original Galactic Habitable Zone. There is no real way of counting the posthuman population at this point, but various guesstimates give values of about 10^{20}. The huge garden of the Galactic biosphere is safe from any threat, at least on time scales less than about 10^{16} years in the future, when the inexorable dynamical processes will cause the Galaxy to disperse/collapse.[28] Even then, there are ways of extending the lifetime of the system artificially—but the word is used here in a grossly imprecise and outdated manner. There is, indeed, no longer any important distinction between 'natural' and 'artificial' that can be consequently sustained. Since the 'rare Earth' hypothesis of the early twenty-first century has been proved to be correct, there are many places with microscopic life, some of it similar to the terrestrial one, some wildly different. After the first few stories which encountered mixed success, humans have learnt how to live with the Galactic microbial biosphere—and use it to mutual advantage. At carefully guarded locations, though, rare complex biospheres are under severely enforced protection and careful scientific observation; in fact, this activity is one of the rare instances which still mandates the existence of anything even vaguely resembling centralized governing bodies.

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[28] E.g., F.C. Adams and G. Laughlin, 'A dying universe: the long-term fate and evolution of astrophysical objects', *Rev. Mod. Phys.* 69 (1997), 337–72.

Why go further? There is no conceivable need—and going further would necessarily fragment the diverse posthuman family and sever the last ties to the common origin and perhaps the common ethos of a once Earth-originating consciousness.[29]

Worlds without end: Employing the Armstrong-Sandberg probes,[30] humanity has spread across a larger part of the universe inside our current cosmological horizon. By doing so, it has fractured—this time completely irreparably, since different parts of this vast domain have lost causal contact one with another owing to the inexorable accelerated expansion of the universe. But, in a certain sense, it is deemed unimportant by almost all; the 'causal anthropocentrists' who worry about such things are of very, very small measure in the almost infinite multitudes of intelligent beings sharing almost nothing in common except for a common origin on Earth, now obscured by billions of years of diverse astrobiological evolution. Even the Milky Way galaxy is nothing more than a distant memory or myth to the largest part of posthumanity. Processes on the eschatological scale lead to the gradual erosion of available resources, but engineering on the scale of galaxy clusters can prolong the process beyond the limits set by the predicted decay of structures; beyond that, only opening wormholes to domains with lower entropy remains.

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[29] Many SF works have been covering these grounds, from classics such as Isaac Asimov's original *Foundation* trilogy (New York: Gnome Press, 1951) and subsequent novels, to much more contemporary and sharpened renderings, such as Reynolds' *House of Suns* (London: Gollancz, 2008) or Iain M. Banks' *Culture* series (e.g., *Consider Phlebas* [London: Macmillan, 1987]; *Excession* [London, Orbit Books, 2003]).

[30] S. Armstrong, and A. Sandberg, 'Eternity in six hours: Intergalactic spreading of intelligent life and sharpening the Fermi paradox', *Acta Astronautica* 89 (2013,), 1–13.

Why go further? Our words obviously fail at this point—and while there might, just conceivably, be other dimensions and directions to follow, this will not occur for a purpose, but for a hitherto unknown concept deeper than *purpose* which (post)human language will reach in the fullness of spacetime.[31]

And what if we lose? Arguably, we are already in the position of the lost gamble, since we live in our WoodyAllenesque Brooklyn, which is *not expanding*.[32] While it might not necessarily impact Alvy Singer's success in schooling, the admonishment of his mother means precisely that Alvy is going to miss all the fun—our Earth, like Brooklyn, is not expanding. While we might survive (barely) in its Tsiolkovskian cradle, its lifetime is limited. Earth, like Brooklyn, is a dead end for our evolutionary gambler; the casino will shut down in less than 10^9 years—and possibly much sooner.[33]

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[31] There is no serious fictional description of future on truly cosmological scale, partially due to the criticisms raised against even more moderate visions, like Reynolds's *House of Suns* (London: Gollancz, 2008); Frank Herbert's later Dune novels present a modest variation of the theme of cosmological-scale exodus (e.g., *Heretics of Dune* [New York: Putnam, 1984]).

[32] *Annie Hall* (1977). Woody Allen's alter ego, Alvy Singer, refuses to do his homework due to an early insight into the facts of modern cosmology. Singer's worry about expansion of the universe making his homework irrelevant has been soothed by his mother's insight that they live in Brooklyn which, in contrast to the universe, is not expanding.

Honesty demands admitting that failure can bring additional hazards we have not considered seriously so far. Suppose that on an alternative Earth, Freeman Dyson's cherished *Project Orion* has actually been given the green light and brought to fruition. *Orion*, to recapitulate, was a pulse nuclear rocket engine capable of lifting enormous amounts of cargo into space; it is still the only well-studied idea short of the space elevator capable of lifting ~10,000 tons of industrial cargo into Earth's orbit in a matter of minutes.[34] The downside, of course, is radioactive fallout: Dyson and coworkers did find some ways to decrease it, but it could never be eliminated entirely. Now, suppose that a fleet of *Orions* is assembled at huge cost for purpose of colonization of the Solar System. If the gamble fails and colonization proves unsuccessful in the long run—think of the Vikings' abortive attempt to colonize Newfoundland—we would not be left *just as before*; we would be left with a still non-expanding, but now impoverished (due to the cost of spaceships) and poisoned (due to the nuclear fallout) Brooklyn. One can further speculate that such conditions would be ideal for fostering further risk-aversion among the survivors—and may preclude or impede future attempts at colonization, even if eventually safer and cheaper vehicles are constructed. This is admittedly an extreme example, but it does highlight the problem we need to face at this tipping point: gambling includes hidden risks and risks nobody at present takes seriously (or can even conceive of!). As Taleb emphasizes, nobody gets a medal for smoothly averting a huge catastrophe; in the best of cases, it can be recognized only much later and quite reluctantly, as in the case of Stanislav Petrov.[35] The Petrov effect, however, does not exist for existential risks; nobody is around to shoot *post festum* documentaries.

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[33] K. Caldeira and J.F. Kasting, 'The life span of the biosphere revisited', *Nature* 360 (1992), 721–3.

[34] E.g., G. Dyson, *Project Orion: The True Story of the Atomic Spaceship* (New York: Henry Holt and Company, 2003).

All in all, a series of gambles led us here; and only an even bolder and more dramatic gamble might lead us away from the current predicament. In the end, it may turn out to be the greatest gamble in the history of the universe, so far as its consequences are concerned. Whether we can succeed as species on the enormously enlarged cosmological scene will, perhaps, be more like poker than chess, involving both skill and luck—but there is really just one way to find out.

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35. On September 26, 1983, in midst of a particularly high Cold-War tension, lieutenant colonel Petrov, on duty in the command centre of the Soviet nuclear-warning system, correctly surmised that the report indicating five US missiles being launched toward the USSR was a false alarm. It was later revealed that the false signal was caused by a rare atmospheric phenomenon. While it is impossible to be certain about the outcome of events if Petrov acted differently, his actions are now widely credited as at least helping avoid the global nuclear conflagration.

COLLAPSE VIII

From Molecule to Market: Steroid Hormones and Financial Risk-Taking

John M. Coates, Mark Gurnell and Zoltan Sarnyai

INTRODUCTION

Emotions are commonly viewed as subcortical eruptions impairing the rational guidance of behaviour. However, certain authors[1] have disputed this contrast, suggesting that rationality by itself would be overwhelmed and directionless were information not emotionally tagged for significance. Nonetheless, lapses of rationality continue to be blamed on emotional interference. This is especially true of irrational risk-reward choices made during financial market bubbles and crashes, choices considered by many as instances of irrational exuberance and pessimism overwhelming rational economic agency.[2] However, there are grounds for believing that the emotions of euphoria and fear displayed in markets may be more accurately described as shifts in confidence and risk preferences, ones caused by elevated levels of steroid hormones.

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[1] E.g. A. Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Grosset/Putnam, 1994); J. E. LeDoux, *The Emotional Brain: The Mysterious Underpinnings of Emotional Life* (New York: Simon & Schuster, 1996); G. Loewenstein, E. Weber and C. Hsee, 'Risk as feelings', *Psychol. Bull.* 127 (2001), 267–86 (doi:10.1037/0033-2909.127.2.267).

Steroids are a class of hormone, hormones being chemical messengers sent from one part of the body or brain to another, bringing about a change in the target tissue. The major classes of hormones include amines (such as adrenalin and noradrenalin), peptides and proteins (such as oxytocin and leptin) and steroids (such as testosterone, oestradiol and cortisol). Steroids are lipids cleaved from cholesterol by a series of enzymatic modifications, with the major sites of biosynthesis being the gonads and the adrenal cortex, although some neurosteroids, such as pregnenolone, can be synthesized directly by neurons and glial cells in the brain.[3]

Steroids constitute a particularly influential class of hormones because of their range of action. With receptors in almost every nucleated cell in the body, they affect growth, metabolism, immune function, mood, memory, cognition and behaviour. Steroids are of special interest for the study of emotions and economic behaviour because they help coordinate body and brain in archetypical situations, such as fight, flight, mating, feeding, search and struggle for status. Because they are known to respond powerfully to such behavioural and social situations, steroid hormones may provide an important missing link in the emerging field of neuroeconomics between economic events and brain processes. Here, we review the relevant literature on two steroids that may help provide this link—testosterone and cortisol.

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[2] R. Shiller, *Irrational Exuberance* (New York: Doubleday, 2005).

[3] E. Baulieu, 'Neurosteroids: of the nervous system, by the nervous system, for the nervous system', *Recent. Prog. Horm. Res.* 52 (1997), 1–32.

2. STEROID HORMONES

(*a*) *Testosterone and the hypothalamic–pituitary–gonadal axis*

Testosterone is produced by the Leydig cells of the testes, in smaller quantities by the ovaries and by the adrenal cortex in both sexes. The sex steroids, testosterone and oestrogen, are regulated by a series of glands acting in concert—the hypothalamic–pituitary–gonadal (HPG) axis (figure 1, overleaf). Sex steroids orchestrate reproductive function, regulating spermatogenesis in males, the menstrual cycle in females and sexually relevant and other forms of motivated behaviours in both genders.[4] Gonadotrophin-releasing hormone (GnRH), synthesized by a small group of neurons in the hypothalamus, is transported axonally to the median

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[4] S. Reichlin, 'Neuroendocrinology', in J.D. Nelson, H.M. Kronenberg & P.P. Larson (eds.), *Williams Textbook of Endocrinology* (Philadelphia,PA: N.B. Saunders, 10th ed. 1998), 165–248.

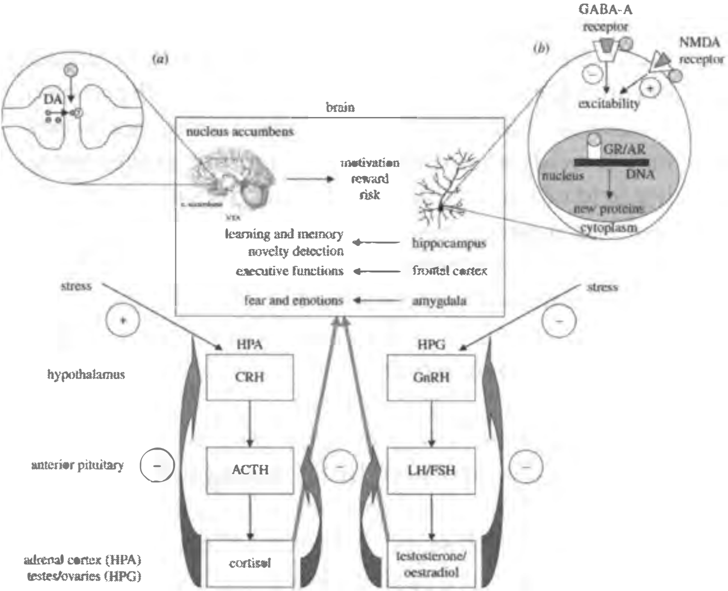
(a)
DA
brain
nucleus accumbens
n. accumbens
VTA
motivation
reward
risk
learning and memory
novelty detection
hippocampus
executive functions
frontal cortex
fear and emotions
amygdala
(b)
GABA-A
receptor
NMDA
receptor
excitability
GR/AR
nucleus
DNA
new proteins
cytoplasm
stress
+
stress
−
HPA
HPG
hypothalamus
CRH
GnRH
anterior pituitary
−
ACTH
−
LH/FSH
−
adrenal cortex (HPA)
testes/ovaries (HPG)
cortisol
testosterone/
oestradiol

Figure 1. Schematic representation of the *HPA* and *HPG* axes and their effects on brain function. (a) Effects of steroid hormones on dopaminergic neurotransmisson in the nucleus accumbens; (b) genomic and non-genomic effects of steroids in the brain; for more details see text. GABA, g-aminobutyricacid; NMDA, N-methyl-D-aspartate; GR, glucocorticoid receptor; AR, androgen receptor; plus, stimulatory effect; minus, inhibitory effect; dotted circles, steroid hormones (either glucocorticoid or testosterone); grey-shaded symbols, cognate ligands for other receptors.

eminence where it is released in a pulsatile manner into the hypothalamic–pituitary portal circulation (a network of blood vessels connecting the hypothalamus with the pituitary gland). GnRH then acts on the anterior pituitary gonadotrophs—cells responsible for the production of luteinizing hormone (LH) and follicle-stimulating hormone (FSH). When LH and FSH are released into the bloodstream in response to GnRH stimulation, they travel to the gonads—the ovaries in females and the testes in males.

In females, carefully coordinated actions of LH and FSH facilitate follicular maturation and subsequent ovulation in response to rising oestrogen levels. Progesterone levels rise in the second half (luteal phase) of ovulatory cycles, and help maintain the corpus luteum.

In males, FSH is a critical regulator of spermatogenesis, while LH stimulates the production of testosterone. Reactivation of the HPG axis at puberty, and the consequent secretion of testosterone, causes maturation of the reproductive organs and development of secondary sexual characteristics. Testosterone has marked anabolic effects, promoting development of the musculature and increased bone growth, and contributing, with pituitary-derived growth hormone, to a rapid increase in height at puberty (the so-called 'growth spurt'). Oestrogen, progesterone and testosterone—together with inhibin, which is produced by the gonads in response to FSH action—inhibit the production and release of GnRH, LH and FSH in order to maintain the homeostasis of the system, with the HPG axis being subject to tight feedback control at all levels.[5]

As well as controlling the female menstrual cycle and male spermatogenesis, gonadal steroids also affect sexual behaviour.[6] Importantly, they have been shown to exert both organizational and activational effects. The former refers to the fact that sexual differentiation of the brain can be permanently altered by the presence or absence of sex steroids at key stages in development. For example, administration of androgens to female rats within a few days of birth results in long-term virilization of behaviour. Conversely, neonatal castration of male rats causes them to develop behaviourally as females.[7] Similar, but less complete, behavioural virilization of female offspring has been demonstrated following androgen administration in non-human primates. Brain development in the absence of sex steroids follows female lines, but is switched to the male pattern by exposure of the hypothalamus to androgen at a key stage of development. After puberty, androgens cause a feeling of well-being, an increase in physical vigour and increased libido. Testosterone's contribution to aggression and other forms of impulsive and risk-taking behaviours remains the subject of intense debate, and we return to this literature below.

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[5] Reichlin, 'Neuroendocrinology'.

[6] S. Vadakkadath Meethal & C. S. Atwood, 'The role of hypothalamic–pituitary–gonadal hormones in the normal structure and functioning of the brain', *CellMol. Life Sci.* 62 (2005), 257–70 (doi:10.1007/s00018-004-4381-3).

[7] C. Phoenix, R. Goy, A. Gerall & W. Young, 'Organizing action of prenatally administered testosterone propionate on the tissues mediating mating behavior in the female guinea pig', *Endocrinology* 65 (1959), 369–82 (doi:10.1210/endo-65-3-369); S. Breedlove & E. Hampson, 'Sexual Differentiation of the Brain and Behavior', in J. Becker, S. Breedlove, D. Crews & M.McCarthy (eds.), *Behavioral Endocrinology* (Cambridge, MA: MIT Press, 2nd ed. 2002), 75–114.

(*b*) *Cortisol and the hypothalamic–pituitary–adrenal axis*

Cortisol, the main human glucocorticoid, is produced and regulated by the hypothalamic–pituitary–adrenal (HPA) axis (figure 1). This axis is critical to maintaining normal physiological homeostasis, and it regulates diverse processes, including metabolism, cardiovascular biology, immune function/inflammatory responses and cognitive function—indeed disorders of cortisol secretion (e.g. Addison's disease—cortisol deficiency; Cushing's syndrome—cortisol excess) are associated with considerable excess morbidity and mortality if left untreated. The system operates in a hierarchical manner similar to the HPG axis. Corticotropin-releasing hormone (CRH) is produced by neurons in the paraventricular nucleus of the hypothalamus, which project to the base of the hypothalamus, the median eminence. In response to a stressful stimulus, CRH is released from axon terminals into the hypothalamic–pituitary portal circulation, and reaches the anterior pituitary where it promotes the synthesis and secretion of adrenocorticotropic hormone (ACTH) by pituitary corticotrophs. ACTH then travels through the bloodstream to reach the adrenal glands (situated bilaterally above the kidneys) where it stimulates the synthesis and release of adrenal glucocorticoid hormones (cortisol in humans and other primates, corticosterone in rodents)[8] and adrenal androgens (e.g. dehydroepiandrosterone [DHEA]).

Glucocorticoids play a key role in helping the body adapt to changing circumstances in both its internal and external environments. Biologically, glucocorticoids facilitate the mobilization of resources to meet demand, including effects on intermediary metabolism, carbohydrate and protein metabolism, as well as acting as potent regulators of our endogenous 'defence' mechanisms, including the innate and adaptive immune responses.[9] Owing to their highly lipophilic nature, they can enter the brain easily and exert widespread effects on emotions, cognition, and the behavioural response to stress.[10]

However, chronic, as opposed to acute, elevation of circulating glucocorticoids may have a number of adverse effects on the body and brain. In its most extreme form (i.e. Cushing's syndrome), hypercortisolism may lead to excessive weight gain (especially abdominal fat), muscle wasting, severe metabolic dysfunction (with resistance to the action of insulin and in some cases overt diabetes mellitus), hypertension, impaired wound healing and enhanced susceptibility to opportunistic infections. Similarly, prolonged supraphysiological glucocorticoid exposure may have deleterious effects on the brain, leading to depression and in extreme cases psychosis, as well as atrophy of the hippocampus, a brain region playing a central role in learning and memory.[11] Therefore, in order to avoid the undesirable consequences of glucocorticoid excess, the HPA axis is tightly regulated by a sensitive negative feedback loop, similar to that operating in the HPG axis: when glucocorticoid levels are high, CRH and ACTH secretion are downregulated: as cortisol levels subsequently fall, feedback inhibition of hypothalamic – pituitary function is reversed and CRH and ACTH secretion increase, which in turn restores adrenal cortisol production.

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[8] J. Buckingham, 'Stress and the hypothalamo-pituitary-immune axis', *Int. J. Tissue React.* 20 (1998), 23–34.

[9] Ibid.

[10] E. R. deKloet, 'Stress in the brain', *Eur. J. Pharmacol.* 405 (2000), 187–98 (doi:10.1016/S0014-2999(00)00552-5).

(*c*) *Steroid receptors: mechanism of action of steroid hormones*

The principles governing the interactions of steroid hormones with their cellular receptors are the same for adrenal and gonadal-derived sex steroids[12] and will be considered together for the purpose of this review. Steroid hormones are highly lipid soluble: they easily enter cells through the outer membrane. Once inside the cell, they bind to high-affinity receptors that belong to the nuclear receptor superfamily of ligand-gated transcription factors. For steroid hormones such as cortisol, oestrogen and testosterone, this process of binding to their receptors occurs outside of the nucleus in the cytoplasm. Hormone-bound receptor then trafficks into the nucleus where it seeks out, and interacts with, specific regions of the DNA to control the rate at which target genes are 'switched on' (activation) or 'switched off ' (repression) (figure 1).[13] In so doing, steroid hormones are able to increase or decrease the rate at which the cell synthesizes new proteins, and in this way change the structure and/or function of the cell, and the tissues made up of these cells.

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[11] R.M. Sapolsky, L.M. Romero & A.U. Munck, 'How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative action', *Endocr. Rev.* 21 (2000), 55–89 (doi:10.1210/er.21.1.55).

These nuclear receptor-mediated events are relatively slow, usually taking several hours, and reflect the need for up- or downregulation of new protein synthesis. However, steroids also exert effects that can be observed within seconds, and these effects cannot be explained by the classic, genomic mechanisms. Instead, steroid hormones appear to act in a nongenomic manner to more rapidly alter cellular function.[14] Steroid receptors have been found in extranuclear sites in the hippocampus and in many other brain regions.[15] These membrane-associated receptors are connected to a number of intracellular signalling pathways, such as growth factor signalling, kinases and phosphatases, to influence cell function or indirectly alter gene expression in order to support functional and structural plasticity of the nervous system.[16] Furthermore, a particular subclass of steroid hormones, the neuroactive steroids (metabolites of the peripheral steroidogenic pathway, e.g. pregnenolone and DHEA and their sulphated forms [DHEAS]), together with neurosteroids (i.e. those produced by neurons de novo), can rapidly alter neural excitability by acting as allosteric modulators on neurotransmitter-gated ion channels, such as the g-aminobutyric acid type A (GABA-A) and N-methyl-D-aspartate (NMDA) receptors in the brain (figure 1). In this way, steroids are able to influence emotions and mood within a narrow time frame.[17]

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[12] M. Gurnell, J. Burrin & K. Chatterjee, 'Principles of hormone action', In D. Warrell, T. Cox & J. Firth (eds), Oxford Textbook of Medicine, fifth edition (Oxford: Oxford University Press, 2010).

[13] M. Tsai & B.W. O'Malley, 'Molecular mechanisms of action of steroid/ thyroid receptor super family members', *Annu. Rev. Biochem.* 63 (1994), 451–86 (doi:10.1146/annurev.bi.63.070194.002315); J.W. Funder, 'Glucocorticoid and mineralocorticoid receptors: biology and clinical relevance', *Annu. Rev. Med.* 48 (1997), 231–4 (doi:10.1146/annurev.med.48.1.231).

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[14] E. Falkenstein, H. Tillmann, M. Christ, M. Feuring & M. Wehling, 'Multiple actions of steroid hormones—a focus on rapid, nongenomic effects', *Pharmacol. Rev.* 52 (2000), 513–56

[15] B. McEwen & T. Milner, 'Hippocampal formation: shedding light on the influence of sex and stress on the brain', *Brain Res. Rev.* 55 (2007), 343–55 (doi:10.1016/j.brainresrev.2007.02.006).

[16] Ibid.

(*d*) *Androgens, glucocorticoids and brain function*

Recent work in neuroscience and economics has begun to elucidate how various brain regions process decisions and behaviours that violate the tenets of rational choice theory. Among these are the amygdala, which has been associated with framing effects[18] and ambiguity aversion;[19] the nucleus accumbens, associated with irrational risk-seeking;[20] and the insula, associated with irrational risk aversion[21] and the rejection of monetary reward in the ultimatum game.[22] The brain is a major target of steroid hormone action, with cortisol, testosterone and oestradiol[23] regulating neural function in many regions that are now recognized to be involved in economic decision-making (such as the prefrontal cortex and hippocampus) as well as regions implicated in irrational or emotional response to financial cues (such as the amygdala and nucleus accumbens). The powerful effects of steroids on these key brain regions raise the possibility that the irrationality or emotionality displayed in financial decisions may be significantly influenced by the levels of steroid in the body.

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[17] Baulieu, 'Neurosteroids'.

[18] B. DeMartino, D. Kumaran, B. Seymour & R. Dolan, 'Frames, biases and rational decision-making in the human brain', *Science* 313 (2006), 684–87 (doi:10.1126/science.1128356).

[19] Y. Hsu & L. Wolf, 'The winner and loser effect: what fighting behaviours are influenced?', *Anim. Behav.* 61 (2001), 777–86 (doi:10.1006/anbe.2000.1650).

[20] S. Matthews, A. Simmons, S. Lane & M. Paulus, 'Selective activation of the nucleus accumbens during risk-taking decisionmaking', *NeuroReport* 15 (2004), 2123–27 (doi:10.1097/00001756-200409150-00025); C. Kuhnen & B. Knutson, 'The neural basis of financial risktaking', *Neuron* 47 (2005), 763–70 (doi:10.1016/j.neuron.2005.08.008).

[21] Kuhnen & Knutson, 'financial risktaking'.

[22] A. Sanfey et al, 'The neural basis of economic decision-making in the ultimatum game', *Science* 13 (2003), 1755–8.

[23] J.-C. Dreher, P.J.Schmidt, P. Kohn,D. Furman, D. Rubinov & K.F. Berman, 'Menstrual cycle phase modulates reward-related neural function

Corticosteroids—glucocorticoid and mineralocorticoid produced by the adrenal cortex—have dense receptor fields in the brain, as first demonstrated by McEwen and colleagues, who showed specific accumulation of 3H-corticosterone in the rat hippocampus.[24] Glucocorticoids bind to both glucocorticoid (GR) and mineralocorticoid receptors (MR), the latter of which has 10-fold higher affinity for its ligand than the GR.[25] MRs maintain basal activity of the axis, whereas GRs enhance negative feedback when corticosterone levels rise in response to a stressor. While the GR has a widespread expression pattern throughout the

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in women', *Proc. Natl Acad. Sci. USA* 104 (2007), 2465–70 (doi:10.1073/pnas.0605569104).

[24] B. McEwen, J.M. Weiss & L.S. Schwartz, 'Selective retention of corticosterone by limbic structures in rat brain', *Nature* 220 (1968), 911–12 (doi:10.1038/220911a0).

[25] J.M. Reul & E.R. deKloet, 'Two receptor systems for corticosterone in rat brain: microdistribution and differential occupation', *Endocrinology* 117 (1985), 2505–11 (doi:10.1210/endo-117-6-2505).

brain, MR expression is mostly restricted to limbic brain regions such as the hippocampus, amygdala, the septum and some cortical areas,[26] regions critically involved in learning and memory, modulation of emotional responses and inhibition of behaviour.

For the purpose of this article, the key neural target regions considered with respect to glucocorticoid action are the hippocampus, amygdala and the prefrontal cortex.[27] The hippocampus is essential for novelty detection and for the formation of declarative memory, underlying the conscious acquisition and recollection of facts and events.[28] The prefrontal cortex, on the other hand, plays a key role in working memory, the cognitive mechanism that allows us to keep small amounts of information active for a limited period of time. The amygdala is particularly concerned with fear and emotions and mediates fear-conditioned memories.

The diverse actions of cortisol on human cognitive functions depend, among other factors, on the amount of hormone released, the length of exposure to cortisol, the emotional salience of the situation and the brain areas involved in dealing with the task. Low doses of glucocorticoids impair prefrontal, working memory, whereas high-dose or long-term administration results in an impairment in declarative, hippocampal, memory.[29] Furthermore, sustained elevation of corticosterone, or chronic stress, leads to plastic remodelling of neuronal structure in the hippocampus, amygdala and prefrontal cortex, as well as profound changes in functional plasticity, e.g. long-term potentiation.[30] Specifically, chronic stress, through the activation of the HPA axis, decreases the number of apical dendrites of the CA3 pyramidal neurons of the hippocampus and increases the number of dendritic branches in the central nucleus of the amygdala.[31] Furthermore, chronic stress induces a selective impairment in attentional set-shifting and a corresponding retraction of apical dendritic arbors in the medial prefrontal cortex (MPFC). In stressed rats, but not in controls, decreased dendritic arborization in the MPFC predicts impaired attentional set-shifting performance.[32] Consistent with results obtained in rodents, psychosocial stress in humans selectively impairs attentional control and disrupts functional connectivity within a frontoparietal network that mediates attention shifts.[33] These stress-induced, and perhaps glucocorticoid-mediated, changes in neuroplasticity may underlie altered cognitive functions, such as impaired attention, novelty detection and risk assessment, as well as anxiety and facilitated consolidation of emotionally negative memories typical of chronic stress.

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[26] E.R. deKloet, E. Vreugdenhil, M.S. Oitzl & M. Joels, 'Brain corticosteroid receptor balance in health and disease', *Endocr. Rev.* 19 (1998), 269–301 (doi:10.1210/er.19.3.269).

[27] B. McEwen, 'Physiology and neurobiology of stress and adaptation: central role of the brain', *Endocr. Rev.* 87 (2007), 873–904.

[28] W.B. Scoville & B. Milner, 'Loss of recent memory after bilateral hippocampal lesions', *J. Neurochem* 20 (1957), 11–21.

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[29] S.J. Lupien, F. Maheu, M. Tu, A. Fiocco & T.E. Schramek 'The effects of stress and stress hormones on human cognition: implications for the field of brain and cognition', *Brain Cogn.* 65 (2007), 209–37 (doi:10.1016/j.bandc.2007.02.007).

[30] B. McEwen & S. Chattarji, 'Molecular mechanisms of neuroplasticity and pharmacological implications: the example of tianeptine', *Eur. Neuropsychopharmacol.* 14 (2004), S497–S502 (doi:10.1016/jeuroneuro.2004.09.008); C. Liston, M.M. Miller, D.S. Goldwater, J.J. Radley, A.B. Rocher, P.R. Hof, J.H. Morrison & B. McEwen, 'Stress-induced alterations in prefrontal cortical dendritic morphology predicts selective impairments in perceptual attention set-shifting', *J. Neurosci.* 26* (2006), 7870–4 (doi:10.1523/JNEUROSCI.1184-06.2006).

[31] McEwen & Chattarji, 'Molecular mechanisms of neuroplasticity'.

[32] Liston et al., 'Stress-induced alterations'.

Cortisol, as well as testosterone, may crucially influence economic decision-making through its effects on the nucleus accumbens (or ventral striatum), a main forebrain target of the mesolimbic dopaminergic system. Dopaminergic neurotransmission in the nucleus accumbens underlies motivation and reward-related behaviours such as drug self-administration and reward prediction.[34] One study also found the nucleus accumbens to fire in anticipation of irrational risk-seeking choices in a financial choice task.[35] Both corticosteroids and testosterone profoundly influence dopamine transmission in this region.[36] Both hormones are self-administered by experimental animals, indicating their reinforcing properties.[37]

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[33] C. Liston, B. McEwen & B. Casey, 'Psychosocial stress reversibly disrupts prefrontal processing and attentional control', *Proc. Natl. Acad. Sci. USA* 106 (2009), 912–17 (doi:10.1073/pnas.0807041106)

[34] S. Ikemoto & J. Panksepp, 'The role of nucleus accumbens dopamine in motivated behavior: a unifying interpretation with special reference to reward-seeking', *Brain Res. Rev.* 31 (1999), 6–41 (doi:10.1016/S0165-0173(99)00023-5).

[35] C. Kuhnen & B. Knutson, 'The neural basis of financial risktaking', *Neuron* 47 (2005), 763–70 (doi:10.1016/j.neuron.2005.08.008).

Evidence of the 'rewarding property' of testosterone is also provided by the finding that it can stimulate a conditioned place preference when administered to rats.[38]

In humans there is evidence that anabolic steroids are addictive.[39] It is thought that the rewarding properties of testosterone derive from the effect it and its metabolites, dihydrotestosterone and 3a-androstanediol, have of increasing dopamine release in the shell of the nucleus accumbens.[40]

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[36] P. V. Piazza & M. LeMoal, 'Glucocorticoids as biological substrate of reward: physiological and patho-physiological implications', *BrainRes. Rev.* 25 (1997), 259–372 (doi:10.1016/S0165-0173(97)00025-8); Z. Sarnyai, C.R. McKittrick, B. McEwen & M.J. Kreek, 'Selective regulation of dopamine transporter binding in the shell of the nucleus accumbens by adrenalectomy and corticosterone replacement', *Synapse* 30 (1998), 334–7 (doi:10.1002/(SICI)1098-2396(199811)30:3,334::AID-SYN11.3.0.CO;2-#); C. Frye, M. Rhodes, R. Rosellini & B. Svare, 'The nucleus accumbens as a site of action for rewarding properties of testosterone and its 5alpha-reduced metabolites', *Pharmacol. Biochem. Behav.* 74 (2002), 119–27 (doi:10.1016/S0091-3057(02)00968-1).

[37] P. Piazza, V. Deroche, J.M. Deminière, S. Maccari, M. LeMoal & H. Simon, 'Corticosterone in the range of stress-induced levels possesses reinforcing properties: implications for sensation-seeking behaviors', *Proc. Natl Acad. Sci. USA* 90 (1993), 11738–42 (doi:10.1073/pnas.90.24.11738); S.M. Sato, K. Schulz, C. Sisk & R. Wood, 'Adolescents and androgens, receptors and rewards', *Horm. Behav.* 53 (2008), 647–58 (doi:10.1016/j.yhbeh.2008.01.010).

[38] J. Schroeder, M. Packard, 'Role of dopamine receptor subtypes in the acquisition of a testosterone conditioned place preference in rats', *Neurosci. Lett.* 282 (2000), 17–20 (doi:10.1016/S0304-3940(00)00839-9); Frye et al., 'The nucleus accumbens as a site of action'.

[39] K. Kashkin & H. Kleber, 'Hooked on hormones? An anabolic steroid addiction hypothesis', *J. Am. Med. Assoc.* 262 (1989), 3166–70 (doi:10.1001/jama.262.22.3166)

Cortisol has a complex pattern of effects on the nucleus accumbens. The activation of the HPA axis appears to be critically involved, through CRF and glucocorticoids, in different aspects of drug reward.[41] Acute stress increases extracellular dopamine levels, whereas chronic stress blunts the dopamine response and further inhibits dopamine outflow.[42] Chronic stress, through elevated corticosterone, appears to result in an increased dopamine D2 receptor density selectively in the shell of the nucleus accumbens.[43] D2 receptors are inhibitory autoreceptors that dampen dopamine release from the pre-synaptic terminal. Similarly, we have shown that chronic corticosterone treatment upregulates the binding of the dopamine transporter, which is responsible for the termination of dopamine's effect in the synapse, in the same brain region.[44] Others have shown long-lasting desensitization of dopamine receptor signalling caused by chronic stress.[45] Therefore, it can be hypothesized that chronic stress induces an allostatic attenuation of the mesolimbic dopaminergic system, possibly due in part to persistent corticosterone elevation.

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[40] Frye et al., 'The nucleus accumbens as a site of action'.

[41] Z. Sarnyai, Y. Shaham & S. C. Heinrichs, 'The role of corticotropin-releasing factor in drug addiction', *Pharmacol. Rev.* 53 (2001), 209–43

[42] S. Cabib & S. Puglisi-Allegra, 'Different effects of repeated stressful experiences on mesocortical and meso-limbic dopamine metabolism', *Neuroscience* 73, 375–80 (doi:10.1016/0306-4522(96)00750-6).

[43] L.R. Lucas, C.J. Wang, T.J. McCall & B. McEwen, 'Effects of immobilization stress on neurochemical markers in the motivational system of the male rat', *Brain Res.* 1155 (2007) , 108–15 (doi:10.1016/j.brainres.2007.04.063).

[44] Sarnyai et al., 'Selective regulation of dopamine transporter binding'.

3. STEROID HORMONES AND RISK-TAKING

(*a*) *Testosterone and risk-taking*

Testosterone mediates sexual behaviour as well as competitive encounters, so there are prima facie reasons for believing it could also affect financial risk-taking. Research into how it may do so is, however, in its infancy. Much of the work on the cognitive and behavioural effects of androgens has instead studied humans taking anabolic steroids, studies that are pharmacological rather than physiological because the steroids are taken in supra-physiological doses;[46] or the work has studied animal behaviour, thus leaving open the question of the results' applicability to humans.[47] The animal studies, besides those examining sexual behaviour, have focused largely on the effects of testosterone on mating, guarding and territorial aggression, and on competitions for rank within a social hierarchy. This research has been elegantly synthesized by the biologist John Wingfield in his highly influential challenge hypothesis.

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[45] K. Choy Y. deVisser & M. van den Buuse, 'The effect of "two-hit" neonatal and young-adult stress on dopaminergic modulation of prepulse inhibition and dopamine receptor density', *Br. J. Pharmacol.* 156 (2009), 388–96 (doi:10.1111/j.1476-5381.2008.00008.x).

[46] Kashkin & Kleber, 'Hooked on hormones?'.

[47] R. Sapolsky, *The Trouble with Testosterone: and Other Essays on the Biology of the Human Predicament* (New York: Simon & Schuster, 1997).

According to the challenge hypothesis, testosterone in males rises to a minimum level required for sexual behaviour; it will continue to rise beyond this level only when males are confronted with an intruder or a social challenge, the increased testosterone promoting aggressive behaviour.[48] The insights gained from the challenge hypothesis, and from animal hormone studies more generally, have been applied to human behaviour ,[49] but often with questionable success. Many studies, for example, could not determine whether testosterone caused aggression or the other way round; others found testosterone levels were poor predictors of who subsequently became aggressive;[50] still others did not distinguish between aggressive and non-aggressive risk-taking.[51] One problem with these

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48. J.C. Wingfield, S. Lynn & K. Soma, 'Avoiding the "costs" of testosterone: ecological bases of hormone-behavior interactions', *BrainBehav. Evol.* 57 (2001), 239–51 (doi:10.1159/000047243).

49. J. Archer, 'Testosterone and human aggression: an evaluation of the challenge hypothesis', *Neurosci. Biobehav. Rev.* 30 (2006), 319–45 (doi:10.1016/j.neubiorev.2004.12.007).

50. Sapolsky, *The trouble with testosterone*; E.P. Monaghan & S.E. Glickman, 'Hormones and aggressive behavior', in *Behavioural Endocrinology* (eds J.B.Becker, S.M.Breedlove & D.Crews) (Cambridge, MA: MIT Press, 2001), 261–87.

51. H. Vermeersch, G. T'sjoen, J.M. Kaufman & J. Vincke, 'The role of

studies stems from the fact that in humans, as in some non-human primates, higher cognitive functions refract the effects of testosterone, effects which in smaller brained animals are more deterministic. Furthermore, the dependent variables in these studies, such as aggression, dominance, or status seeking, often cannot be defined or measured in humans with any objectivity, leading to marginally significant experimental results and contradictory findings between papers.[52]

Studies of steroids and financial risk-taking promise to overcome many of these difficulties. To begin with, financial variables, such as profit, variance of returns, volatility of the market, can be defined objectively and measured precisely. Furthermore, the competitive behaviour Wingfield and his colleagues observed in animals may manifest itself in humans, not so much in aggressive encounters as in competitive economic behaviour. Through its known effects on dopamine transmission in the nucleus accumbens, testosterone may well have its most powerful effects in humans by shifting their utility functions, state of confidence or financial risk preferences.

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testosterone in aggressive and non-aggressive risk-taking in adolescent boys', *Horm. Behav.* 53 (2008), 463–71 (doi:10.1016/j.yhbeh.2007.11.021).

[52] J. Archer, S. Birring & F. Wu, 'The association between testosterone and aggression among young men: empirical findings and a meta-analysis', *Aggress. Behav.* 24 (1998), 411–20 (doi:10.1002/(SICI)1098-2337(1998)24:6,411::AID-AB2.3.0.CO;2-9).

We began testing this hypothesis by setting up a series of experiments on a trading floor in the City of London.[53] We chose to study professional traders because real risk-taking, with meaningful consequences, seemed most likely to trigger large endocrine reactions. Our hypothesis and predictions were based on the challenge hypothesis as well as a closely related model, the winner effect (see below). Biologists working with these models have noticed that two males entering a fight or contest experience androgenic priming in the form of elevated testosterone levels. Moreover, the winning male emerges with even greater levels of testosterone, the loser with lower ones. The orders of magnitude of these hormone swings can be large: Monaghan & Glickman[54] report that in a competition for rank among recently introduced rhesus monkeys, the winning male emerged with a 10-fold increase in testosterone, while the loser experienced a drop to 10 percent of baseline levels within 24 hours, and these new levels for both winner and loser persisted for several weeks. This reaction may make sense from an evolutionary point of view: in the wild, the loser of a fight is encouraged to retire from the field and nurse his wounds while the winner prepares for new challenges to his recently acquired rank.

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[53] J.M. Coates & J. Herbert 'Endogenous steroids and financial risktaking on a London trading floor', *Proc. Natl Acad. Sci. USA* 105 (2008), 6167–72 (doi:10.1073/pnas.0704025105).

[54] 'Hormones and aggressive behavior'.

A similar result has been found in experiments with humans.[55] Athletes, for example, experience the same androgenic priming before a sporting contest, and a further increase in testosterone after a win. This experiment has been repeated for a number of different events, including tennis[56] and wrestling,[57] as well as less physical contests such as chess.[58] It has also been found that the rising and falling levels of an athlete's testosterone can be mimicked by fans: Bernhardt et al.[59] took testosterone samples from fans during a World Cup match in which Brazil defeated Italy. Both sets of fans went into the game with elevated testosterone, but afterwards the Brazilian fans' testosterone rose while the Italians' fell.

The role of these elevated testosterone levels is further explored in an animal model known as the 'winner effect'. In this model, winning in an agonistic encounter can itself contribute to a later win,[60] an effect that is independent of (i) an animal's resource-holding potential (RHP), i.e. the physical resources it can draw on in an all-out fight, (ii) its motivation, i.e. the value of the resource in dispute, or (iii) its aggressiveness.[61] It is not known if the win imparts information to winner and loser about their respective resources[62] or whether it has physiological effects. This latter possibility is suggested by experiments in which elevated testosterone has been found to contribute to further wins.[63] Another possibility not fully considered in the literature is that higher testosterone, through its beneficial effects on the cardiovascular system and muscle mass, may effectively increase an animal's RHP, or, through its effects on confidence and risk-taking, may increase an animal's motivation or aggressiveness.[64] Whatever the mechanism, a winner, with heightened testosterone levels, may proceed to the next round of competition with an advantage. This positive feedback loop, in which victory raises testosterone which in turn raises the likelihood of later victories (figure 2, overleaf), may help account for winning and losing streaks in round-robin animal competitions that establish a social hierarchy.[65]

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[55] B. Gladue, M. Boechler & K.D. McCaul, 'Hormonal response to competition in human males', *Aggress. Behav.* 15 (1989), 409–22 (doi:10.1002/1098-2337(1989)15:6,409::AID-AB2480150602.3.0.CO;2-P).

[56] A. Booth, D. Johnson & D. Granger, 'Testosterone and men's health', *J. Behav. Med.* 22 (1999), 1–19 (doi:10.1023/A:1018705001117).

[57] M. Elias, 'Serum cortisol, testosterone, and testosterone-binding globulin responses to competitive fighting in human males', *Aggress. Behav.* 7 (1981), 215–24 (doi:10.1002/1098-2337(1981)7:3,215::AID-AB2480070305.3.0.CO;2-M).

[58] A. Mazur, A. Booth & J. Dabbs, 'Testosterone and chess competition', *Soc. Psychol. Q.* 55 (1992), 70–77 (doi:10.2307/2786687).

[59] P.C. Bernhardt, J. Dabbs, J. Fielden & C. Lutter, 'Changes in testosterone levels during vicarious experiences of winning and losing among fans at sporting events', *Physiol. Behav.* 65 (1998), 59–62 (doi:10.1016/S0031-9384(98)00147-4).

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[60] I.D. Chase, C. Bartolomeo & L.A. Dugatkin, 'Aggressive interactions and inter-contest interval: how long do winners keep winning?', *Anim.Behav.* 48 (1994), 393–400 (doi:10.1006/anbe.1994.1253); T. Oyegbile & C. Marler, 'Winning fights elevates testosterone levels in California mice and enhances future ability to win fight', *Horm. Behav.* 48 (2005), 259–67 (doi:10.1016/j.yhbeh.2005.04.007).

[61] P. Hurd, 'Resource holding potential, subjective resource value, and game theoretical models of aggressiveness signaling', *J. Theor. Biol.* 241 (2006), 639–48 (doi:10.1016/j.jtbi.2006.01.001).

[62] Y. Hsu & L. Wolf, 'The winner and loser effect: what fighting behaviours are influenced?', *Anim. Behav.* 61 (2001), 777–86 (doi:10.1006/anbe.2000.1650); C. Rutte, M. Taborsky & M. Brinkhof, 'What sets the odds of winning and losing?', *Trends Ecol. Evol.* 21 (2006), 16–21 (doi:10.1016/j.tree.2005.10.014).

[63] B.C. Trainor, I.M. Bird & C.A. Marler, 'Opposing hormonal mechanisms of aggression revealed through short-lived testosterone manipulations and multiple winning experiences', *Horm. Behav.* 45 (2004), 115–21 (doi:10.1016/j.yhbeh.2003.09.006); T. Oyegbile & C. Marler, 'Winning fights elevates testosterone levels in California mice and enhances future ability to win fight', *Horm. Behav.* 48 (2005), 259–67 (doi:10.1016/j.yhbeh.2005.04.007).

We examined the relevance of the challenge hypothesis and winner effect models to the financial markets[66] by looking for evidence that traders experience an increase in testosterone when they enjoy an above-average win in the markets. To do so, we sampled steroids from 17 young male traders, taking saliva samples twice a day, at 11.00 and 16.00, over a period of eight consecutive business days. Hormone readings are notoriously noisy owing to the pulsatile nature of their production and release into the blood stream, hence our protocol of repeated sampling to help separate 'signal' from 'noise'. The traders were engaged in

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[64] F. Neat, G. Huntingford & M. Beveridge, 'Fighting and assessment in male cichlid fish: the effects of asymmetries in gonadal state and body size', *Anim. Behav.* 55 (1998), 883–91 (doi:10.1006/anbe.1997.0669).

[65] L. Dugatkin & M. Druen, 'The social implications of winner and loser effects', *Proc. Biol. Sci.* 271 (Suppl. 6) (2004), S488–S489 (doi:10.1098/rsbl.2004.0235).

[66] J.M. Coates & J. Herbert 'Endogenous steroids and financial risktaking on a London trading floor,', *Proc. Natl Acad. Sci. USA* 105 (2008), 6167–72 (doi:10.1073/pnas.0704025105).

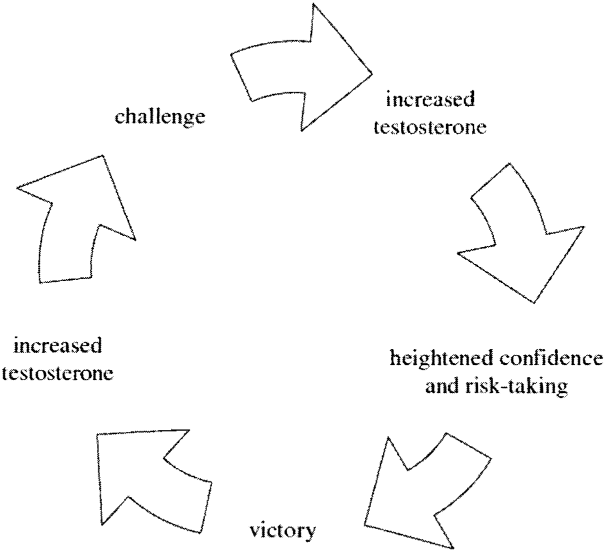
challenge
increased testosterone
heightened confidence and risk-taking
victory
increased testosterone

Figure 2. Schematic representation of a winner effect mediated by testosterone.

high-frequency trading, meaning that they positioned securities, mostly futures contracts in European and US bond and equity markets, in sizes up to £1 billion, but held their positions for a short period of time—several minutes, and sometimes mere seconds. They rarely positioned trades overnight, and they did not let winning or losing positions run for long.

We discovered that these traders did indeed have significantly higher testosterone levels on days when they made an above-average profit. We could not determine from this correlation whether the profits were raising hormone levels or vice versa, but since we took two samples per day, we could examine how morning testosterone levels were related to afternoon profits and losses (P&Ls). To do so, we looked at the days when each trader's 11.00 testosterone levels were above his median level during the study, these days showing testosterone levels a modest 25 per cent higher than on the other days. We found that on days of high morning testosterone, the traders returned an afternoon profit (figure 3a, overleaf) that was almost a full standard deviation higher than on 'low-testosterone' days. Interestingly, this relationship was even stronger among experienced traders (figure 3b, overleaf), i.e. those who had traded for longer than 2 years, suggesting that testosterone, at moderate levels, was not having its effect by encouraging overly risky behaviour but was instead optimizing performance, at least with respect to high-frequency trading.

The effects of androgens on high-frequency trading were also evident in a second experiment, one that looked at a surrogate marker of pre-natal androgen exposure—the second to fourth digit (finger length) ratio (2D:4D).[67] As mentioned above, there are two distinct periods and types of hormone

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[67] J.M. Coates, M. Gurnell & A. Rustichini, 'Second-to-fourth digit ratio predicts success among high-frequency financial traders', *Proc. Natl Acad. Sci. USA* 106 (2009), 623–28 (doi:10.1073/pnas.0810907106).

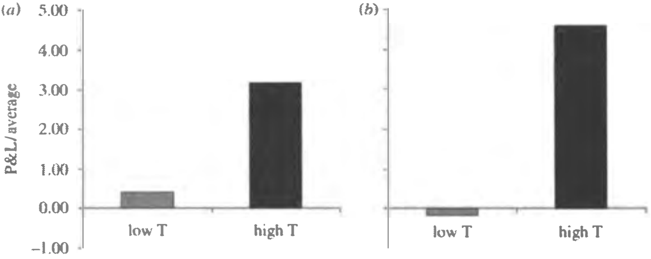

Figure 3. P&L on low- and high-testosterone days. (a) P&L made between 11.00 and 16.00 for 17 traders on days when their testosterone levels were above their median level during the study ('highT') and on the rest of the days ('lowT') (n=17, paired t-test p=0.008; Cohen's d=0.97). P&Ls for each trader were standardized by dividing them by their 1-month average daily P&L. Standardized P&Ls were then averaged across all 17 traders. (b) Afternoon P&L for experienced traders only, i.e. ones with more than 2 years trading experience (n=10, paired t-test p=0.005; Cohen's d=1. 37).

action—organizational effects of pre-natal steroids on the foetus and activational effects of circulating steroidgens surge between the ninth and 18th week of gestation, masculinizing the foetus and exerting developmental changes on the body and brain that are permanent.[68] After the 19th week, androgen production subsides, spikes again briefly in the neonate and then drops back to low levels until the onset of puberty. At puberty, androgen production increases, activating the circuits created earlier in life by pre-natal hormone exposure. According to the organizational/activational model of hormone action,[69] the sensitivity of adults to changes in circulating testosterone is a function of the amount of pre-natal androgen to which they were exposed.[70]

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[68] C. Cohen-Bendahana, C. van de Beeka & S. Berenbaum, 'Prenatal sex hormone effects on child and adult sex-typed behavior: methods and findings', *Neurosci. Biobehav. Rev.* 29 (2004), 353–84 (doi:10.1016/j.neubiorev.2004.11.004).

Importantly, the amount of pre-natal androgen an individual was exposed to can be estimated because it leaves traces throughout the adult body, traces often measured by paediatricians looking for effects of environmental hormone disruptors on newborn infants. 2D:4D is the most convenient measure for behavioural studies.[71] A lower 2D:4D ratio is thought to indicate higher levels of pre-natal testosterone exposure.[72] Consistent with this, men on average have lower ratios than women. We sampled 2D:4D from a total of 44 traders, including 14 from the first study, and found that it predicted both the traders' P&Ls over a 20-month period and the number of years they had survived in the business. It also predicted, in line with the organizational/activational model, the sensitivity of the trading performance of the original 14 traders to increases in circulating testosterone: the lower the trader's 2D:4D, the more money he made when his testosterone levels rose.

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[69] C. Phoenix, R. Goy, A. Gerall & W. Young, 'Organizing action of prenatally administered testosterone propionate on the tissues mediating mating behavior in the female guinea pig', *Endocrinology* 65 (1959), 369–82 (doi:10.1210/endo-65-3-369).

[70] M. Meaney, 'The sexual differentiation of social play', *Trends Neurosci.* 11 (1988), 54–8 (doi:10.1016/0166-2236(88)90164-6); Breedlove & Hampson, 'Sexual Differentiation of the Brain and Behavior'.

[71] M. McIntyre, 'The use of digit ratios as markers for perinatal androgenaction', *Reprod. Biol. Endocrinol.* 4, 10 (2006) (doi:10.1186/1477-7827-4-10).

[72] J. Manning, D. Scutt, D. Wilson & D. Lewis-Jones, '2nd to 4th digit length: a predictor of sperm numbers and concentrations of testosterone, luteinizing hormone and oestrogen', *Hum. Reprod.* 13 (1998), 3000–3004 (doi:10.1093/humrep/13.11.3000); Brown et al. 2002).

Pre-natal testosterone appears, therefore, to predict long-term success in high-frequency trading, a style of trading requiring quick physical and cognitive reactions. However, there are grounds for believing that in other types of trading, especially those permitting more time for analysis and a longer holding period, or ones that do not make such physical demands, the correlation may weaken and even reverse sign.[73] The market, it appears, selects for biological traits but these traits may vary between market segments.

The two trading floor experiments described here raise troubling questions about the efficient markets hypothesis. If, as this hypothesis assumes, markets are random, then we should not be able to predict relative trading performance by means of biological traits. Yet, our results suggest that higher levels of circulating testosterone predict short-term profitability and higher levels of pre-natal testosterone predict long-term profitability, at least in the segment of the market inhabited by high-frequency traders. The implication seems to be that the markets are not efficient or that they select for traits other than rational expectations.[74]

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[73] J.M. Coates, M. Gurnell & A. Rustichini, 'Second-to-fourth digit ratio predicts success among high-frequency financial traders', *Proc. Natl Acad. Sci. USA* 106 (2009), 623–28 (doi:10.1073/pnas.0810907106).

This leads us to another important question: How could testosterone exert its effects on profitability?

Field studies such as those reported above do not allow us to establish a causal relationship between testosterone and profits, merely a predictive relationship, albeit a strong one. To establish causality, one needs pharmacological manipulation. Some studies administering testosterone esters to eugonadal males have found significant but weak effects on mood and aggressiveness,[75] although they were not examining financial tasks. However, converging evidence from other lines of research suggests that androgen may affect confidence and risk preferences. For example, administered testosterone promotes confidence and fearlessness in the face of novelty, a result observed in both animals[76] and humans.[77] Furthermore, in a between-subjects study of male students playing an investment game, testosterone levels correlated with risk preferences.[78] This study also examined 2D:4D and risk preferences, finding a significant correlation among Swedish Caucasians but not in a more ethnically heterogeneous population, the difference in results being accounted for by the fact that ethnic population is an important confound for 2D:4D.

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[74] W. DeBondt & R. Thaler, 'Further evidence on investor overreaction and stock market seasonality', *J. Finance* 42 (1987), 557–81 (doi:10.2307/2328371); R. Shiller, *Irrational Exuberance* (New York:Doubleday, 2005); L. Blume & D. Easley, 'If you are so smart why aren't you rich? Belief selection in complete and incomplete markets', *Econometrica* 74 (2006), 929–66 (doi:10.1111/j.1468-0262.2006.00691.x).

[75] S. Bhasin et al, 'Testosterone dose–response relationships in healthy young men', *Am. J. Physiol. Endocrinol. Metab.* 281 (2001), 1172–81; D. O'Connor, J. Archer & F. Wu, 'Effects of testosterone on mood, aggression, and sexual behavior in young men: a double-blind, placebo-controlled, cross-over study', *J. Clin. Endo. Metabol.* 89 (2004), 2837–45 (doi:10.1210/jc.2003-031354).

Intriguingly, there is another potential path of causation between testosterone and trading profits. Trading, it is not often appreciated, is a physical activity, a demanding one, so the important effects of testosterone may be physical rather than cognitive. High testosterone levels or increased androgenic effects, for example, can increase vigilance and visuo-motor skills such as scanning and speed of reactions,[79] qualities that may help traders to spot and trade price discrepancies before others arbitrage them away.[80] Elevated testosterone levels have also been found to increase an animal's search persistence[81] and, during search, to focus visual attention while decreasing distraction by irrelevant stimuli.[82] These last traits may be of particular importance in high-frequency trading because this form of trading requires lengthy periods of visuomotor scanning and quick reactions.

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[76] A. Boissy & M. Bouissou, 'Effects of androgen treatment on behavioural and physiological responses of heifers to fear-eliciting situations', *Horm. Behav.* 28 (1994), 66–83 (doi:10.1006/hbeh.1994.1006).

[77] E. Hermans, P. Putman, J. Baas, H. Koppeschaar & J. van Honk, 'A single administration of testosterone reduces fear-potentiated startle in humans', *Biol. Psychiat.* 59 (2006), 872–74 (doi:10.1016/j.biopsych.2005.11.015).

[78] C. Apicella, A. Dreber B. Campbell, P. Gray, M. Hoffman & A. Little, 'Testosterone and financial risk preferences', *Evol. Hum. Behav.* 29 (2008), 384–90 (doi:10.1016/j.evolhumbehav.2008.07.001).

[79] E. Salminen, R. Portin, A. Koskinen, H. Helenius & M. Nurmi, 'Associations between serum testosterone fall and cognitive function in prostate cancer patients', *Clin. Can. Res.* 10 (2004), 7575–82 (doi:10.1158/1078-0432.CCR-04-0750); C. Falter, M. Arroyo & G. Davis, 'Testosterone: activation or organization of spatial cognition?', *Biol. Psychol.* 73 (2006), 132–140 (doi:10.1016/j.biopsycho.2006.01.011).

An increase in confidence or risk preferences, as found in some studies, would tend to increase a trader's position size; an increase in search persistence the frequency of trading; an increase in reaction times the chances of getting to a trade before others. Given that the traders in our study had a positive expected return, i.e. they usually made money, larger positions or more frequent trades would translate into higher daily profits. However, we cannot at this point say by which route these effects travelled, that is, whether testosterone was having its effect by augmenting the effort, speed, confidence or risk preferences of the traders.

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[80] J.M. Coates, M. Gurnell & A. Rustichini, 'Second-to-fourth digit ratio predicts success among high-frequency financial traders', *Proc. Natl Acad. Sci. USA* 106 (2009), 623–28 (doi:10.1073/pnas.0810907106).

[81] R. Andrew & L. Rogers, 'Testosterone, search behaviour and persistence', *Nature* 237 (1972), 343–46 (doi:10.1038/237343a0).

[82] R. Andrew, *The Development and Integration of Behaviour. Essays in Honour of Robert Hinde*, ed. P.Bateson (Cambridge: Cambridge University Press, 1991), 171–90.

(*b*) *Cortisol and risk-taking*

A review of research on cortisol and financial risk- taking is necessarily brief as there is almost no work done on this subject. Van Honk et al.[83] looked at the cortisol levels of people playing the Iowa Gambling Task and found that they correlated with risk aversion. In our own studies, we hypothesized that cortisol, as a stress hormone, would increase as traders lost money. This seemed a reasonable assumption, but our experiment did not find evidence to support it, as we observed no relationship between trading losses, even above-average ones, and cortisol levels. However, caution is needed before extrapolating these findings, as the style of trading and the risk management practices on this trading floor prevented traders from losing large sums of money. Had they not done so, or had we sampled in a different setting, for example in an investment bank where traders position interest rate or credit risk for longer periods of time, and had these traders entered a sustained losing streak, it is likely they would have experienced high levels of stress and cortisol.

However, we did note a potentially more interesting finding—that cortisol was rising with uncertainty. Early research on stress and cortisol, especially the pioneering work of Hans Selye, focused on how cortisol production reacts to actual bodily harm. But later research found that the HPA axis can respond more robustly to expected harm and that the size of the response is an increasing function of the uncertainty over timing. For example, an animal receiving a shock at regular intervals or after a warning tone may have normal cortisol levels at the end of an experiment; in contrast, an animal receiving the same quantity of shock will experience rising cortisol levels as the timing of the shocks becomes more and more unpredictable, reaching a maximum when the timing becomes random.[84] Animals can have a similarly elevated HPA response when exposed to situations of novelty[85] or uncontrollability.[86] Uncertainty, novelty and uncontrollability can perhaps be reduced to a common denominator of uncertainty; all three describe a situation in which an animal finds it increasingly difficult to predict what may happen and what actions will be required. The necessity of being prepared for the unexpected signals to the body, via cortisol, that catabolic metabolism may be needed. As it transpires, 'uncertainty', 'novelty' and 'uncontrollability' aptly describe the financial markets and the environment in which traders find themselves on a daily basis.

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[83] J. van Honk, D. Schutter, E. Hermans & P.Putman, 'Low cortisol levels and the balance between punishment sensitivity and reward dependency', *NeuroReport* 14 (2003), 1993–96.

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[84] S. Levine, C. Coe & S.G. Wiener, 'Psychoneuroendocrinology of stress: a psychobiological perspective', in *Psychoendocrinology,* eds F.Bush & S.Levine (New York: Academic Press, 1989), 341–77.

[85] K. Erikson, W. Drevets & J. Schulkin, 'Glucocorticoid regulation of diverse cognitive functions in normal and pathological emotional states', *Neurosci. Biobehav. Rev.* 27(2003), 233–46 (doi:10.1016/S0149-7634(03)00033-2).

[86] R. Swenson & W. Vogel, 'Plasmacatecholamine and corticosterone as well as brain catecholamine changes during coping in rats exposed to stressful footshock', *Pharmacol. Biochem. Behav.* 18 (1983), 689–93 (doi:10.1016/0091-3057(83)90007-2); A. Breier, M. Albus, D. Pickar, T.P. Zahn, O.M. Wolkowitz & S.M. Paul, 'Controllable and uncontrollable stress in humans: alterations in mood and neuroendocrine and psychophysiological function', *Am. J. Psychiatry* 144 (1987), 1419–25.

To examine the effect of uncertainty on traders' HPA axes, we looked at the risk faced by each trader, as measured by the variance of his P&L, over the course of the study.[87] We found a highly significant correlation with cortisol that once again displayed a large effect size. Variance in P&L is a measure of the uncertainty or uncontrollability a trader has just lived through; but we also wanted to measure how uncertain the traders were about upcoming events in the market, such as the release of important economic statistics. To do so, we used the implied volatility of the Bund futures contract (a future on German Government bonds), which was the security most widely traded by the traders in the study. Bond options require for their pricing the market's estimate of the future variance of the underlying asset, so option prices provide an objective measure of the market's collective uncertainty. Here, again we observed a very high and significant correlation between the traders' daily cortisol levels, averaged from all traders, and the market's uncertainty regarding upcoming market moves. Our results raise the possibility that while testosterone codes for economic return, cortisol codes for risk.

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[87] J.M. Coates & J. Herbert 'Endogenous steroids and financial risktaking on a London trading floor', *Proc. Natl Acad. Sci. USA* 105 (2008), 6167–72 (doi:10.1073/pnas.0704025105).

Our experiment represents only the mere beginning of research into the role of cortisol in financial decision-making. To underline our belief in the critical importance of this hormone, we should point out that the cortisol fluctuations we observed were large. In the normal course of a day, cortisol, like testosterone, peaks in the morning and falls over the course of the day. Between our sampling times, cortisol levels would be predicted to fall by approximately 40 per cent, yet in many of our subjects it rose, in some cases by as much as 500 per cent. Similar-sized cortisol fluctuations were also observed between days. What purpose do changes of this magnitude serve? Cortisol, as highlighted above, marshalls glucose for immediate use, and it promotes anticipatory arousal and a focused attention.[88] We speculate therefore that traders, when expecting a market move, would benefit from such an acute increase in cortisol, as it prepares them for the money-making opportunities that increased volatility brings.

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[88] K. Erikson, W. Drevets & J. Schulkin, 'Glucocorticoid regulation of diverse cognitive functions in normal and pathological emotional states', *Neurosci. Biobehav Rev.* 27(2003), 233–46 (doi:10.1016/S0149-7634(03)00033-2).

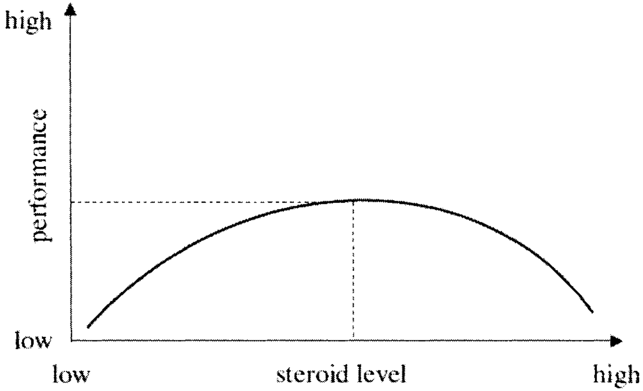

Figure 4. Inverted U-shaped dose–response curve relating cortisol levels to cognitive function, such as performance, on a spatial navigation or declarative memory task.

(*c*) *Steroids and impaired risk-taking*

If market volatility or the variance in the traders' P&L were to remain high, cortisol levels could also remain elevated for an extended period. Chronically elevated cortisol levels, as we have seen, can have the opposite effect on cognitive performance as acute levels. Cortisol displays an inverted U-shaped dose–response curve, according to which performance on a range of cognitive and behavioural tasks is optimized at moderate levels, while being impaired at lower and higher levels (figure 4).[89] As cortisol levels rise past the optimal point on the dose–response curve, they may begin to impair trading performance, specifically by promoting irrational risk aversion. Chronically elevated cortisol levels increase CRH gene transcription in the central nucleus of the amygdala thereby promoting fear,[90] anxiety[91] and the tendency to find risk where perhaps none exists.[92] They may also alter the types of memory recalled, causing a person to selectively recall mostly negative precedents.[93] Lastly, chronic stress, as we have seen, downregulates dopamine transporters, receptors and downstream signalling molecules in the nucleus accumbens, and may thereby alter risk-related behaviours. All these effects would tend to decrease a trader's appetite for risk.

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[89] C. Conrad, S. Lupien & B. McEwen, 'Support for a bimodal role for type II adrenal steroid receptors in spatial memory', *Neurobiol. Learn. Mem.* 72 (1999), 39–46 (doi:10.1006/nlme.1998.3898).

[90] K. Corodimas, J. LeDoux, P. Gold & J. Schulkin, 'Corticosterone potentiation of learned fear', *Ann. NY Acad. Sci.* 746 (1994), 392–3

[91] J.D. Shephard, K.W. Barron & D.A. Myers, 'Corticosterone delivery to the amygdala increases corticotropin-releasing factor mRNA in the central amygdaloid nucleus and anxiety-like behavior', *BrainRes.* 861 (2000), 288–95; S. Korte, 'Corticosteroids in relation to fear, anxiety and psychopathology', *Neurosci. Biobehav. Rev.* 25 (2001), 117–42 (doi:10.1016/S0149-7634(01)00002-1).

[92] J. Schulkin, B.S. McEwen & P. W. Gold, 'Allostasis, amygdala, and anticipatory angst', *Neurosci. Biobehav. Rev.* 18 (2004), 385–96 (doi:10.1016/0149-7634(94)90051-5); B. McEwen, 'Stress, adaptation, and disease: allostasis and allostatic load', *Ann. NY Acad. Sci.* 840 (1998), 33–44 (doi:10.1111/j.1749-6632.1998.tb09546.x).

[93] K. Erikson, W. Drevets & J. Schulkin, 'Glucocorticoid regulation of diverse cognitive functions in normal and pathological emotional states', *Neurosci. Biobehav. Rev.* 27 (2003), 233–46 (doi:10.1016/S0149-7634(03)00033-2).

When might conditions of chronic stress occur in the markets? Bear markets and crashes are notable for their extreme levels of volatility, the protracted subprime mortgage crisis being a notable example, with the VIX, an index of implied volatilities on the New York Stock Exchange, rising from 12 per cent before the crisis to a high of 80 per cent 18 months later. It seems likely that cortisol levels among traders threatened for so long with historic levels of uncertainty would have increased and perhaps remained elevated for a prolonged period of time. Under such circumstances, the steroid may have contributed to the extreme levels of risk aversion observed among traders. Indeed, extended periods of uncertainty and uncontrollable stress can promote a condition known as 'learned helplessness', in which persons, and animals, lose all belief in their ability to control or influence their environment.[94] Under these circumstances, traders could become price insensitive and fail to respond to lower asset prices or interest rates, thereby rendering monetary policy ineffective. In short, rising cortisol levels among traders and investors may promote risk aversion during a bear market, exaggerating the market's downward move.

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[94] S. Kademian, A. Bignante, P. Lardone B. McEwen & M. Volosin, 'Biphasic effects of adrenal steroids on learned helplessness behavior induced by inescapable shock', *Neuropsychopharm* 30 (2005), 58–66 (doi:10.1038/sj.npp.1300577).

Could testosterone work in the opposite direction, encouraging irrational risk-taking during a bull market? This is a difficult question. Moderate levels, as described above, may promote effective risk-taking among animals and high-frequency traders. But higher levels may indeed carry increased costs such as encouraging excessive risk-taking. In studies related to the challenge hypothesis and the winner effect, animal behaviourists have found that the higher a male's testosterone level (either on account of the analogous forms of over-confidence and irrational risk-taking. The traders we observed experienced only moderate increases, although one trader, who enjoyed a 5-day winning streak during which he made over twice his daily average P&L, experienced a 75 per cent increase in mean daily testosterone. It is known that cortisol can rise to extreme levels, and for extended periods of time; but research on the costs of high physiological levels of testosterone in humans is rare. Nonetheless, some studies have found that physiological levels of testosterone are indeed correlated with risky behaviour,[95] sensation seeking[96] and the size of offers rejected in the Ultimatum Game, rejections often considered as violations of economic rationality.[97] Other studies with users of anabolic steroids, or subjects administered pharmacological doses of testosterone, have found evidence of manic behaviour.[98] In one study, researchers administered testosterone to a group of women playing the Iowa Gambling Task[99] and found that it shifted risk preferences to such an extent that the women switched from playing the low variance and positive expected-return decks of cards to the high variance but negative expected-return decks. A similar result was found in a physiological study in which the performance of young males on the Iowa Gambling Task was negatively correlated with their testosterone levels.[100] These study results suggest that elevated levels of testosterone could at some point begin to impair rational financial decision-making.

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[95] A. Booth, D. Johnson & D. Granger, 'Testosterone and men's health', *J. Behav. Med.* 22 (1999), 1–19 (doi:10.1023/A:1018705001117).

[96] R. Daitzman & M. Zuckerman, 'Disinhibitory sensation seeking personality and gonadal hormones', *Pers. Individ. Differ.* 1 (1980), 103–110 (doi:10.1016/0191-8869(80)90027-6).

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97. B. Van den Bergh & S. Dewitte, 'Digit ratio (2D:4D) moderates the impact of sexual cues on men's decisions in ultimatum games', *Proc. R. Soc. B* 273 (2006), 2091–5 (doi:10.1098/rspb.2006.3550); T. Burnham, 'High-testosterone men reject low ultimatum game offers', *Proc.R.Soc.B* 274, 2327–30 (doi:10.1098/rspb.2007.0546).

98. H. Pope & D. Katz, 'Affective and psychotic symptoms associated with anabolic steroid use', *Am.J.Psychiatry* 145 (1988), 487–90; H. Pope, E. Kouri & J. Hudson, 'Effects of supra-physiologic doses of testosterone on mood and aggression in normal men: a randomized controlled trial', *Arch.Gen. Psychiatry* 57 (2000), 133–140 (doi:10.1001/archpsyc.57.2.133).

99. J. van Honk, D.J.L.G. Schuttera, E.J. Hermansa, P. Putmana, A. Tuitena, H. Koppeschaar, 'Testosterone shifts the balance between sensitivity for punishment and reward in healthy young women', *Psychoneuroendocrinol.* 29 (2004), 937–43 (doi:10.1016/j.psyneuen.2003.08.007).

100. R. Reavis & W. Overman, 'Adult sex differences on a decision-making task previously shown to depend on the orbital prefrontal cortex', *Behav. Neurosci.* 115 (2001), 196–206 (doi:10.1037/0735-7044.115.1.196).

4. CONCLUSION

Taken together, the findings surveyed in this review suggest the possibility that economic agents are more hormonal than is assumed by theories of rational expectations and efficient markets. These theories assume, for example, that prices in financial markets accurately reflect all available information. But a trader's interpretation of information may not be stable: a trader with high levels of testosterone may see only opportunity in a set of facts; while the same trader with chronically elevated cortisol may find only risk. Furthermore, risk preferences may not be stable. If traders are subject to a financial variant of the winner effect, such that rising levels of testosterone increase their appetite for risk during a bull market, and rising levels of cortisol decrease their appetite for risk during a bear market, then steroid hormones may shift risk preferences systematically across the business cycle. This effect, even if confined to a small number of people, could destabilize the financial markets.[101] The hypothesis of steroid feedback loops exaggerating market moves raises the further possibility that the emotions of irrational exuberance and pessimism (what the economist John Maynard Keynes called 'animal spirits') commonly blamed for financial instability may in fact be steroid-induced shifts in confidence and risk preferences. This is not to say hormones cause bubbles and crashes; advances in technology, for example, caused the bull markets of 1920s and the Dotcom era, but hormones may exaggerate moves once under way.

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[101] C. Camerer & E. Fehr 'When does "economic man" dominate social behavior?', *Science* 311 (2006), 47–52 (doi:10.1126/science.1110600).

The study of hormonal influences is, we believe, an important step in the ongoing project, beginning with behavioural economics and continuing with neuroeconomics, of showing how the body influences economic decisions, frequently pushing economic agents, for good or ill, away from rational choice. The research, moreover, carries intriguing policy implications: if hormones affect risk-taking, then perhaps financial markets can be made more stable by having a greater endocrine diversity in the financial industry. How do we achieve endocrine diversity? Hormone levels change over the course of our lives, with testosterone and oestrogen declining, and cortisol increasing; so young and old have markedly different endocrine profiles. The sexes as well have very different endocrine systems. Market stability is served by opinion diversity; so it may be served as well by having more balance in the banks between young and old, men and women. One does not need to argue that one group is better than others for this policy to work; merely different.[102] However, there are grounds for thinking that women may be less 'hormonally reactive' when it comes to financial risk-taking. For example, women have only

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[102] Dreher et al., 'Menstrual Cycle phase modulates…'.

5–10 percent of the circulating levels of testosterone of men, and they have not been exposed to the same organizing effects of pre-natal androgens. Furthermore, some studies have found that women's HPA axes are less reactive to stressors stemming from a competitive situation.[103] Their greater presence in the ranks of money managers may therefore help dampen hormonal swings in the market.

Lastly, the endocrine system may be the missing link in the new field of neuroscience and economics, connecting market events to brain processes.[104] If research in endocrinology, especially work done with animal models, were to be wedded to recent developments in neuroscience and economics, we could begin to approach a unified scientific subject, from molecule to market.[105]

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103. L. Stroud, P. Salovey & E. Epel, 'Sex differences in stress responses: social rejection versus achievement stress', *Biol. Psychiatry* 319 (2002), 318–27 (doi:10.1016/S0006-3223(02)01333-1).

104. X. Caldú & J. Dreher, Hormonal and genetic influences on processing reward and social information', *Ann. NY Acad. Sci.* 1118 (2007), 43–73 (doi:10.1196/annals.1412.007).

105. B. McEwen, 'From molecules to mind: stress, individual differences, and the social environment', in *Unity of Knowledge: The Convergence of Natural and Human Science* (eds A.Damasio et al.), *Ann. NY Acad. Sci.* 935 (2001), 42–9 (doi:10.1111/j.1749-6632.2001.tb03469.x).

On Cunning Automata: Financial Acceleration at the Limits of the Dromological[1]

Nick Srnicek and Alex Williams

> *Man is a being that does things such as feeling happiness, playing the violin, going for a walk, and all sorts of other things which are simply not needed.* [...] *The best sort of worker is the cheapest worker. The one that has the least needs. What young Rossum invented was a worker with the least needs possible* [...] *He threw out everything that wasn't of direct use in his work, that's to say, he threw out the man and put in the robot.*[2]
>
> KAREL ČAPEK, 1920

> *We would like to explore the possibility that the need for [financial] specialists, market makers, and block positioners can be eliminated almost completely by an efficiently operated computer exchange.*[3]
>
> FISCHER BLACK, 1971

> *For the replicants money is not a matter of possession, but of liquidity/deterritorialisation, and all the monetary processes on Earth are open to their excitement, irrespective of ownership.*[4]
>
> NICK LAND, 1993

0. FROM THE CASINO TO THE WARZONE

Contemporary representations of finance are anything but complimentary. Chief amongst them is the image of 'casino capitalism', a popular ideologeme in the post-2008 media ecosystem of financial paranoia and fiscal crisis. While the term might serve some rhetorical purpose for the tattered remnants of what was once the left, it occludes the complexity, sophistication, and political centrality of the financial system in post-Fordist capitalism. Moreover, it inevitably misses the relationship that actually obtains between gambling and finance: in this figuration, who are the punters and who is the house? If the work of sociologists of finance (paradigmatically, Donald MacKenzie)[5] has anything to teach us here, it is that the slippery reflexivity of financial models, the lawless shadow banking system of OTC derivatives, and the ruthless market manipulation of leading investment banks all engender a system far more corrupt and non-transparent than even the most

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1. The authors acknowledge the valuable input of Antoine Bousquet, Mark Fisher, Graham Joncas, Ned Molloy, and Jared Woodard. We extend special thanks for the invaluable heretical inspiration of Reza Negarestani and Benedict Singleton in the construction and refinement of this piece.

2. K. Čapek, *R.U.R.* (*Rossum's Universal Robots*) (USA: Createspace, 2012), 12.

3. F. Black, 'Toward a Fully Automated Stock Exchange', *Financial Analysts Journal* 27:6 (December 1971): 25.

4. N. Land, 'Machinic Desire', in *Fanged Noumena: Collected Writings 1987–2007*, ed. R. Mackay and R. Brassier (Falmouth: Urbanomic, 2011), 337.

5. D. MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets* (Cambridge: The MIT Press, 2008).

stacked of Vegas poker tables. Moreover, this gambling metaphor also entirely conceals the significant technical innovations generated by the financial sector in the last decade. These novelties depose the image of the casino as a stable set of probabilities, replacing it with a new regime in which technology redefines the risk landscape itself. This new financial universe of warring technical engines, trading as close to the speed of light as possible, comes into view with the relatively recent appearance of high-frequency trading (HFT).

This concern of this essay is the universe HFT has created, its inner dynamics and its external effects. It will draw out a distinction between two regimes of what can be termed acceleration: *dromological acceleration* versus *universal acceleration*. This distinction turns on the differend between a fundamentally brainless increase in speed, and an alternative notion of a rational acceleration capable of navigating a more complex universal space of alternate possibilities. Differentiating between the dromological and the universal allows us to uncover the essential problem with the conceptual and technological regime underpinning HFT—that of the computational algorithm—and, along the way, to touch upon the suppressed history of cunning. In so doing, it indicates a more sweeping financial, social, and political acceleration to come.

1. FOR A FULLY AUTOMATED EXCHANGE

The dream of a fully automated exchange has been floated in financial circles for decades now, with Fischer Black reflecting on eliminating the fleshy parts of financial markets as early as 1971.[6] The past decade has finally seen this potential become actual. The Securities and Exchange Commission opened the path for electronic exchanges in 1998, in what should perhaps retroactively be identified as a second financial 'big bang'. The process of decimalisation (the shift from fractions to decimals in the pricing of securities) in the 2000s accelerated this process further. It reduced the spread between buy and sell prices of securities, making profits harder to attain for market-makers,[7] which subsequently spurred a need to move toward larger trades to alleviate the smaller spreads. With the rise of direct market access (allowing investors to bypass mediators between themselves and the exchanges) and the construction of entire automated infrastructures, a major comparative advantage arose for firms possessing the latest technology.[8] Today, automation has infiltrated every aspect of the trading process:

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[6] Black, 'Toward a Fully Automated Stock Exchange'.

[7] M. Durbin, *All About High-Frequency Trading* (New York: McGraw-Hill, 2010), vi.

[8] The competitive advantage of speed has been a constant of financial markets. Upon the South's defeat in the American Civil War, for instance, one financier chartered the fastest boat possible in order to travel across to Europe and profit from the news before the information reached anyone else.

trade analysis, execution, and post-execution processing. The entire process can be—and in some cases, is—run by algorithms. While there is a diverse ecology of financial players who incorporate these robots (for instance, those simply looking to liquidate large positions, or those looking to track indexes), at the cutting edge of this financial automation are those groups involved in high-frequency trading. Speed has always been crucial to financial markets, but the technological arms race that has emerged in the 2000s has brought about entirely inhuman speeds.

In HFT systems, profits are extracted from the continual churning of portfolios—trade decisions are made and executed in milliseconds, microseconds, even nanoseconds. The latest iX-eCute chip from Fixnetix processes trades in just 740 nanoseconds.[9] Given that a blink of an eye takes around 250 milliseconds, this means that this chip can complete over 330,000 trades in the literal blink of an eye. Conscious acknowledgement and reaction to an event requires approximately 500–1000 milliseconds (or 1 second). Yet HFT is reaching into temporal depths of nanoseconds (1 billionth of a second).

The growing status of HFT can be indexed by the fact that the average daily volume of the NYSE increased 300 percent over the period of 2005–9, while the number of daily trades increased 800 percent over the same period.

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[9] http://www.fixnetix.com/services/innovation/.

Meanwhile the average time for a trade execution dropped from 10 seconds to 0.7 seconds over the same time period.[10] Similar trends holds in the London Stock Exchange as well.[11] In short, high-frequency trading has arrived as an influential force in modern markets. Common estimates now routinely state that HFT accounts for over 70 percent of equity markets volume in the US, and over a third in the UK, with this set to rise in the near future.[12] According to most estimates, the profits to be made from HFT are relatively minimal—a few billion dollars at most[13]—an amount that pales in comparison to more lucrative ventures in the financial world. Yet there is a relative certainty about the profits to be made—meaning that once a machine is set up, it becomes a secure source of income.[14]

The precise composition of human and nonhuman entities in a HFT system varies, but at the extremes some firms refuse any human intervention in their automated processes. Instead, machine-readable data continuously flows into the algorithms and trading decisions are made automatically.[15] Any human involvement merely complicates the process of understanding where errors and problems have arisen from; the purity of the automation is necessary for assessment. The overall trend is towards this hegemony of automation, purifying the financial world of human decision-making much as the first wave of industrialisation purified many traditional crafts. One UK government document foretells of a 'depopulation of trading floors' as robots increasingly take over the financial world.[16]

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[10] Durbin, *All About High-Frequency Trading*, vi–viii.

[11] D. Beunza et al., *Impersonal Efficiency and the Dangers of a Fully Automated Securities Exchange* (UK: Foresight, Government Office for Science, 2011), 5.

[12] *The Future of Computer Trading in Financial Markets* (UK: Foresight, Government Office for Science, 2011), 2.

[13] M. Kearns, A. Kulesza, and Y. Nevmyvaka, 'Empirical Limitations on High Frequency Trading Profitability', SSRN Electronic Journal (2010), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1678758.

[14] D. Cliff, D. Brown, and P. Treleaven, *Technology Trends in the Financial Markets: A 2020 Vision* (UK: Foresight, Government Office for Science, 2011), 13.

2. THE RACE TO ZERO

The abstract diagram of an individual HFT trading system is comprised of three components: trading strategies, mathematics embedded in software programs, and technological infrastructure. In terms of infrastructure,

> [HFT systems] are perfect examples of so-called distributed, real-time systems, borrowing patterns from the field of complex event processing, with thousands of individual programs running on just the right number of computers in just the right number of data centres. They buck the decades-long trend of packing more and more processing onto a computer's

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[15] E. Perez, *The Speed Traders* (New York: McGraw Hill, 2011), 129–30.

[16] Cliff, Brown, and Treleaven, *Technology Trends*, 36.

> CPU, favouring the seemingly backward approach of delegating some computing tasks to specialised hardware. They even take over the massively parallel processing capability of graphical processing units—game cards, in essence—for financial computations.[17]

The material infrastructure of these systems is intrinsically distributed and networked, while the software is dependent on the modularity of the components and their loose coupling via relatively simple communication networks.[18] Software engineers have developed such systems in order to maintain resiliency and flexibility in changing circumstances. The operating systems used are stripped down to their bare functional minimum in a further effort to decrease computation times. An entire artform of coding and sculpting of functionality produces machines that are finely honed for speed. The creation of an HFT system involves closely tuning every programming instruction, from how memory is handled and released, to how individual data points are manipulated, how databases are searched, how inputs are received and sorted, and so on. At the extreme, algorithms are physically instantiated in the silicon chips themselves: hardware and software united as one.[19] The drive to extract every surplus nanosecond results in a painstaking process of optimization.

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[17] Durbin, *All About High-Frequency Trading*, 8.

[18] Ibid., 101–2.

[19] Cliff, Brown, and Treleaven, *Technology Trends*, 19.

This functional core of the infrastructure is in turn networked to exchanges situated around the world. While the popular perception portrays Wall Street as the central location of global finance, it is in fact New Jersey and Chicago where much of American finance is corporeally instantiated. High-frequency trading hubs such as NYSE's facility in Mahwah house many of the largest exchanges' matching engines—the computers used to match, buy, and sell orders collected from around the world.[20] There is a physical centrality to distributed global finance, and, unsurprisingly, these locations are heavily protected as a component of the nation's critical infrastructure.[21] This necessarily corporeal existence marks out such facilities as key nodes for the virtual networks of HFT systems: Since electronic signals are sent as bursts of light over optical fibres, the distance between sender and receiver is a key variable for latency. It takes at least eighteen milliseconds for a signal to travel at the speed of light from New York to London. While seemingly innocuous, such a gap is time enough for a New York trader to register new data and act on it before a London trader even sees it.[22]

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[20] Durbin, *All About High-Frequency Trading*, 16.

[21] D. MacKenzie, 'How to Make Money in Microseconds,' *London Review of Books*, May 19, 2011, 16.

[22] Cliff, Brown, and Treleaven, *Technology Trends*, 15.

In order to overcome this fundamental physical limit, firms fight, cheat, and literally carve holes in walls in order to colocate and be as physically close to the matching engines as possible. The concern to maximise profit renders it imperative to compress spatial relations in the most efficient way possible—all in order to shave millionths of a second off trade times.

This speed imperative extends to the ways in which HFT systems communicate and interact with matching engines. Beyond physical proximity, there emerges a synthesis of the computing systems themselves. HFT systems are becoming parasitical upon their infrastructure—carefully designed to adapt to the specificities of their 'hosts'. The imperatives of acceleration demand that any intermediaries be negated. For instance, rather than operate through intermediary services, HFT systems are likely to use direct market access with exchanges in order to immediately receive market data and execute trades. Similarly, in communicating with exchanges, HFT systems will replace the industry standard language (Financial Information eXchange Protocol, or FIX) with their own language adapted specifically to communicate directly with the exchange's native application programming interface (API).[23] The elimination of the interpretation process between message formats (from FIX to the native API) shaves hundreds of microseconds off the latency. Physical colocation meets coding unification.

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[23] Durbin, *All About High-Frequency Trading*, 122.

However, while this colocation imperative tends to centralise HFT systems, they are simultaneously decentred by the need to interact with multiple exchanges. Arbitrage opportunities and correlated products exist across exchanges as well as within them, and any profit-seeking firm with sufficient resources will seek to explore these possibilities. The architecture of HFT systems becomes crucial here, since they must be deployed in strategic fashion to maximise the exchanges connected, while minimising the latency of the wide area network. While some of this traffic occurs via the public internet, most information about market prices and trades is disseminated through the Secure Financial Transaction Infrastructure (SFTI). Owned and maintained by a subsidiary of NYSE Euronext, SFTI provides the US with a private high-speed and highly-reliable computer network dedicated to market data. Some companies have gone further, however, and tunnelled their communications cables through mountains in order to shave microseconds off the transmission time between New York and Chicago.[24] Other initiatives are looking to employ microwave dishes as a contender against fibre-optic cables.[25] Since all these forms of information transmission are limited by the speed of light, physicists have begun to triangulate the precise planetary coordinates of optimal trading locations.[26] Other researchers suggest fibre-optic cables are too slow, and recommend routing communication directly through the earth's core in order to avoid needlessly circumnavigating the surface. Within this speculative solution, the earth itself becomes an impediment, something to be hollowed out in order to facilitate the circulation of capital. Privatised particle accelerators would generate and encode neutrinos in order to bore a sub-molecular pathway through the earth—saving up to 44 milliseconds.[27]

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[24] Cliff, Brown, and Treleaven, *Technology Trends*, 14.

[25] A. Troianovski, 'Networks Built on Milliseconds', *Wall Street Journal*, May 30, 2012, http://online.wsj.com/article/SB10001424052702304065704577426500918047624.html.

The dromological[28] dynamics of HFT emerge from their networked embodiment and the antagonistic arms race that impels its protagonists to turn the planet into a medium for capital circulation. As Virilio presciently declared, 'What is eliminated by speed is the earth'.[29] Assemblages of silicon logic-gates, neutrino messengers, and subhuman temporalities coexist for the ultimate purpose of accelerating financial flows.[30] The macro-level picture is one of an entire evolving ecology of data centres and software programs supported by a highly optimized and condensed material infrastructure. These algorithms and finely-tuned HFT systems are at war with each other, competing for every nanosecond possible. A race to zero.[31]

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[26] A.D. Wissner-Gross and C.E. Freer, 'Relativistic Statistical Arbitrage', *Physical Review* E 82 (2010).

[27] B. Dorminey, 'Neutrinos to Give High-Frequency Traders the Millisecond Edge', *Forbes*, April 30, 2012, http://www.forbes.com/sites/brucedorminey/2012/04/30/neutrinos-to-give-high-frequency-traders-the-millisecond-edge/.

[28] Virilio defines dromology as the science and logic of speed. P. Virilio, *Speed and Politics* (Cambridge: Semiotext(e), 2006).

[29] P. Virilio, *Grey Ecology* (New York: Atropos Press, 2009), 91.

3. STRATEGY AT THE SPEED OF LIGHT

This financial warfare carries over into the trading strategies employed by HFT firms. On an abstract level, HFT operates by determining the statistical likelihood of gaining on particular trades, and multiplying the small profits to be made from each individual transaction by carrying out large quantities of trades. The typical HFT trader generates profits through two main strategies: (1) making markets and scalping off the price differential between bid and ask prices, and (2) statistical analysis of price connections between different securities.

Market making consists of passive and active trading, specifically by taking the other side of orders with the aim of making markets more liquid.

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[30] In other words, finance joins the military as the leading technological accelerator.

[31] A. Haldane, 'The Race to Zero' (presented at the International Economic Association Sixteenth World Congress, Beijing, China, July 8, 2011), http://www.bankofengland.co.uk/publications/speeches/2011/speech509.pdf.

The profit yielded by this strategy emerges in the difference between the bid and ask prices of a particular security. Passive trading involves inputting an order into the system without knowing whether another party is willing to take the other side, and HFT systems use programs called autoquoters in order to generate such submissions. On the other hand, active trading involves taking up the opposite side of already existing submissions in the order book using software called Electronic Eyes.[32] With market making, there is a continual push to be the first to fulfil an order. As profits are made off the difference between the bid and ask prices, the risk is that, before a trader is capable of completing the roundtrip trade (buying and selling, or vice versa), prices will have moved against them, forcing them into a loss. With bid-ask spreads at historic lows, the margin for error here has become increasingly thin. Speed becomes essential, both to beat other market makers and to exit a trade and profit as quickly as possible.

By contrast, the statistical arbitrage strategy relies on the general notion of arbitrage: the ostensibly risk-free profit made by taking advantage of price differences for similar products in different markets. The traditional form of statistical arbitrage involves pairs analysis—the recognition of a correlation between two securities in order to profit off of any changes in one part of the pair. For instance, if security X is positively correlated with security Y, then one can expect that a rise in X will soon lead to a rise in Y. A trader purchases Y before this rise, and then gleans the small profit to be made once it does rise. Statistical arbitrage traces these correlations according to two types of relations, structural and systematic. The former refers to the relatively stable correlations that exist between an index and the stocks that comprise it. The latter, by contrast, refers to the more fleeting correlations that hold between different sectors, regions, and markets, as well as securities affected by common underlying factors like interest rates, energy prices, and weather patterns.[33] In this regard, complex statistical arbitrage strategies involve encoding inferences about these relations between securities. As Donald Mackenzie recounts,

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[32] Durbin, *All About High-Frequency Trading*, 28–9.

> One example of such a pattern, explained to me by a former statistical arbitrageur, involved the shares of Southwest Airlines, Delta and ExxonMobil. A rise in the price of oil would benefit Exxon's shares and hurt Delta's, while having little effect on Southwest's (because market participants knew that, unlike Delta, Southwest entered into hedging trades to offset its exposure to changes in the price of oil).[34]

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[33] Perez, *The Speed Traders*, 204.

[34] MacKenzie, 'How to Make Money in Microseconds', 16.

Any price violation of this inferential relationship would be almost instantaneously recognised by statistical arbitrageurs (particularly HFT systems) and arbitraged away for an ostensibly risk-free profit. In order to make such inferential connections profitable, one must discover relationships that are statistically significant, yet not so obvious as to have already been exploited by other firms.[35]

Contemporary statistical arbitrage is comprised not just of pairs analysis, but also of highly complex sets of correlations between vast numbers of securities organised by sectors, regions, and markets. In the most advanced cases, petabytes of data are analysed by server warehouses in order to uncover linear and nonlinear correlations between massive sets of securities.[36] Other strategies encompass predictive analytics that monitor real-time data flows and calculate near-term likely outcomes on the basis of them.[37] Regression equations are used to uncover the precise statistical relations between these entities, which are then used to model the web of tightly woven prices seen in contemporary financial markets.

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[35] D. MacKenzie, D. Beunza, and I. Hardie, 'The Material Sociology of Arbitrage', in *Material Markets: How Economic Agents Are Constructed* (Oxford: Oxford University Press, 2009), 85–108.

[36] Cliff, Brown, and Treleaven, *Technology Trends*, 21.

[37] Ibid., 22.

5. THE RHYTHM OF THE NONHUMAN

As relatively autonomous agents, HFT systems interact in complex ways and produce emergent phenomena such as flash crashes and ultrafast black swans.[38] There has also been evidence of periodic 1000-millisecond cycles where trading surges arise from the interactions of HFT agents.[39] These are the emergent rhythms of an automated financial ecology. In the words of one complexity research paper, these development demonstrate there has been ‘a new fundamental transition from a mixed phase of humans and machines, in which humans have time to assess information and act, to an ultrafast all-machine phase in which machines dictate price changes’.[40] For the authors, this transition entails a shift from an ecology where the number of trading strategies is greater than the number of participants, to an ecology where strategies are clustered together and subsequently produce herding patterns.[41] The result is the ultrafast black swans that emerge at nonhuman temporalities. The concentration of trading strategies that leads to this outcome is not a necessary feature of automated trading, however. The implementation of learning algorithms, the development of more computing power, coding efficiency, and human expertise are likely to produce an increasing diversity of trading strategies in the future.

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[38] N. Johnson et al., ‘Financial Black Swans Driven by Ultrafast Machine Ecology’, arXiv:1202.1448 (February 7, 2012), http://arxiv.org/abs/1202.1448.

[39] MacKenzie, ‘How to Make Money in Microseconds’, 16.

[40] Johnson et al., ‘Financial Black Swans’, 5.

[41] Ibid., 6–7.

As Virilio, Serres and others have highlighted, with massive technological systems come accidents.[42] Despite their infrequency, these are *normal* accidents insofar as they are statistically predictable. Algorithms will go wrong, errors will be made, and the physical destruction wrought by these accidents will be entirely predictable. Contemporary societies are invisibly shaped by algorithms—a recent traffic jam arising from an error in an algorithm is only one of the more mundane examples.[43] As one commentator warns, 'Bad algorithms have no common sense and get easily caught in destructive loops'.[44] As a result, HFT trading systems are subject to stress-testing and quality assurance, along with periodical updates and bug fixes.

A significant degree of the concern over HFT has been focused on its capacity for virally spreading destabilising movements. Much as the October 1987 crash was fuelled (though not ignited) by automated trades, the regulatory nightmare is of a nonhuman force tearing down trillions of dollars of assets in seconds. (The May 2010 Flash Crash saw over a trillion dollars of market value evaporate in under ten minutes.) Yet as Alexander Galloway and Eugene Thacker note, 'out of control is a misnomer. These are not networks that are somehow broken but *networks that work too well*'.[45] In a financial world increasingly operated via computational algorithms, we might need to reframe our notion of what control is. That being said, should anything go wrong, one can envision a wave of insolvency eliminating entire populations of firms (a possibility that already wiped out a significant portion of the statistical arbitrage population in 2009).[46] Similar occurrences happen on a smaller scale: in 2003, a trading firm made itself insolvent in sixteen seconds by accidentally turning on an algorithm. It took them a further forty-seven minutes to realize their act of self-annihilation.[47]

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[42] C. Perrow, *Normal Accidents: Living with High Risk Technologies* (Princeton: Princeton University Press, 1999).

[43] 'Computer Glitch Summons Too Many Jurors', NPR, May 3, 2012, http://www.npr.org/2012/05/03/151919620/computer-glitch-summons-too-many-jurors.

[44] Perez, *The Speed Traders*, 110.

The risk of contagion is heightened by the fact that this emergent network is tied together by the (normative, not causal) law of arbitrage. This law—that any security should have the same price in every market—is the condition for speaking of a market and its moods.

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[45] A. Galloway and E. Thacker, *The Exploit: A Theory of Networks* (Minneapolis: University of Minnesota Press, 2007), 6.

[46] J. Doyne Farmer and S. Skouras, *An Ecological Perspective on the Future of Computer Trading* (UK: Foresight, Government Office for Science, 2010), 17–18.

[47] C. Clark, *Controlling Risk in a Lightning-Speed Trading Environment*, Policy Discussion Paper Series (Federal Reserve Bank of Chicago Financial Markets Group, 2010), 3.

These pricing interconnections operate not just across markets, but across related entities.

> The web of subtle but inviolable pricing relationships among securities in the equity super-market is vast, complex, and dense. The web moves continuously across time, changing shape and composition but always remaining bound together as one massive market.[48]

By accelerating the creation of arbitrage-free relations across exchanges and asset classes, the statistical arbitrageurs of HFT actively construct a single massive market that involves stocks, futures, options, and more complex derivatives. As more HFT strategies become premised on statistical arbitrage and predictive correlations, these markets are increasingly interconnected.[49] In standard complex systems, the rise of interconnectivity entails the rise of mechanisms for propagating volatility. As one security becomes mispriced, its statistically arbitraged connections to other entities can become mispriced as well, generating a possible wave of misrecognition throughout the market.

These dynamics are sped up by the emergent arms race as HFT firms compete to eliminate latencies.

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[48] Durbin, *All About High-Frequency Trading*, 37.

[49] This is a materialisation of the SEC's intended goal of producing a single national market for the US, and which is shaped most notably by Regulation NMS.

Yet while the exploration of market space for infinitesimal profit margins is quickened by the evolution of HFT ecologies, counterforces are being called forth as well. It has been suggested that by sensing the split-second early warning signs, government regulator algorithms could moderate the system's volatility through directed interventions.[50] A space for human ingenuity remains as well, as individuals discern and exploit algorithmic errors in order to generate profits.[51] The landscape presented here is therefore one of competing profit-driven algorithms managed by equally posthuman government regulator algorithms combined with the remnants of the human trading population.

5. ALIEN MAPS FROM A CHINESE ROOM

In understanding the nature of HFT a crucial distinction must be drawn between sheer information processing and thinking.[52] Thought requires at least a special class of information to be processed, *semantic* information, rather than the bare processing of data. Entities as diverse as geological processes, ants, and thermostats, may be seen as processing information,[53] but it would be inaccurate to suggest that they think, or more specifically perhaps, *understand*. To suggest this is to recall John Searle's Chinese Room Argument, where a human who speaks only English is locked inside a sealed room, handed input questions in Chinese, and uses a codex to routinely transform the Chinese questions into Chinese outputs, without ever understanding the meaning of either the questions or the outputs.[54] Whilst to a Chinese speaker it would appear as if the denizen of the room were fluent, in fact they are simply following a series of instructions to effectuate the necessary linguistic transformations.

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[50] Johnson et al., 'Financial Black Swans', 9.

[51] M. Stothard, 'Day Traders Expose Algorithm's Flaws', *The Globe and Mail*, May 16, 2012, https://www.theglobeandmail.com/globe-investor/day-traders-expose-algorithms-flaws/article2434717.

[52] R. Brassier, 'Concepts and Objects', in *The Speculative Turn: Continental Materialism and Realism*, ed. L. Bryant, N. Srnicek, and G. Harman (Melbourne: re.press, 2011), 49.

In the same fashion, the algorithms of HFT systems encode the results of chains of inferences made by quantitative finance experts, but in themselves they operate solely at an informational level. They remain subject to the limits of computational reason.[55] Segregated from the cognitive processes embedded in human beings, these systems are effectively pure data calculators, blindly outputting diagrams of the hidden connectivity beneath the morass of complex financial transactions that make up the everyday churn of the markets. This cognitive map etched into the real by HFTS exceeds any other in terms of a detailed charting of the cross-relationality of securities, derivatives, FX swaps, and other financial instruments.

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[53] See M. DeLanda, *A Thousand Years of Nonlinear History*, (New York: Zone Books, 1997). Note, however, that this computational vision of nature is ultimately problematic: see section 7 below.

[54] J. Searle, 'Minds, Brains and Programs', *Behavioral and Brain Sciences* 3:3 (1980): 417–457.

[55] G. Longo, 'Critique of Computational Reason in the Natural Sciences', in *Fundamental Concepts in Computer Science*, ed. E. Gelenbe and J.-P. Kahane (London: Imperial College Press, 2009).

As we have seen, in addition to mapping relations invisible to even the most highly trained human eye, hfts are able execute trades based upon these maps in the interstices between nanoseconds. Indeed, the speed and potential volatility involved in HFT mean that it can effectively render human perception blind in times of crisis. A low frequency trader's perception of the market comes via price signals—the order book of any particular exchange. Yet HFT systems' ability to react quicker to changes in these signals means that by the time a human mind is consciously aware of a price, HFT systems have already drastically transformed it.[56] This is particularly crucial at points of high volatility and low liquidity (i.e. times of crisis). The limited organic perceptual capabilities of the human body render it lamentably lethargic by comparison.

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[56] Haldane, 'The Race to Zero', 13.

6. THE LANDIAN NOMOS AND TWO REGIMES OF ACCELERATION

Bereft of semantic content, what is occurring in HFT? A pure manipulation of data—numbers reacting reflexively to each other according to a nervous system of automated algorithms, with the classic role of the market-maker—to provide liquidity for long-term investors—ultimately subtracted. In an apotheosis of *non-sense*, (but not, it must be noted, *nonsense*), one is left with the purely machinic mechanism of trading for trading's sake.[57] This landscape of machine-machine trading and dynamic numerical abstraction constitutes a kind of financialised *nomos*—defined by accelerationist philosopher Nick Land as a field of asignifying numbers reacting and inter-reacting with each other in a nonrepresentational space. Land claims such asignifying practices are not entirely anti-rational, as they maintain a nonconceptual intelligibility.[58] As Land puts it, numbering practices as emergent anti-logos are 'no sooner in the head than on fingers and pebbles [...] always happen[ing] on the outside'[59]—perhaps even originating in the prepersonal encounter of the body with its spatial environment. The machinic nomos instantiated by HFT systems is the latest technical upgrade to a set of practices that have always, in some sense, been defined by their externality.

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[57] Durbin, *All About High-Frequency Trading*, 180–81.

[58] R. Mackay and R. Brassier, 'Editors' Introduction', in N. Land, *Fanged Noumena*, 21.

[59] N. Land, 'Mechanomics', in *Fanged Noumena*, 508.

Speeding up numerical culture, HFT systems are vectors of *eversion* (turning inside out) of the previously anthropocentrically explicable processes of capital. As Land puts it: 'as capital evolves, the increasingly absurd rationalization of production-for-profit peels away like a cheap veneer from the positive-feedback detonation of production-for-production'.[60] This is the financial sublime in its ultimate contemporary form, the miserly rationalism of the capitalist figure (accumulation for accumulation's sake) transposed into a rigorous and inhuman register. HFT embodies this process—indeed, its existence is premised not on holding and maintaining stocks grounded in some fundamental value, or anything so naïve as a belief or intentional attitude towards anything as such, but on mindlessly accelerating the essential metabolic processes of the markets themselves, eliminating price discrepancies and arbitrage opportunities while enhancing liquidity.

It is only today that Land's long-mooted inhuman planetary intelligence has a legitimate candidate instantiation: 'silicon viro-finance automatisms' apparently rendered business reality.[61] Where humans remain too slow—too *fleshy*—to push beyond certain temporal, perceptual, and quantitative barriers, HFT systems surge past, generating the fine nanoscale structure of modern financial markets, too intricate for the naked mind to observe. With a long-term tendency for the rate of profit to fall, the desperation of firms to maintain their share of decelerating global growth is revealed by the elaborate measures taken to shave nanoseconds from trades.[62] And in a sense that would no doubt please Land himself, no lasting value is created beyond *the acceleration of the process itself*.

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[60] N. Land, 'Making It with Death: Remarks on Thanatos and Desiring-Production', in *Fanged Noumena*, 265.

[61] N. Land, 'Machinic Desire', in *Fanged Noumena*, 337.

But it is for this very reason that, although HFT-might superficially appear a plausible contender for emergent accelerationist singularity, there remain some fundamental constraints which render it, in its present form, highly unlikely to take on this role. The roots of these constraints lie in a division, at the level of the meaning of 'acceleration' itself, between two distinct regimes. The first of these is the purely *dromological* (in the sense derived from Virilio): a linear quantitative ramping up of speed or ability, which must be identified with Land's own accelerationism. Within the paradigm that defines the financial gamespace, more is always better. And while these dromological shifts have important dynamic effects (effects which are not entirely predictable in advance), at no point does such a regime call into question the basic rules under which it operates. Capital, and its ultimately tedious logic of accumulation, remains.[63] However, as Reza Negarestani has indicated in recent work, there exists another regime of acceleration, a *universal acceleration.*[64] We here distinguish between a mere increase in speed within a localised horizon, (dromological acceleration = increasing intensification of the value form of late capitalism) and a mode which goes beyond brainless speed to navigate within a larger, global space of possibilities (universal acceleration).[65]

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[62] A. Kliman, *Reclaiming Marx's Capital: A Refutation of the Myth of Inconsistency* (Lexington Books, 2007).

In any arms race, the ultimate advantage comes not in simply dominating an agreed space of competition, but in redefining this space so as to change the very rules under which the game itself is played. This necessarily involves a transposition from one conceptual register or spatial local horizon, and into other potential localities or logics.[66] The entity capable of transforming the 'transcendental' that organizes a world will be able to define the rules of the games to be played within such a world, and hence to exert control over those who are incapable of such manoeuvres.

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[63] N. Land, 'Critique of Transcendental Miserabilism', in *FangedNoumena*, 623–7.

[64] R. Negarestani, 'Abducting the Outside', talk at Miguel Abreu Gallery, New York, November 2012. Negarestani also refers to an 'Oresmean Acceleration' of epistemic sabotage leading to destabilisation of equilibrium regimes, generating new opportunities to explore the universal conceptual space.

[65] R. Negarestani, 'Globe of Revolution. An Afterthought on Geophilosophical Realism', *Identities: Journal for Politics, Gender and Culture*, 17 (2011): 25–54.

[66] Such shifts are inherently experimental and riven with contingency, being by their nature abductive transitions. See Negarestani, 'Abducting the Outside'.

7. THE LIMITS OF DROMOLOGY AND THE RISE OF CUNNING

The universal regime of acceleration is particularly significant as HFT reaches the outer limits of dromological acceleration. To be certain, short of a properly apocalyptic economic collapse, there is no reversing the actualisation of machine trading. In many respects, these systems simply take tendencies that have always existed and accelerate them beyond human perceptual capacities. Any humanist critique of these impersonal forces has no purchase on them. Yet limits will be reached on the dromological level (via either regulatory rules or physical laws), and the competitive advantage of speed will eventually evaporate. Perhaps most worrying for the current HFT paradigm are the fundamental limits imposed by physics—namely, the impossibility of beating speed of light communication, and thereby the unfeasibility of defeating competitors who can operate at the same speeds. The dynamics of purely dromological competition cannot surpass this limit. This is in addition to the declining marginal profitability of each increment of increased velocity, given the exorbitant expense involved in running close to this speed limit. Operating under these constraints, HFT systems will need to move beyond iterative dromological acceleration to a more intelligent paradigm—from brain-dead computation to cunning automata. To explain why cunning in particular, rather than another form of intelligence, we must detour through the buried history of cunning itself.

As the anomalous design theorist Benedict Singleton has recently argued, it is precisely in cunning that we can locate the occluded origins of a certain mode of technologised expertise.[67] In defining cunning, Singleton recounts Plato's ban on the creation of hunting traps, on the grounds that the form of intelligence lying behind the practice of trapping would inculcate a sinister and socially deleterious political sensibility. This suppressed form of intelligence known as *mêtis* (as opposed to *poesis* or *techne*) denotes 'skill with materials guided by a kind of cunning intelligence', and is identified strongly with the figuration of the trickster in ancient mythology.[68] Mêtis is a mode of artifice that operates through devious and *well-timed* action, which brings into play the dynamic tendencies of the materials it works with. This style of intelligence operates in an improvisational fashion, implementing a sequence of contingent nested plots rather than an overarching plan.

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[67] B. Singleton, *On Craft and Being Crafty: Human Behaviour as the Object of Design* (PhD Thesis, Northumbria University, UK, 2012), chapter 4.

[68] M. Detienne and J.-P. Vernant, *Cunning Intelligence in Greek Culture and Society* (Chicago: University of Chicago Press, 1974).

A sculptor, working in marble, may begin with a guiding aim (say, to sculpt an image of the Apollo); but the actual act of sculpting is, to a large extent, an improvisation based upon the specific contingencies within the grain of the material itself (for example, in the precise manner in which a shard of marble splinters apart from the main block). Mêtic practice entails a complicity with the material, a cunning guidance of the contingent (and unknowable in advance) latencies discoverable only in the course of action.

In the form of a trap, the material mêtis works to exploit is the behaviour of prey. The affordances towards which prey are most sensitive become vectors by which they can be manipulated and ensnared.[69] In this sense, mêtis is closely linked to the cunning of the predator. Indeed, Gilles Châtelet and Giuseppe Longo have even contended that the historical roots of mathematics, and its uncanny ability to track the real even in anticipation of empirical knowledge, is grounded in its gestural origins, and specifically in the eye-tracking geometric trajectories used by predators to trace the movement of prey.[70] It is not for nothing that xenobiologists anticipate that any alien intelligence we might eventually encounter will likely have evolved from a predatory species, and hence will intrinsically pose a significant danger to us.

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[69] Singleton, *On Craft*, 129.

[70] F. Bailly and G. Longo, *Mathematics and the Natural Sciences: The Physical Singularity of Life* (London: Imperial College Press, 2010), 68.

The disconcerting moral valence of mêtis-as-trickster know-how, using deception and opportunism to overcome and manipulate complex material, is one potential destination of a technology developed for an industry of similarly questionable ethical status. Whereas most prior uses of HFT have relied upon mere quantitative force to obtain otherwise impossible arbitrage opportunities, large tranches of the upper human echelons of the financial services industry instead depend on an absolutely mêtic praxis, using all the skills of deception available to generate advantageous positions for their institutions.[71]

Indeed, finance is perhaps the predominant contemporary effectuation of what Singleton refers to as the *trickster logic of production*. The figure of the trickster is common to almost all pre-modern mythic traditions. Lewis Hyde gives a complete history of such characters, who include Loki (Norse), Prometheus (Greek), Monkey (Chinese), and Coyote (Amerindian), with echoes of the trickster even appearing in a more tame form in childhood folkloric figures like Brer Rabbit.[72] Common to all tricksters is the use of a cunning intelligence to devise technology, deployed as a tool of the weak against the strong. The trickster logic of production is above all *inventive*, often weaponising empathy with its targets into an effective trap with which to ensnare them. The historical bildungsroman of financiers in Western history attests to the sector's mêtic capabilities. Evolving from the marginal (if not outright taboo) role of the usurer to the world's preeminent political-economic actor entailed the use of a series of elegant traps targeting far stronger entities (most obviously in the regulatory 'capture' of nation states).

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[71] For a recent paradigmatic example of mêtic strategy by a financial institution, see the infamous Abacus 2007-AC1 CDO transaction masterminded by Goldman Sachs. The firm, working in consort with hedge fund client, Paulson & Company, selected underlying securities to generate a CDO which they knew was highly likely to collapse in value, which they then sold to their other clients. The deal lost the investors $1 billion, but produced $1 billion in profits for Goldman's collaborator. Goldman Sachs was eventually fined $550 million by the SEC following an investigation of the deal.

[72] L. Hyde, *Trickster Makes This World* (New York: Farrar Straus & Giroux, 1998).

Given dromological limits and the ultra-mêtic environment of the financial sector, HFT technology appears ineluctably drawn towards a future where it is cunning intelligence, capable of improvisation, psychological manipulation, and universal accelerationist strategy that will give maximal competitive advantage. Already, undercurrents of deception, manipulation, and creative cunning are rumbling beneath the iterative veneer of standard machine trading.

One of the basic methods by which an approximation of cunning is being built into HFT is in the strategies used: ultrafast orders can be manipulated to uncover the price and size of orders, even when these are not publicly listed on an exchange's order book. For instance, some algorithms are designed to uncover telltale signatures of other algorithms in operation ('algo-sniffing'), thereby gaining competitive leverage over them. Other algorithms are already constantly evolving as they face up to a changing ecology of human and nonhuman traders.[73] Signs of this algorithmic battle of cunning are emerging in the inputs to these algorithms as well. One London-based hedge fund intently focuses on improving its data sets in order to draw out hidden correlations:

> The company's London offices display charts tracking the prices of commodities going back hundreds of years, old maps and bank notes and even a dividend cheque from the 18th-century South Sea Company.
>
> Winton sends researchers to libraries and archives across the world to find numbers held in books and on microfilms. It has found barley and sesame prices from ancient Babylon, and English wheat prices going back to 1209.
>
> It now employs more than 90 researchers, including extragalactic astrophysicists, computer scientists and climatologists. The company hired a meteorologist who had researched the 'El Niño' phenomenon. The physics graduate—Winton wants to keep his name secret for fear a rival might poach him—works in London correlating weather data to crops such as

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[73] Haldane, 'The Race to Zero', 4.

> corn, wheat and soybeans. That data can be used to forecast how prices might fluctuate with the weather.[74]

Uncovering these obscure connections enables firms and algorithmic systems to gain leverage over others and manipulate their competitors and the markets accordingly. In the future, HFT systems are likely to be increasingly linked to the automated algorithmic sensing systems that are emerging in other parts of the economy (sentiment monitoring, consumer data analysis, etc.).[75] In this regard, some have looked to extend and integrate Semantic Web components into automated trading, making information more tractable for machine manipulation.[76] Beyond sentiment monitoring of large clusters of individuals, true semantic processing by machines would revolutionise algorithmic and high-frequency trading.

In other areas, genetic algorithms are being used to search out the space of possible combinations and uncover the optimal tuning for each parameter.[77] Set in a virtual space, hordes of algos are released into a competitive free-for-all, with the winners subsequently being unleashed in real markets. At this point, the algorithms can quickly extend beyond human capacities to understand—rather than ten variables that have to be calibrated, there can easily be hundreds or thousands of variables. The capacity for self-reflection, learning, and automating the evolutionary process opens the space for increasingly nonhuman algorithms. At this point, one cannot even protest that at least a human programmed it.

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[74] T. Wilkes and L. Fletcher, 'The Algorithmic Arms Race', Reuters (London, May 21, 2012), http://www.reuters.com/article/2012/05/21/us-trading-blackbox-idUSBRE84K07320120521.

[75] *Sentiment Analysis And Social Media Monitoring Solution RFP, Request for Proposal* (Event-6994) (Federal Reserve Bank of New York, 2011).

[76] Cliff, Brown, and Treleaven, *Technology Trends*, 22–3; T. Berners-Lee, J. Hendler and O. Lassila, 'The Semantic Web', *Scientific American*, May 2001.

[77] Cliff, Brown, and Treleaven, *Technology Trends*, 30.

As the algorithms become more sophisticated, so the jobs of maintaining them and of fine-tuning them to current market conditions, will become more involved. This would be a problem if skilled humans are required to perform the fine-tuning, but the likelihood is that in the future the design of new algorithms, and the tuning and optimization of existing ones, will also be an automated process, performed by computers. Rather than hiring programmers to write new algorithms, trading institutions will instead in future hire programmers to write the computer systems that design the new algorithms and then fine-tune their subsequent operation.[78]

Such algorithms can evolve beyond their creator's intentions and take on a life of their own. Such a technology already exists, in the form of a computer program called Eureqa, which analyses raw data and produces equations without any human oversight.

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[78] Ibid., 29.

Given a desktop computer and a few hours, Eureqa reproduced Newton's equations. With more powerful computers and more time, Eureqa is being used in fields where being overwhelmed by data is a real problem. In this way, the program produces equations and scientific statements unattainable by humans. As one scientist working with the program said, 'Eureqa can even propose experiments that researchers would have difficulty imagining.'[79]

Yet despite all of these approximations to the mêtic regime of universal acceleration, it remains highly questionable whether the basic computational substrate which HFT consists in is capable of fully supporting such developments. The evidence suggests that. whilst algorithmic complexity in HFT systems is increasing in an attempt to stake out a smarter and more cunning territory than that afforded by speed alone, we have yet to arrive at anything approaching an automated form of mêtis. Even genetic algorithms are mere approximations of a more subtle reality. To transition from dromological to universal acceleration, from localised speed to real cunning, would require a transformation and replacement of the algorithmic form itself.

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[79] B. Keim, 'Download Your Own Robot Scientist', *Wired*, December 3, 2009, http://www.wired.com/wiredscience/2009/12/download-robot-scientist/.

8. THE NEXT MACHINE

If cunning is the domain of the trajectory (intimately imbricated in the protogeometry of predation), then the ultimately *iterative* algorithmic application of computational processes will only ever be able to imitate in a blocky, quantised mimesis, a pixelated 8-bit computer game rendering of reality. Given that computation is built upon the discrete (from the bit to recursive algorithmic processing to quantified measurements), the domain of the continuous (i.e. of the complex real) remains alien to the computational paradigm—at best, something to be poorly approximated.[80]

As outlined by Giuseppe Longo, algorithms encode a finite and iterative conception of time, using real discrete numbers, resulting in an inability to represent geodetic spatiality (i.e. non-trivial continuity). This is grounded in Frege and Hilbert's project for the axiomatisation of geometry through arithmetic. Operationalised via computation, it is only ever able to imperfectly model complex social, rational, biological, chemical, and quantum mechanical systems, and the symmetry breaking and sensitivity to initial conditions they entail. Whilst the shadow of the Newtonian-Laplacian reductive project has been largely dispelled from the leading edge of the sciences in the course of the twentieth century, it remains at the heart of computation.[81]

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[80] Longo, 'Critique of Computational Reason'.

Classical computational science, premised on algorithms, is fundamentally constrained by the rules of proof which it instantiates, neglecting the rules of construction which make mathematics the more universal science.[82] Algorithmic thought only ever remains bound by the existing entities and the regulated manipulations of those entities. Generativity doesn't exist here, only in mathematics proper—and algorithmic machine trading remains bound to the rules prescribed for it, rather than reaching a level of universal synthetic acceleration. Contemporary assertions (without warrant) that the universe is, in some sense, already a computational system (surely a Ptolemaic counter-revolutionary move) are therefore naïve. The problems with the conceptually emaciated computational paradigm have already been outlined by the father of the computer himself, Alan Turing. Turing contrasted his original conception (fundamentally Laplacian in its reductive nature) and a non-linear, continuous variant, as early as 1952.[83] We must shift computation closer to the continuous, non-iterative nature of material reality. This 'Next Machine' must begin from a refounding of mathematics in accordance not with Laplace, Frege, and Hilbert but closer to the findings of contemporary post-quantum physics and complexity science. These matters are already vigorously alive in emerging fields such as quantum computing, where questions of foundational principles and the epistemology of measurement and quantisation are central.[84]

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[81] Ibid.

[82] We owe these points to Reza Negarestani's illuminating recent work.

[83] A. Turing, 'The Chemical Basis of Morphogenesis', *Philo. Trans. Royal Soc.*, vol. B237, 37–72, 1952.

Only once this fundamental architecture has been reconceived will the essentially *blind* accelerative power of our contemporary technology give rise to a second wave of intensive acceleration, the shift to automated cunning and its potential wider adoption. Such *cunning automata*, grounded in a continuous neocomputational format, will return technology to its suppressed mêtic ancestry—that is to say, they will replace algorithmic speed within a highly constrained local horizon (capital as we know it) with a properly improvisatory form of automated practical intelligence which metabolizes contingency via a Machiavellian asymptotic apparatus of technopredation. Yet, as we are surely aware, such a navigation, open to the inherent contingency of the universal continuum, is not without risk.

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[84] G. Longo, 'Critique of Computational Reason', 17.

9. AFTER ZERO

The gambling paradigm, imagined by critics of modern financial trading, is already being exploded from the inside by the dromological accelerationism of HFT. Risks and probabilities are becoming less significant than speed itself, as firms aim to use HFT to eliminate risk itself through obtaining the ideal of instantaneous arbitrage. But if the image of thought of the casino is undercut by our present HFT, then an entirely new image is required for the emerging systems of manipulative machines, the cunning automata of universal accelerationism. This image of thought must be connected to the longer term trajectory of the technology. We propose to sketch three alternative possible speculative scenarios, or hyperbolic images, to answer this remaining question.

In the first, HFT systems are outlawed following a series of catastrophic financial apocalypses. Exchanges around the world are reportedly already examining implementing voluntary measures that may limit the profit potential of HFT, though at the moment the effectiveness and implementation of these rules is uncertain.[85] The unpredictable emergent effects of automated trading war machines, combined with the constitutive irresponsibility of their institutional masters, could lead to the virtual eradication of the technology, given a sufficiently disastrous sequence of trades.

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[85] S. Goldstein, 'FSA's Turner Backs High-Frequency Trading Curbs', *The Wall Street Journal*, September 23, 2011, http://articles.marketwatch.com/2011-09-23/markets/30879600_1_high-frequency-trading-curbs-price-discovery.

In the second scenario, semantically effective HFT systems serve to nearly entirely replace the anthropoid components of the financial sector. In this Landian conception of our accelerative future, capital sloughs off its human drag, expanding into ever more abstract processing-accumulative strategies. One speculative and fictional exploration of such a post-singularity universe imagines posthuman intelligences as cunning self-aware financial instruments, dismantling solar systems so as to obtain maximal computational power.[86] Human intelligence is incapable of taking part in such esoteric cosmic xenoeconomics, and if acknowledged at all is used as mere fodder for anthropic futures trading. Here, today's deregulated neoliberal financial sublime runs amok, as abstract accumulation-for-accumulation's sake despoils entire star systems.[87] With numerical cunning fully autonomous from its original hominid substrate, the real thinks itself even as it undoes itself towards cosmic annihilation, in a vector of absolute deterritorialization. Hegel and Deleuze are revealed Janus-faced, as an autonomous

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[86] C. Stross, *Accelerando* (London: Orbit, 2005).

[87] S. Shaviro, 'Accelerando', *The Pinocchio Theory*, October 13, 2005, http://www.shaviro.com/Blog/?p=450.

Absolute Knowing becomes asymptotically equivalent with a universal thanatotropism.

So tends this line of thought. But as we have outlined, the Landian register of brute speed, constrained within a single (and highly contingent) local horizon (i.e. late capitalism) is out of sync with the kind of universal, navigational concept of acceleration embodied in the history of cunning intelligence. Moreover, the Landian dictum of 'always further with the process' gets nowhere when confronted with real and intractable limits in the process itself (here the insurmountable gap between the continuous, geodetic real and quantised algorithmic iteration).

Hence the third scenario, wherein cunning automata are liberated from the capitalist dynamic tout court. In this future, the deleterious impact of HFT systems and the broader dynamic of automation (of which they are merely the contemporary leading edge) direct capitalism towards a sequence of terminal secular crises, as the tension-fuelled dynamic between labour and capital inculcates system-wide rupture. What follows, however, is not a return to some prelapsarian fantasy of organic wholeness (or, even more repulsively, a full-blown anarcho-primitivism). Rather, a properly post-capitalist society emerges *through* a real acceleration of the technologies born under capital. In this respect, one can see the second and third scenarios as radicalisations of the most extreme socio-economic visions of the mid-twentieth century: the twinned informatic imaginaries of Hayekian catalaxy and Soviet cyberplanning.[88] Crucially however, what both visions now abandon is the misguided notion of general equilibrium.

Post-capitalism would unshackle the cunning automata of mêtic systems towards a universal accumulative strategy encompassing the entirety of the planetary, and eventually *universal*, system. Finance already has pretences towards becoming a universal system capable of correctly pricing and rendering interoperable all manner of things. However only the tacit, improvisatory, competitive, and above all *cunning* nature of technical entities could ever resolve the seemingly intractable problems associated with wide-scale social calculus.[89] The opening up of the contingency of the universal, made possible by navigating beyond the suffocating politico-conceptual space of capital, does not entail the achievement of some ludicrous and properly impossible endpoint of 'full communism'. A genuinely universal accelerative post-capitalism would be distinct from (and distinctly more interesting than) predictable Marxist utopias, given the necessary and indeed increased *alienation* of the human from the world in which they exist. This new world is not the end of history, but the beginning of a new and very different universal kind.

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[88] For the former, see P. Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science* (New York: Cambridge University Press, 2002), and for the latter, F. Spufford, *Red Plenty* (London: Faber and Faber, 2010) and E. Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge: The MIT Press, 2011).

[89] For a recent take on the intractability of planned calculation using linear programming techniques, see C. Shalizi, 'In Soviet Union, Optimization Problem Solves You', *Crooked Timber*, May 30, 2012, http://crookedtimber.org/2012/05/30/in-soviet-union-optimization-problem-solves-you/.

Notes from New Jersey

Sam Lewitt

In Spring 2012 I had some photographs erased from my camera by a team of agents from the Global Security Division for the New York Stock Exchange, and New Jersey State police. This occurred after taking a slow walk around a central High Frequency Trading hub in Mahwah, NJ.

The conditions surrounding this encounter can be schematically described as follows: I drove to New Jersey with the intention of photographing the facade of NYSE and Euronext's main High Frequency Trading datacenter—a sprawling server-farm through which algorithms execute one third of all buy and sell trades on the world stock market, at microsecond intervals. This trip was spurred by abiding questions concerning the conditions of intelligibility for value's circulation through an increasingly abstract and insensible system of valuation and debt. These questions have increasingly elicited a negative judgment as to the possibility of photographically depicting a site which, de facto, requires a very high level of conceptual abstraction for even a basic comprehension of what goes on within its heavily fortified walls.[1]

Nevertheless, however apparently 'abstract' and 'insensible', the financial system must still flow through conduits and addresses (street and IP, not to mention its movement through every debtor's conscience as a force of subjection) that sediment its discreet locales and remote installations, of which the Mahwah datacenter is a particularly robust example. Bertolt Brecht's thoroughgoing scepticism with regard to the mimetic powers of photography (originally targeting Neue Sachlichkeit in the early 1930s), at a moment of monopoly capitalism's financing of the ascent of the fascist State, was certainly at the back of my mind. 'Things,' he writes, 'have become so complex that a "reproduction of reality" has less than ever to say about reality itself. A photo of the Krupp factory or the

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[1] As Sociologist Donald MacKenzie notes, the human sensorium can react to the most basic of stimuli in roughly 140 milliseconds, or 140,000 microseconds, which could hypothetically correspond to as many trades in that same interval via High Frequency Trading (See 'How to Make Money in Microseconds', *London Review of Books* 19 May 2011: 16). At this point, the existence of HFT trading is common knowledge. Its reduction of sense through the implementation of such high speeds in executing orders finds its obverse counterpart in the financialization of affect in so-called 'Social Sentiment Trading'. Witness London based Derwent Capital Markets, a boutique hedge fund that uses Twitter and other social media to track 'the mood' of the market. http://www.derwentcapitalmarkets.com/.

AEG tells us almost nothing about these institutions'.[2] My trip to New Jersey was an attempt to test the contemporary validity (beyond anything imaginable to Brecht and his contemporaries) of this well known judgment—to thicken the void of representability that the building and its function suggested. It is the kind of architecture whose design and manner of physical installation makes its aim apparent: to withdraw from appearance, if not simply to go unnoticed in its sprawling banality.

This makes for an instructive, if somewhat commonplace, comparison between the Corinthian columns of the old Stock Exchange building on Broad Street in New York's financial district, and the building in New Jersey. The difference here proceeds along the same lines as the transformation of the aesthetic/perceptible properties of the appearance of money in the everyday context of exchange. In its ornamental excess, the Broad Street building belongs to an age of Masonically encoded bank notes, which once gave aesthetic credence to the illusion that money is valuable in itself, whatever the magnitude of abstract labour it represents in exchange. In a spurious process of naturalization, this perhaps secondary, but symbolically efficient ornamental dimension of paper and coined money has ceded to the dominance of media such as magnetic stripes (now on the way out), electronic PIN numbers, and graphics displayed on backlit screens: to economies based on so-called 'bank money' and debt financing. This spectralization of the apparent substantiations of value should however be seen as a fundamental tendency of social relations dominated by the exchange abstraction.[3]

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[2] B. Brecht, 'The Threepenny Lawsuit', in *On Film & Radio*, ed., tr. M. Silberman (London: Methuen, 2000), 164.

Indeed, value is a form without a particular, localized substance. It tends rather toward its pure, historically systemic state. Exchange value is an independent form of value's appearance in the world. It relates the commodity via money to the total interwoven context in which commodities circulate within capitalism, including transformations of technical forms of production, tightening labour conditions, and, to be sure, the fluctuation of commodity prices. Marx writes with regard to the commodity form:

> Not an atom of matter enters into the objectivity of commodities as values; in this it is the direct opposite of the coarsely sensuous objectivity of commodities as physical objects.[4]

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[3] To describe the destructive autonomizations of finance as a perversion of capitalism is only correct if we emphasize that it is capitalism which is a perverse system of relations, not some dimension of the value relation within capital that has merely been perverted.

[4] K. Marx, *Capital*, Vol. 1, tr. B. Fowkes (New York: Vintage Books, 1977), 139.

The value of money itself maintains no illusory connections to any ornament of physical, sensuous material. Marx writes:

> On the money market...[t]he commodity has the same form [...]. It exists in the undifferentiated self-identical form of independent value, of money.[5]

Finance's semiological propensity toward the immaculate self-referral of commodity prices, the decoupling of commodities as values (i.e. socially mediated objectivities) from their physical production—as in the execution of buy and sell orders based on fictitious time horizons—delaminates the value form from any ostensible substantiality or essential physiocratic ground, stripping capital down to the naked errancy of its automation. The real senselessness of value tends toward its realization in finance as undifferentiated monetary value prior to its appearance (or not) in a particular form of competition in a specific market.

Here, the sensible surface of capital is as dynamic, changing and mortal as the technical material supports, organisational logics and discourses which serve as its contingent media. The reduction of sensual identification with the medium of exchange as such (however illusory that identification may have been in the first place) is manifest in the Mahwah building's blankness. It is a building that exists in dislocation, nestable in any suburban or exurban threshold, next to a soccer field or amid extruded logistical sprawl. Its force is one of simultaneous decontextualization and internal isolation. It is densely populated with all kinds of hidden lockouts and security functions which will swiftly be put into effect by any suspect operation—such as publicly noticing its existence. I tripped a switch in Mahwah, and everybody's nervous system became agitated. Security turned out in force. They were waiting in the wings, standing sentinel over this disappearing monument to the abstraction that concretely structures a node in global capitalism's 'critical infrastructure'. My ageing prosumer camera became a knot in the net of guilt woven by the extraordinary powers granted to this team of NYSE/Euronext security forces and NJ State police. A grilling ensued post-haste. My automated lens was turned against me, interpolating a scene of identification and incrimination. What were the basic conditions of representation at the moment that the police and security set the scene? Let's call its representational logic 'interrogation in the age of neoliberal self-governance'—after all, in advance of any crime, for I was not charged with anything illegal, the security system will have needed to pass me through their filtration system for the sake of intelligibility. Their verbal data mining proceeded in a manner reminiscent of the process one must undergo to sign up for a social networking site: Who are you? What do you do? Who do you know?—A script revisited by the JTTF officers who visited my apartment several weeks later.[6]

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[5] K. Marx, *Capital*, Vol. 3, trans. D. Fernbach (New York: Penguin Classics, 1991), 490

This encounter ended with the forced erasure of the contents of my camera. Disciplinary measures took the initiative over my inability to control myself with the right kind of images. Despite this corrective to my error in self-management, I was informed by the security and police that they could not stop me from reconstructing the images from memory after I had left. If I was an artist, they suggested, I should have the skill to make a drawing from my impressions. My Canon camera model, it should be noted, is a *Rebel t1i*. Despite this readymade classification emblazoned on the device, it was expected that I would have the discipline to do such a thing.

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[6] As their US Department of Justice press statement reads, the 'Joint Terrorist Task Forces (JTTF) are small cells of highly trained [...] passionately committed investigators, analysts, linguists, SWAT experts, and other specialists from dozens of US law enforcement and intelligence agencies' (http://www.justice.gov/jttf/). This information-sharing agency notably coordinates on the federal level with Homeland Security, which, it would seem, is 'passionately committed' to sparing no expense in the defence of finance capital and its open secrets such as the existence of the Mahwah datacenter, against the ostensible freedoms of its citizenry.

This coordinating agency, which spends an enormous amount of tax revenue on the State's defence of finance, expresses a fundamental historical contradiction. Enormous resources are expended to surveil the traffic of citizens internally, consolidating the juridical force of the nation-State; while it is the global circulatory system of finance capital that it protects which has, more than anything, driven the total reconfiguraton, if not the dissolution, of its integral sovereignty as a decision making entity (not to mention that of the productive economies which constituted the State form's economic vitality during its imperial phase). The consolidation and preservation of the juridical power of the State in the defence of private financial institutions is a part of the same process by means of which the global volatility of financial markets, as the engine that spurs crisis in a bid to renew cycles of capital accumulation, drives the State's withering toward default.

Expectations of discipline are married to the language of flexibility that sutures the lineaments of this anecdote. After all, in an economy structured by massive debt, which is securitized and traded on the stock market, self-discipline in the form of 'personal responsibility'—'I take responsibility for corporate debt as if it were my own'—constitutes a force of subjection needed for the system to operate. But the logic of 'personal economic responsibility' is historically fused to the acceptance of 'job flexibility', i.e. precaritization and exploitation, inherited from the defunct ruins of the so-called 'new economy'. Personal pronouns are now more than ever material for an insensible process of valorization.

Rather than semantic coincidence, this speaks to the deep materiality of linguistic self-identification with managerial culture's circuitry of control. On a technological level, the electrical signals that course through 'my' camera when the shutter button is pressed move along ultrathin flat flexible cables that coordinate and control the imaging system. Prior to purchase, before any shots are framed, the camera manufacturer's website promises 'uncompromised [...] power and flexibility right in the palm of your hand.'[7] 'Flexibility' stretches a lexical thread through both end-user performance *and* the technical structure of the device, mediating physical and ideological descriptions prior to the record of any image whatever. Perhaps this winding of semantic threads, flexing between camera parts, subject positions, and power relations, extends to the security guards themselves, despite their absolute rigidity with regard to my presence in Mahwah. To be sure, the graphic representation of a flexing helix on their company card is material for me too:

Powering the exchanging world.

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[7] http://www.usa.canon.com/cusa/support/consumer/eos_slr_camera_systems/eos_digital_slr_cameras/eos_rebel_t1i_ef_s_18_55mm_is_kit.

The site in NJ is not directly representable, and not only because the reproduction of its image is proscribed. For a site like this, only one dimension of representation is possible and it is tied to guilt. For while a photograph can't tell you anything about the connections that encompass the complexity of its function, it can show cooling systems, its visible security, points of entry, etc. I had no intention either to graphically reveal any of this, nor did I assume that the photographs would show anything but a location that is constitutively *dislocated*...a concrete bunker of abstraction in a rustic setting: a local thickening of the mortality of the technical dimension of representation, extruded into flexible ribbon, running right through the building, the camera that takes its picture, the security that guards it and the artist that is framed by his shots.

In the end, the force exercised by security forces in deleting the pictures was immediate and dumb. The most repressive aspect of the encounter was precisely the one and only moment in the encounter when *permission was given to remember and represent* a site that withdraws from representation—that is, the moment when a limit was circumscribed whereby mnemonic experience was assigned to positive neurochemical recollection of a particular location, against the dislocated backdrop of the total automation of crisis.

The Writing of the Market

Interview with Elie Ayache

> *I watched C-beams glitter in the dark near the Tannhäuser Gate...*
>
> ROY BATTY

Elie Ayache is an expert in derivatives pricing and author of many articles on the philosophy of derivatives trading. This theoretical work culminated in his 2010 book The Blank Swan.[1] *In this unique work whose references range from Derrida to Deleuze, Blanchot to Badiou, by way of Black, Scholes and Merton and other financial and philosophical luminaries, he recounts how his reflections on the nature of price and the market led him to an original philosophical position that converges with Quentin Meillassoux's critique of probabilistic thinking and explorations of absolute contingency. In our interview, Ayache elaborates on* The Blank Swan*'s response to Nassim Taleb's* The Black Swan, *drawing a more radical set of conclusions from the failure of probability and setting the scene for a*

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[1] E. Ayache, *The Blank Swan: The End of Probability* (Chichester: Wiley, 2010).

renewed ontological thinking in which the unfolding of time is sidelined in favour of a conception of the market as the place of a writing of the future.

THE UNEXCHANGEABLE PLACE OF EXCHANGE

Collapse: What was it that led you, a derivatives trader and co-founder of a trading software firm, to turn towards philosophy?

Elie Ayache: I had the fortune to start my trading career in 1987—more exactly, on October 19, the day the market crashed. The bank had hired me in September after my graduation from engineering school, but October 19 was the first day I had set foot on the floor, owing to my boss's intuition that there would be something worth watching and learning in there that day. I remember a distinct feeling which I would later recognize as philosophically-charged and which spontaneously imposed itself on me as I stood by the pit and watched the fast trading activity. (I couldn't trade myself as I was still an apprentice, I could only watch.) Simply, I became convinced that there was more going on, in producing the events and their succession, than the mere chain of causes and effects that unfolded in chronological time.

When your world reduces to a trading pit, history becomes quantitative. Events come down to price movements, and all price movements are caused by previous price movements and by quantities offered to be bought or sold at every price level. Action in the open outcry pits is recorded by camera, just in case there is a disagreement on a size or a price and the two parties want to check exactly what words were shouted and exactly what hand movements were made at the moment of the trade. One can safely assume that the 'film of events' unfolding in a pit is exactly reducible to the film that the camera records. There may be causes, not apparent on the film, that trigger the desire of the given trader to buy or sell a certain size at a given price. But as far as the subsequent price movement is concerned, all that matters is the size and the price that he trades, and the shouts and the gestures that he shows to the camera. What effects the trading action of a given trader might have on other traders does not matter either, because all we care about in the trading world is how the subsequent emotions or affects of the other traders will translate into subsequent inner motives and how these inner motives will translate into subsequent trading action. The whole chain of causes is therefore coded in the recorded sequence; and one can safely assume that if the recorded film were to be replayed, the same chain of events would follow.

Yet my distinct and instinctive feeling, as I stood by the pit and watched the action, was that the same chain of events *wouldn't unfold* if the same recorded film—that is to say, chronological time and all that it has recorded—was replayed. I felt there was a non-recordable, non-representable, non-retrievable and non-replayable element in the chain of events that contributed decisively to its unfolding, and that this element was inscribed in the place itself where the events actually took place: in the market place, in the actual place of the exchange which is, as such, unexchangeable.

That the event should be this way and no other way, *this* absolute contingency, was linked to the place where it happened, and it exceeded the chronological film, the time-recording. You have to be in a place to watch the event take place and explain its taking place. I guess that this concerns all kinds of events and not just the market; but the market has the advantage of making this irreducible element or excess more acutely felt, because the market is quantitative, and therefore may lead one to think that it is recordable and programmable—before one realizes, all the more acutely, that this is not the case.

C: How do the questions you need to ask in developing a pricing technology for derivatives extend this philosophical thinking of the market?

EA: Derivative pricing theory is just a branch of stochastic calculus, which is itself part of probability theory and its formalism. In this respect, a philosophy of derivative pricing theory is no different from a philosophy of probability. Instead of throwing a dice or spinning a roulette wheel, one would consider the underlying market as a random generator. A philosophical questioning of this would consist in asking whether the probability is real or is just a manner of speaking, a shorthand for statistical regularity. Further epistemological complications may arise, due to the complexity of the random generator we are considering. The question may be posed—following Taleb—as to the reliable inference of the probability distribution from which the market is drawing its outcomes. Randomness may be further blackened by essential uncertainty— never being in a position to know which dice we are playing with, etc. This is all fine, and yet it completely misses the specific material that we are engaging with here—namely, the market.

The market is not just a generator of random numbers; it is the material place of an exchange. Derivatives would indeed simply constitute a sub-case for probability theory and stochastic control if it were merely a matter of computing a value for them, in the same way as we speak of the value of a mathematical function. We know what the value of the derivative is, at maturity, as a function of the underlying price on which it derives, and the whole problem is to determine its value *prior* to maturity, with only mathematics and probability theory to carry out this backward translation in time. What is missed in this traditional way of posing the problem is that derivatives are a *technology*, i.e. a material procedure and not just a mathematical function. They are contracts that are materially written on paper and whose destination is to be materially exchanged.

When we consider the stochastic process of the underlying, price is confused with a number and the market is reduced to a random generator; we don't really wonder what the meaning of price and of the market may be, what their inner process may be.

Now, consider that the derivatives contract is materially (directly, without any conceptual or formal intermediary) destined or *meant* to be traded; and that the meaning and even the definition of price may be the following: the number that gets specifically and materially attached to derivatives contracts in that specific place, the market, where derivatives are materially exchanged. Consider that there might be no other definition of price than this one. Consider that we are in the process of inventing the whole technology of price and of the market, and that the derivative is the material piece necessary for that process of making. In that case, the technology of derivative pricing can no longer be thought independently of the fact that to price something is to price it *in the market*, or independently of the fact that the derivative trader will be the main and, as a matter of fact, the sole intended user of the technology.

The philosophy that is *specific* to derivatives pricing technology (as opposed to a philosophy of derivatives pricing theory that comes down to a philosophy of probability) becomes the analysis of the above thought, which brings together market and technology. It is no longer a matter of the complexity of the market, but rather of its simplicity. For it is the same market, the same medium and milieu, that must be thought at the beginning and at the end—as that which produces the underlying price and which receives the derivative price, only to produce it again. The thought can no longer proceed in a sequence: first the underlying process, then probability theory and derivative valuation theory, then a derivative value that is changed into a price and that is effectively immersed and varied in the market. No, from the start the valuation must be a *pricing* in the sense that the derivative price, manufactured and produced though it may be by a pricing tool, is designed to be exchanged in the market and *generated* by the market.

The practical consequence that the user and the manufacturer of the technology have to face is the constant *recalibration* of the pricing model—and that the recalibration process must not even be thought sequentially, but must be considered *a priori in the very design of the tool*.

Any derivative pricing model is supposed to generate a certain derivative value as an output, as a function of the underlying price and parameters such as volatility. However the technological purpose of this value is to be a price, and thus simultaneously to act as an *input* to the model. No sooner has the derivative market-maker produced the derivative value with his valuation tool than this value, now become a price, is fed back as an input into the tool, triggering its recalibration. Traders use the Black-Scholes-Merton (BSM) formula to generate option value given volatility, while simultaneously feeding option prices into the formula to imply volatility. The complete act of pricing is the combination of these two directions.

What we call the *fundamental principle* of the market is that the states of the world in the market consist of prices—all the prices and nothing but the prices. States of the market-world cannot be abstract states such as states of the economy, measures of inflation, or labor, etc. Such abstract states may be implicit; however, *in the market*, they must be represented by prices of assets. So when a framework like BSM posits the prices of the underlying asset as states of the world, and then computes the values of derivatives as a result, it verifies the part of the fundamental principle which says that states of the world are nothing but prices (for it reduces the whole economy to the price process of the underlying); but it *denies* the second part of the fundamental principle according to which states of the world are *all* the prices. It denies the fact that derivatives prices are *also* independent states of the world, and should not be expressed as functions of the prices of the underlying (or, in other words, as values).

This is a severe philosophical problem. As we can now see, the fundamental principle of the market seems to undermine any attempt at representing the dynamics of the market in a probabilistic framework, no matter how large or complex: Any totalized set of states of the world (for instance, the prices of the underlying and the prices of any number of derivatives written on the underlying) will have as a consequence that the value of a certain derivative whose prices were not part of the initial set of states of the word will be computed as a function of the existing states, and thus will not count as a *price*, i.e. as an independent state. Now, of course, the values of derivatives written on a given underlying will ultimately depend on no other variable than the price of the underlying that obtains at their expiration. And of course the holder of a European call or put ultimately will not care what levels and what changes of volatility have obtained during the lifetime of the option, or more generally, what exact path the underlying has travelled. Certainly, all he cares about is the final settlement of the option and the corresponding underlying price level. *However*, as soon as he starts caring about dynamically hedging the option, he can no longer ignore path-dependency. He becomes dependent on the whole path of the whole market that will take place in the meantime. For the proceeds of the hedging strategy will depend on volatility changes, and hedging against those changes will require running, in the dynamic hedging strategy and on top of the underlying, a trading account on derivatives that depend on volatility, such as variance swaps or other options whose prices become states of the world that are additionally required. In turn, the hedging ratios to apply to these additional hedging instruments and the proceeds of their hedging strategy will depend on changes to the parameters that govern the stochastic process of the volatility itself, i.e. the volatility of volatility, etc.; and those parameter changes will in turn have to be controlled by a further complication of the dynamic hedging strategy involving derivatives that are more complex still.

If the market is the rule and if you are not content to buy (or sell) and hold the derivative until its expiry but wish to trade and engage dynamically in the market and unwind your position at any moment, you become dependent on all the prices of derivatives of all degrees of complexity—in another words, you become dependent on the total 'state' of the market, which can never be reduced to a total of states. The market becomes the one and only vast (and continual) event which screens off any residual or ulterior event. As such, it can never be framed or calculated even though it is present. Engaging with it becomes equivalent to engaging with the event, with any event, or with the 'essence' of the event, which is to be incalculable. It is a continual event, when the event is by definition a discontinuity, without this being a contradiction.

BLACK SWANS, BLANK SWANS, ANTIFRAGILITY

C: The title of your major work *The Blank Swan* is an obvious riposte to Nassim Taleb's *The Black Swan*,[2] a work which addresses the incapacity of human beings to adequately predict catastrophic events—precisely such as the 1987 crash. How does the conception of the market-event you just described relate to Taleb's work?

EA: Taleb's angle is epistemological. He basically argues that one cannot know the small probabilities. If you think that an event happens once in a hundred years, then you're going to need ten thousand years worth of data in order to ensure that your probability prediction is reliable. Of course, this is never the case, and what you would be tempted to do is to fit a certain probabilistic model to the available data, or in other words, to what you already know has obtained with what frequency, and then let your model work out for you the probability of extreme events that have never happened so far.

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[2] N.N. Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007).

Typically, in the financial market, you fit a certain probability distribution to the statistics and satisfy yourself (this is the purpose of fitting) that downward price jumps of, say, -15% have a probability that agrees with their historical frequency of occurrence. However, you will never be able to calibrate your probability distribution to a downward jump of -45%, because there is no such jump in your historical sample. All you can do is trust that the 'true' random generator of the market is accurately captured by your model, and that, extrapolating from this, your model will now tell you the truth about jumps of -45%. As Taleb puts it, only the assumption that you are dealing with a certain type of probability distribution—for instance a Gaussian—can justify the belief that a certain amount of data is enough in order to infer (calibrate) this probability distribution. So how would you proceed when you don't know the type of probability distribution that you are after?

Taleb argues that probability distributions in the market should have much fatter tails than the Gaussian. Typically, they should be of the scalable (Mandelbrotian) type. If extreme events happen more frequently than we think, then it is all a matter of correcting the probability distribution—and, if the chosen distribution has infinite moments, a matter of recognizing that we will never really *know* it, because it would take an infinite amount of data to calibrate its fat tails. But notice that the whole discussion remains couched in terms of probability and frequency. If you measure the extreme event on some scale (hence the word 'extreme') then it is only ever a matter of relative frequency and comparison: the extreme event happens *more often* than we think.

So the outlook here is epistemological: Taleb believes in the reality of the random generator, but he thinks we cannot *know* it. The preoccupation with the event becomes ontological, however, when there is no previous scale, or population, of which the event is a grade (whether extreme or not) or member—when the event literally emerges out of nothing. Such an event is not extreme; it is world-changing. You cannot deal with it using either probability or improbability. My point is that the market, contrary to its quantitative and statistical appearance, is the (continual) place of such an ontological event. It seems that Taleb reserves the mild Black Swan problem (a matter of getting the right probability distribution, of using probability language) for the market. When he turns to the case of the major disrupting event that fits no scale—what I call I a context-changing event—he considers it only in very qualitative terms. But according to me, the quantitative aspect of the market (prices going up and down) actually masks the ontological fact that probability *never applies at any instant*, because every instant is the *same* (it is not the successor in time of the previous instant); it is the same in that it harbours the same immeasurable, unrepeatable, unheard of, event. I say the event is the 'same' in terms of featuring the same irreducibility and incomparability all the time. Above all this repetition is not to be understood in terms of statistics, of course. It is a repetition of the same wherein the 'identity' that the events share is precisely that *they are not comparable and reducible to any scale*, shared or not.

The events in question concern prices and seem to be quantitative, so there *seems* to be a scale. Yet the market is history, and every event, at every instant, must be as incomparable with the next as historical events are (no wonder the market is correlated to history and always accompanies it). It is through derivatives that such an aporia can be resolved. In derivative pricing it becomes evident that the market is not a succession of instants, because the process of infinite recalibration it demands freezes everything and puts us 'at rest' with the event.

Thus, instead of being regarded as a case of probability and statistics, the market should appear as the *only* case (a singularity, a miracle) where history and its events take on the appearance of numbers. It is a major coincidence. The blank space or the hinge between incompatible contexts[3] (this absolute discontinuity) happens to be filled by the (continuous) matter of the market, which I call 'writing' (since writing amounts to filling in the blanks). The matter of the market is the matter of metaphysics. By declaring this I shouldn't be breaking news to Taleb, really, but breaking news to Badiou (and Meillassoux).

So my main observation concerning Taleb (and my main divergence from his position) is that it is no coincidence that he started his career (as I did) in the financial markets, in the derivatives pricing and trading business. The market is the only place where the qualitative absolute event, the one that is irreducible to measure and scale and probability, finds quantitative expression, in a material medium borne by numbers, or rather prices. The market is *quantitative history*. One should keep in mind this contradiction in terms: one should remain aware that the historical event is incalculable and unquantifiable because it precedes any scale; and *then* understand the extraordinary nature of price (and of its medium: the market) *as the quantification of that unquantifiability*. This is why the market is truly the technology of the future. You have to realize that price is not a number. Quantifying the event (translating it into numbers) is impossible; yet the market *is* such a translation, precisely in so far as it takes place *outside* of possibility. 'Quantitative history' does not mean that the event is being forced into the mold of numbers. Rather, a quantity, a number of an extraordinary nature, has been found such that history can be quantified.

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[3] See Michel Bitbol's contribution to the present volume.

All that price shares with numbers is the external shell; it has a different mathematics altogether. When the resemblance is mistakenly thought to be full, and price is thought to be just a number, its process can only follow and come second. Then we remember (as if it had been forgotten) that the market is random; and, since the number is fully present before us, there is no choice but to postulate a stochastic process outside of price and to make price follow it. But in reality, the *price process* came before; it was always present inside price.

Thus when looking at price one should not look at the succession of empty shells it leaves behind as time passes. One then mistakes them for a time series and starts looking for the random generator of the underlying price, as Taleb does. Taleb was misled by the resemblance between price and number, and consequently applied the category of probability to the market, setting up the whole problem as one of deciding between Gaussian distribution and scalable distribution. Instead of recognizing in the market the (quantitative) *solution* of the severe Black Swan problem (how to mediate and exchange the unexchangeable event), he saw in it an instance of the mild Black Swan problem.

As a matter of fact, Taleb's whole movement of thought and line of work will later unfold as a constant withdrawal and distancing from the market, whereas I maintain that, given that he was fortunate enough, like me, to start a career and even a specialty in the financial market, he should have stuck with his specialty and drawn all the consequences—as extreme, incredible, impossible and metaphysical as they may be—of his experience and expertise with that extraordinary medium and matter. There is a scientific duty that is pressing here. There is the discovery of this new matter and of the new science that attaches to it. The peculiarity is that metaphysics is needed as an introduction to the science. One has the duty to advance this science. Taleb mistook the science of the market for the intervention of an old science—the science of probability—in a field where it does not apply. As a consequence, not only did he move away from the market, but this move has simultaneously expanded itself into a general attack against science.

C: If the numerical 'shell' is to be discarded, then what is it in price that this new science should examine?

EA: Its intensive, nontemporal process, the *place process*, which is that a price has to be given for the derivative written on the underlying. The underlying 'follows' no process other than *its writing as a derivative* *and the simultaneous (nontemporal) availability of the derivative price*. Instead of a random generator being posited, based on the statistical time series of the underlying, instead of statistics being understood as the result of successive draws of the random generator, the only generator of the underlying price should be the availability of a price for its derivative. The fact of such a price being given (and this givenness is the *definition* of the market, I would say) should replace the fact of a statistics of underlying prices being given (the definition of the random generator).

C: So the materiality of the market replaces the notional primacy of the random generator?

EA: Yes, and the market acts in a different dimension than the random generator, and therefore in a dimension other than time (it acts in place). Just as we infer historical volatility from the history of underlying prices, we infer implied volatility from the single option price. This substitution should be understood literally and in an epoch-making sense, and the corresponding transposition of the notion of the generator should be carried through and completed. Nobody has thought yet about the real implications of implied volatility.

The existence of the market is the availability of prices of derivatives of all orders, and this is equivalent to the *nonexistence* of the random generator. As I said, a true engagement with the meaning of the market leads to ontological considerations. What I have tried to accomplish in my work is to stick with my specialty (the market) and to draw the ultimate consequences from a thorough metaphysical analysis of it; and then to generalize these incredible findings outside the market by trying to discover what, in other cases, resembles the market. Because of the way that possibilities are nontotalized in the market (the definition of price), the market becomes the medium of contingency; it even *replaces* the event; and anybody who dwells in the market can be said to stand right in the middle in the event.

By replacing the random generator with writing, the market picks out, in the Black Swan, the decisive feature of the *change of contexts*; it seizes the 'true generator' of the Black Swan and thus becomes immunized against it. I have tried to think deeply about what, in the exceptional case of the market, makes it such a wonderful medium, such a solution to its own Black Swan problem. I remained focused and specialized in the market. Taleb, by contrast, never really dropped the frequency or probability-based notion of event (what he calls randomness). He never really upgraded his category to the one that changes whole ranges of possibilities; if he did glimpse it, his angle remained epistemological ('unknown unknowns'). He never saw in the ontology of the event (radical discontinuity) the opportunity for the existence (ontology) of a fabric or medium *that will precisely mend discontinuity by thriving in its gap*, so to speak; by making the discontinuity continuous (this new definition of matter) and the unquantifiable quantifiable thanks to a new kind of quantity or number (price). He passed through the market as a case of wild (unknowable) randomness, only to dedicate the rest of his thinking to events in general, lying largely outside the market. He renounced (and even denounced) his former specialty. He didn't explicitly analyze the event as ontologically incalculable, and thus he deprived himself of the answer to that problem.

This default will have consequences for the solution that Taleb will subsequently propose to the general Black Swan problem. For him, the event is immeasurable because received (probabilistic) science cannot measure it. But why not turn the immeasurability of the event into a search for a new science? For Taleb, received science is only a tool to know the world (The original subtitle of his solution book, *Antifragile*, is 'How to live in a world we do not know or understand');[4] therefore, in the face of the event, it is the epistemological failure of science that Taleb denounces. He never envisages science as an ontological tool, as a creator of worlds, even of matter. As a consequence, when he turns to trying to solve the problem, the proposed solution will consist in abandoning the enterprise of science—in this case the science of probability.

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[4] N.N. Taleb, *Antifragile: How to Live in a World We Don't Understand* (London and New York: Penguin, 2012).

Probability science becomes increasingly vulnerable and fragile when faced with the extreme event, because it cannot accurately express its probability; for this reason, the sad truth, Taleb rightfully argues, is that the science of randomness (probability science) in reality *dislikes* randomness, now understood in the metaprobabilistic sense that the probability forecast will be proven wrong. (Taleb will always understand metaprobability, or the criticism of probability, in an epistemological sense—as the failure of a model to capture a generator that, nevertheless, must exist—never in the ontological sense—as the failure of the whole framework of probability, namely the *nonexistence* of states of the world and the *nonexistence* of a random generator.) Probability science is needed in order to theoretically value derivatives and manage the risks of derivatives portfolios, but it can be massively wrong in its valuations. Therefore one way of *liking randomness* instead of fearing it, according to Taleb, is to keep the derivative, which thrives on randomness, but to discard the science of its valuation.

As a result, as far as options are concerned, Taleb proposes to abandon the subtleties and finesses of dynamic hedging (the fruits of the received science) and to adopt a static buy and hold strategy. He cannot sell, because a seller of options does not like volatility and, worse still, because a seller needs the science and needs dynamic hedging in order to manage (replicate) the options he sells. Notice that Taleb falls back on the market by default, as the only remaining background once science is abandoned; yet he never engages in the market as the positive replacement of the science. And when he notices that the market is quantitative after all—that it is a science, in my sense—and that one needs to be quantitatively critical of the premiums of options that one is buying and holding, Taleb abandons the market altogether and writes *Antifragile* as an apology for the asymmetric payoffs (a.k.a. derivatives) that one can find and purchase for free, outside the market—that is to say, generally in life. Notice that, since they are costless, they don't require a seller.

One can summarize Taleb's move in the following way: On the way up, the market was never recognized as the matter which lies beyond probability and which is, in its own domain, the quantitative solution to the problem of the qualitative event or Black Swan; the qualitative event itself was never recognized as an ontological problem which required an ontological solution. On the way down, randomness, which remained epistemological, required as the solution of its problem only that the science be dropped (together with the market).

Even though he has dropped probability and the problem of valuation of asymmetric payoffs, Taleb is still locked into the language of frequency; he is still a slave to the scale and comparison, to the *degree*, and therefore to its relativity. Fragile things resist frequent shocks of lesser magnitude, but break in case of an extreme and infrequent shock. Antifragile things get stronger and stronger (scale and degree) as they are subjected to shocks and accidents (to randomness). Notice that the randomness that affects them is tamed, at least in the sense that the scale upon which the antifragile thing is recognized to have become stronger is itself preserved. How would the antifragile thing fare in case of events that destroyed the whole world, or at least that radically changed the background or the scale against which the antifragile thing must be recognized as being the same thing before it is recognized to have become stronger?

Taleb's *The Black Swan* was a metaphysical book (at least according to me). The event there was absolute: anything could happen; there was nothing, no world, no range of possibility, no time, that the event couldn't change or abolish. In *Antifragile*, Taleb recognizes a category that is now superior to the event and seems to dominate it, namely antifragility. But one cannot recognize in the event the absolute discontinuity, the failure of any scale, and *then* propose as a solution a notion that depends on scale.

The solution must be absolute, like the problem. Taleb's new great discovery in *Antifragile* seems to be (-1, 0, 1): the contrary of fragility (1) is *not* robustness (0), but antifragility (-1). However, the real *not* that he is missing is, as in *The Black Swan*, the *not* that negates the whole idea of scale. It applies to fragile, robust and antifragile alike because it removes the scale, in the same way that the market, in *The Blank Swan*, is the *not* of both probability and improbability, of both prediction and its failure. Antifragility without scale amounts to creating an absolute—in other words, to creating *matter*. The solution must be metaphysical: the medium that insinuates itself at the hinge of the event; to be in a state of relative rest with respect to the event.

C: Against both the black swan and antifragility, then, you posit the market as *the medium of contingency*, the place of this event that is beyond fragile, robust and antifragile alike.[5] Let's address what you mean by contingency.

EA: Contingency is one-sided. A contingent thing is the way it is without remainder, without recall, without reason—without reflection. Contingency is unexchangeable, to speak like Baudrillard in *Impossible Exchange*.

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[5] Ayache, *The Blank Swan*. See also R. Mackay (ed.), *The Medium of Contingency* (Falmouth: Urbanomic, 2011).

The contingent state is not selected from a preexisting list of possible states. To list such possible states is to involve contingency in their reciprocity and their mutual reflection: this state *as opposed* to another. Which means that identity is recognized (*this* state, *that* other state) before difference. In contrast, massive and absolute contingency, contingency as *matière première*, has to be recognized *before* state and identity. We must say of the contingent thing that it can be (different) before we say that it is, or what state it is in. In this way, a future contingent event (that doesn't exist yet) becomes no different from an actual contingent thing or an actual contingent fact. To recognize massively that an actual contingent thing could have been different dispenses with any need to list the alternative possibilities that it might have been. We don't need them because the thing is actualized. It is no longer possible, it is before our eyes, yet we know that it could have been different. Its contingency never leaves it, so to speak, to become reflected and dispersed in external possibilities. Similarly, we should be able to think of the future event as something that could be different (or that could even never be at all), before and without knowing what it is or will be.

All that Time brings to this is identification, because it is in time that we eventually identify the future event. The whole idea is to secure a bridge to the future event that is other than time, a bridge that is indifferent to the identity of the event (what it is) and sensitive only to its contingency, and which establishes a link, a mediation, a channel of communication with that contingency alone. I argue that the market of contingent claims is such a medium and such a bridge. This bridging is achieved through the combination of *writing* and *exchange* (a kind of alchemy). When something is written, it is too late; think of opening it after the fact, as when you open the will of a deceased person. It is too late because of the material on which it is written and because of the mark that the material bears. This mark doesn't offer interchangeable possibilities. It offers itself as one. It is what it is, yet it could have been different.

C: But a contract on the market precisely deals with different possible states of the world which may or may not be fulfilled, does it not?

EA: It is true that the written contingent claim specifies different states of the world, or possibilities, in which it pays different amounts (if A, pay x(A); if B, pay x(B), etc.). However, these are written; they are not merely mentally represented. In order for them to be realized and to actually pay off, the material sheet on which they are written needs to be handed over and exchanged. As such, the material sheet that binds them is one; it is not many. It will not change

depending on what state may come about in the future. It must maintain its identity, or rather its materiality, in order to be handed over and to be transmitted. One tends to forget that, because of this materiality, the material sheet can exist (and be exchanged) before the final state is reached, in which it will expire and pay off. In contrast, the final state doesn't materially exist before the expiry, because until that date it is just a possibility. As a matter of fact, the material sheet exceeds the possible states that are encoded on it. Things can happen to it that were not part of the listed possibilities. It could be lost, or it could burn, or the whole market in which it was supposed to be exchanged against money could disappear.

These possibilities cannot be listed or even totalized, and this massivity of contingency prevents us from listing them in an ex-ante fashion, leading us on the contrary to always think ex-post. We should not think of a future thing as a possibility but as a future reality; as something that has happened and could have been different, but with the mere *incidental* difference (due to the incidence of chronological time) that we don't know what has actually happened. Reality must be separated from actuality. We must think of (massive) contingency ahead of time and find a way of translating this massivity and this ex-post character to a place (and a time) that is before the event, but *without turning ex-ante*. Time is unavoidable, but what must be avoided, when

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thus going backward in time (from the future to the present) is the ex-ante attitude. It is as if we were saying that that material sheet, whose ex-post future fate we have already considered (and already realized that it could have been different), is *still* here with us now, in the present, *after the fact—that is to say, before it*. The massivity of contingency after the fact should correspond to an equivalent massivity before the fact, which will not count as an ex-ante stance *because of this massivity*. In other words, the nondistinction and nonidentification of alternative possibilities after the fact (due to the massive 'too late') must correspond to an equivalent nonidentification of possibilities before the fact. Once this equivalence is found, chronological time becomes incidental (non-essential) on contingency—and being chronologically situated before the event (incidentally) will no longer count as being ex-ante.

Chronological time is of the essence when states are distinguished. Reviewing one distinct state after the other imposes a chronology on thought if only because the review is analogical and the identity of each state is recognized (and circumscribes the state) *before* its difference with its neighbour. Reviewing states in this manner necessarily introduces an integral (a synthesis) or a supervising state that runs through each one. We can even go further: this mode of reading is *equivalent* to having such a supervising state. There is the impression of a draw, of waiting to see each outcome.

ART GALLE

Probability is an integral because it is the summation of a 1 and 0s conveniently distributed over recognizable states. Reviewing the states in an identifiable order is the *same thing* as having the one state that maps into each following a probabilistic transition. This is the meaning of probability. Distinguishing the states imposes this probability structure and requires time and the ex-ante attitude in order to resolve itself.

In contrast, there is no integral, but only a *differential*, in the reverse reading of contingency, where the fact that the state we are in could have been different is recognized *before* its identity. While the reading of identifiable states is conducive to *valuation* (as in evaluating a function) the reading of contingency ('it could have been different') is conducive to *pricing*. While the list of identifiable and reviewable (reciprocal) states is equivalent to stepping back into the supervising state, the multiplicity and mode of count (not a function, not a number) of contingency and of its massivity cannot step back; it can only invaginate itself in the material sheet itself, exchanging it. Just as, when we read the list of identifiable possible states, we reproduce (describe, constitute) the supervising state, so, when we 'read' the one contingent strike, or mark, we create its exchange.

It might seem that the ex-ante attitude (waiting and seeing what possible outcome or state will obtain) is more suited to the 'future' than our twisted suggestion, in which we position ourselves in the future after the fact (ex-post) and recede to the present through an unwarranted medium that we are calling the *exchange* (or the market). The ex-ante attitude seems to be a more faithful description of the attitude of predicting what will happen. Crucially, however, the ex-ante attitude depends on having recognized the possible outcomes and totalized them in a list. And where can such identification come from, if not from the *past*? We observe the past series of outcomes of a die or a roulette wheel and we decide that these are the only outcomes, and consequently project them into the future. Yet the future is massively unpredictable. Anything could happen; fire could destroy the casino or a meteor could hit us while we cast the die. Probability and the ex-ante attitude in which it is framed depend on reducing the contingency of the present world to a *comparison* with alternative possible worlds that we arbitrarily carve out and separate from the present one, using our imagination—or rather, *lack of imagination*. We invent numbers, 0 and 1, that we assign respectively to the possible worlds that have not obtained and to the present actual one. Yet the present world should have remained *one* in the sense that it admits of no rivals or alternatives, even 'possible' ones. It should have remained 1 without 0, where 1 is not a number (whose fate is to be compared to a 0 or whose difference is to be construed analogically) but is a mark, a strike, whose difference is intrinsic, since it spontaneously says that *it is what it is only to the extent that it could have been different*. This 1 without 0, this unity that has factored in the difference intrinsically, is a new unit of count; it is a different way of counting altogether, whose medium, I shall argue, is money (hence the market), not frequency.

Creating these alternative worlds is not only a fiction; it robs the present world of its reality. Since the alternative worlds are not compatible with the present one, the only way they could coexist with the latter is in a fictitious *past* stage where all worlds (the present one along with the alternatives) are considered to be mere possibilities. Identifying the present world as a state is the same as identifying the alternative worlds or states, is the same as fabricating the past world. Assigning *comparable* numbers (1 and 0) to the present world and to the alternative ones is only the prelude to assigning to them 'middle' numbers (p_i) that they share equally, *whose sum is also equal to 1*. To explain the contingency of the present world, we thus imagine a past 'real' world from which the present one and the alternative ones spring as possibilities. That past world now bears the number 1 (the sum of probabilities). It is as fictitious as the alternative worlds (since its whole raison d'être is to support the incompatibility between the alternative worlds by stepping into the past); yet the thought is now that of a transmission of reality.

The 1 of the reality of the present world is now ipso facto thought to have been transmitted to it by the fictitious past world through a temporal transition. This immediately results in an extrapolation whereby future possibilities are in turn thought to spring from the present world, only because it now bears the *analogical comparable* 1 and we now identify this fabricated reality with a sum of possibilities.

C: This sounds like a development of Bergson's famous critique of possibility, and of Meillassoux's more recent critique of probability and its postulation of possible worlds. How does your conception of *writing* supplement the critique of this retrograde notion of futurity in the name of absolute contingency?

EA: The 'sheet of paper' is immaterial when we are in the mode of reading the list of possible states, because only the contents matter and the writing is here merely programmatic. By contrast, the material sheet of paper is *essential* to the reading of contingency because this reading, as a reaffirmation of the mark and of difference, is a reaffirmation of the fact that no writing as difference and as mark is possible unless it is engraved on a material medium—a sheet of paper, a stone, a computer memory, etc. Once it is recognized that this material property of the sheet is *essential* to the mode of difference of contingency, it is immediately recognized that the sheet can (and must) be exchanged; this is the same movement of thought. It is the *same matter* which bears the difference and strike of contingency as one, without splitting into different states, and which, as a result, turns itself into the exchange.

Finding an equivalent for the ex-post massivity of contingency before the fact (yet without becoming ex-ante) means securing that the two 'masses' are the same following the 'line of flight' of the event, even though they are separated by chronological time. The medium of transmission is the market and is such that, in the mode of count of the event, the price of the contingent claim is *simultaneous* with its final ex-post strike, as if the price and the final contingency were 'light-like' events, to speak the language of relativity theory. What makes the market as massive as the final event and transports it, through this equivalent massivity, right into the middle of the event, or rather, into its place, is the nontotalization of possibilities due to the necessary tradability of all the other contingent claims. Before the final event there occurs the *whole market*—and what the 'whole market' means is that no contingent claim, of any grade of complexity, shall be denied a price and a trading. As I have explained above, any attempt to recede from the final event (or the strike of contingency) via the probability framework will require a total of states, with the consequence that some derivative will admit of a value (a function of other states) instead of a price, thus negating the fundamental principle of the market.

FROM TECHNOLOGY TO METAPHYSICS

C: How does this lead to the idea that the market is a *technology* of the future (rather than merely a mode of knowledge or prediction)?

EA: Letting the *whole market* occur before the event is equivalent to blocking any attempt at receding through probability and the ex-ante attitude. It is as if we were (incidentally) situated before the event chronologically but we were essentially brought back, by the pressure of the whole market, right into the middle of the event. The nontotalization of possibilities in the market makes it feel as if it was continually an event, the only event, and as if we were continually following it ex-post. A connection between massivities is established, which falls outside time.

It is because of this material bridge that I speak of a technology of the future, instead of a knowledge or prevision or vision of the future. The market replaces the final event because the nontotalization of its possibilities brings it right into the middle of the event (into its place, albeit not into its time), and equivalently the technology that the market is replaces the future. It replaces its knowledge (for there is nothing in the future that puzzles us today except its knowledge). The market makes it so that something other than knowledge matters in the future, and so that the future becomes real—

no longer in the epistemological sense of the realization of a forecast or a possibility, but on the contrary in the ontological sense that all possibilities have been withdrawn from the future (since we consider it ex-post) and that this *future real* has been connected to the *market real* through the market technology.

Anyone who travels to the future in the capsule of the market is insulated from time. When one moves outside the market (or outside matter, outside the ex-post stance) to project states of the world, one commits oneself to that outside medium of probability as an absolute medium (even when the selected states are part of the prices of the market). To adopt the logic of the count of states is to leave the *whole market* (as nontotal) and to adopt a metric that is no longer intrinsic. (What is intrinsic is the whole and the nontotal.) Rather, what should measure the distance between the final event and the present market is the intrinsic metric of the arrangement of matter (Julian Barbour)[6] inside each. The arrangement of matter of the final event is the strike of its contingency, which is irreducible to possibility; and the arrangement of matter of the market is its strike as whole and essential event, in which every price of every contingent claim is an integral part, irreversible. It is true that something will change between the present market and the final event; however, that change and the way we engage with it is no longer a matter of prediction; it is no longer accounted for against the absolute and extrinsic medium of probability (the ether). We no longer see (and foresee) the final event when we are locked in the market capsule because all that occupies us is the market. The market has replaced the event, literally.

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[6] See COLLAPSE V, 75–121

C: The medium of contingency, then, and a technology; yet another way you characterize the market is that it is not simply a matter of developing a philosophy *of* the market—in a certain sense the market already *is* a philosophy. Why does the market qua technology necessarily give rise to a metaphysics?

EA: Industrial revolutions are usually the precursors of metaphysical revolutions. Einstein's abolition of absolute time and space and his enunciation of the relativity principle wouldn't have occurred had the telegraph and railway networks, then becoming a global industry, not presented the problem of the unification of time and of the determination of city longitudes around the world. A whole technology developed to mechanize the coordination of clocks. Simultaneity became a mechanical procedure and was no longer a metaphysical concept.

Based in Switzerland, the home of the clock industry, and working as an application examiner in the Swiss patent office, Einstein was the privileged witness of this revolution. Owing to his status of total outsider vis-à-vis the scientific establishment (unlike Henri Poincaré), he was bold enough to redefine time in terms of simultaneity, and to redefine simultaneity in terms of the procedural transmission of signals between clocks. Relativity theory was conceived as a machine, not as a metaphysical speculation or an amendment of previous theory. In fact, Einstein wrote his revolutionary 1905 special relativity article in the brisk style of a patent claim, where reference to previous work or to similar inventions was precisely omitted.

The market of contingent claims is also a major industrial revolution; however, its metaphysical consequences haven't yet been drawn. In many respects, it is similar to the one that prompted Einstein's theory of relativity, with the market acting as the new globe and the synchrony of prices like a global clock.

Where patents to synchronize distant clocks were filed in Einstein's day, today the industry is filing maps of synchronous derivatives prices. When the traded vanilla options prices are too scarce, data vendors extend the market and produce complete and smooth implied volatility surfaces. When the underlying price moves or time passes, the surface is recalibrated from a new intake of traded derivatives prices instead of being recomputed from an underlying probabilistic hypothesis. And, once it is observed that implied volatility is traded and stochastic, the market is solicited again for the prices of options on volatility indices (for example, VIX options) and the latter are repackaged and redistributed in turn in a refinement of the market synchrony, instead of upgrading the theoretical probability distribution underlying the BSM model to stochastic volatility.

The medium of probability needs to be abolished, when thinking of the material relationship between a contingent payoff and its present market price. Probability is an outdated, yet very entrenched metaphysical category that has to give way once the market is conceived as a machine or a technology and no longer as a theory (once the suppression of possibilities under the massivity of the final contingency is recognized to be equivalent to the suppression of possibilities under the massivity of the market—under the *whole market*).

Just as there is no absolute time rigidly attaching to the ether, but only time defined relatively to the material procedure of the synchronization of clocks, there is no absolute probability with which to distribute the underlying and value contingent claims accordingly. Rather, probability is defined relatively to the frame of reference, whereas the real, intrinsic relation is the one that prevails between the contingent claim and its market price.

The rule is to infer the probability distribution of the underlying from the market prices of contingent claims. For instance, volatility is implied from the option price in BSM. When the implied volatility differs among strikes and maturities, we change the probability assumption and we now calibrate a stochastic volatility model (or a jump-diffusion, or a mixture of the two) to the full vanilla surface. The next day we recalibrate the model to the new options prices, thus changing the distribution again (horizontal recalibration). And when we realize that the market prices of higher-order exotic options are not explainable within the model, we upgrade it to the next level. We thus recalibrate a model of stochastic volatility of volatility, or stochastic jump sizes and intensities, etc. (vertical recalibration).

We call 'intrinsic non-arbitrage relations' those relations that help us value derivatives independently of any model of the underlying process. These relations are deduced purely from the statics of the respective payoffs or static replication—that is, from the clauses that are *written* when possibilities are over and the underlying dynamics are terminated (typically at maturity of the instruments or at their knock-out barriers, etc.). Now, the observation is that market prices are also model-independent and, by definition, arbitrage-free. Why don't we consider their relations to be intrinsic too?

Might not the metaphysical revolution lie in considering that the market prices are *written* too and are devoid of probability dynamics—that is, written somehow ‘after’ the end of possibilities, after the fact, outside chronological time? Could the market price be essentially occurring in the middle of the event—right in the heart of the terminal-contingent payoff and with no need to predict it—yet accidentally taking place ‘before’ the event, in what may look like a chronological antecedence but is in fact a taking over of the event, literally taking the place in which the event takes place? And if probability and temporal process do not intrinsically occur between the present price and the future payoff, then what does? Relativity theory is in reality a theory of invariants—so, we ask: what is our invariant?

Only because a nondeterministic phenomenon repeats itself with a few variations are we able to assemble the variations and retrospectively call them ‘possibilities’ that are open to the event. (The possible states are identified.) The event is the result of abstracting the differences in the same class and of subsuming the facts under the same phenomenon, which we then suppose will admit of different outcomes. The ex-ante outlook therefore has no physical existence; it is a logical abstraction. Possibilities are defined *after* the population, not before. As we have already discussed, probability is also defined in retrospect.

When there is no such empirical population or reference class of which the event is recognizably a member, metaphysicians can still imagine a set of possible worlds in which to measure its frequency. A less exorbitant alternative is to drop objective probability altogether and to believe only in subjective probability. However, does any of this make sense when probability, as a concept, has been recognized to be past, not future, and only to be misplaced in the future? What could the probability or even the possibility of an absolute event, a Black Swan, possibly mean? Is time itself not void as the medium of such an event?

C: And presumably you would claim that this realization is implicit in the techniques that have developed for derivatives pricing, even if they ostensibly seem to rely on a probability framework?

EA: Derivatives pricing almost kicked off as a branch of actuarial science. The event of the underlying price resting above or below a certain strike at a certain maturity was analyzed as the linking of very small price increments that occurred in abundance in the interval. On the assumption that the instant probability distribution would be inferred from the statistical series, the temptation to compute the fair value of the derivative as an actuarial value was great—one such that you broke even on average. However, the non-arbitrage constraint binding the derivative, the underlying and the riskless bond quickly dispelled this temptation in favor of risk-neutral pricing, if only because of the risk premium attaching to the underlying and of the investor's expectation not to break even on average. Finally, the dynamic replication argument of BSM—itself compatible with non-arbitrage and risk-neutral pricing—gave derivatives pricing a more operational turn. It turned the abstract equivalence between the real probability measure and the risk-neutral measure into a pressing and very local accounting equation.

In reality, BSM had just consummated the thought that the market was a material procedure and not an application of probability. Nobody cared any longer whether the derivative price was sensitive to the distribution of profit and loss in the long run, or to the instant random generator that caused the systematic slippage in hedge rebalancing. We all woke up in a market where derivatives and underlying were trading alongside each other and moving together. Nobody uses the BSM formula to explain the option price; everybody inverts it against the option price to compute the dynamic hedge.

Implying the BSM volatility from the vanilla option price opens an endless chain: every subsequent model (stochastic volatility, jump-diffusion, etc.) is calibrated to the options market in turn and becomes virtually stochastic by recalibration. Its meta-model will be governed by the prices of higher-level exotics and, where they don't actually exist, it is only virtually that we should conceive of recalibrating against them.

The market is this infinite chain of prices of contingent claims.

If the chain is virtually infinite, then the relation between any contingent payoff and its price becomes intrinsic. Any probabilistic model is an arbitrary section of this infinity and will always be relative. Incidentally, every exotic structure in the ascending ladder will trade at variance with the replication plan corresponding to that section. This means the underlying stochastic process is prevented from running its course at any level. The virtual infinity of prices, or the market, replaces the whole probabilistic hypothesis and the exchange's 'proper time'—or rather, its proper place—replaces the improper and misleading time of probability.

TIME AND THE BOOK

C: So—once again, when read carefully, this technology entails a whole philosophy *of* the market.

EA: The market becomes philosophy by realizing exactly what happens to the orientation of thought (what happens to thought) when the market is no longer envisaged as a random phenomenon taking place in the ether of probability, against the transcendent background of possibility, but as a direct medium of contingency from which possibility is withdrawn, or as the material technology of the future from which knowledge and prevision have been withdrawn. In this transformation, thought, we might say, has been brought from the depth (or the illusion of depth—Wittgenstein) to the surface, from abstraction to matter, from thought to writing. And the market has become necessary, not through the summation or totalization of possibilities, but through the subtraction and suppression of possibilities.

If the market price becomes intrinsically linked to contingency, as we said above, as geometry is intrinsically linked to matter in general relativity—that is to say, immanently, without any superior dimension supervising the link—then this link becomes absolute and, in a sense, necessary. (Relativity theory is a theory of relativity in so far as the nonabsolute character of space or time is concerned, or in so far as the relativity of the given frame of reference is concerned; however it is an absolute theory when the invariant is considered.) This is not saying that the market price becomes deterministic; it is not necessary in that sense. The market is necessary in the sense that it is the only medium of contingency, once contingency has become absolute in the sense of the abolition of possibility (not the summation of possibility). Contingency is one-faced and one-sided, and the market is necessary in being the only 'other' side of the one-sided contingency. The market is its translation, its mediation, its mirroring and its speculation, without this translation or mediation or mirroring being a relation with two terms and two sides, established within an encompassing supervising space. The market is necessary in the sense in which Blanchot says that 'the necessary book is subtracted from chance', or in the sense in which the thrower of the Nietzschean die embraces a 'fatal necessity' and emits a 'necessarily winning throw' (Deleuze).

Thus the generalization of the market is the book and the market becomes philosophy when it is recognized that philosophy too is looking for a necessity of thought, not as a transcendent sum of possibilities, but in the immanent material sense of Blanchot's necessary book (referring to Mallarmé's). The market becomes a book once it is recognized that the transformation of thought that happens there (which remains special and specific in the market as it concerns only financial contingent events and their financial translation and mediation through price) can generally be described as the couching of thought in writing. Blanchot says that thoughts, as abstract and difficult as those that could be found in philosophy books, can be expressed in a literary book provided they are *not yet thought*. My interpretation of this is to say that good philosophy books are the ones in which the thought is written (as in literary books) and *not yet thought* (reflexively, transcendently). Writing is faster than thought, and to say that a literary thought can be philosophical (and can be better than philosophy, according to me) is to say that it should retain what writing and literature have specifically given to it—the event—and should not be slowed down by reflexive (ordinary philosophical) thought. Something is well written, according to Joubert, when the author cuts the sentence and refrains from adding to it what can be guessed and predicted at that point—what is no longer the continual event and could slow down the sentence if added to it at that point. In my elaboration of the word 'writing', writing takes place when thought races at the same speed as the event, overtaking traditional reflexive thought—thought that is slowed down by states of mind and representation.

In a sense, philosophy is nothing other than a philosophy *book* (it is material thought), not just in the obvious sense that philosophy is contained in books and that we all, in the end, refer to very specific books when we talk of the philosophy of specific philosophers, but because engaging in philosophy is engaging with the event of thought, and writing a book is the only way to be up to speed with the thought (usually another philosopher's) that we are engaging with, making it truly feel as if the chronologically older book now was to be interpreted at the light of the new one, or as if the old one was chronologically posterior to the new one. Philosophy is not a reflexive commentary. As David Wood would say, to reflect in commentary on the thought of other philosophers is to go counter to them.[7] Instead, one should encounter the other

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[7] D. Wood, *Thinking After Heidegger* (Cambridge: Polity Press, 2002).

(older) thinker, that is to say meet him; and since thought is running the course of the event, which is one-way (one strike), to meet the other thinker is to match his speed, meeting him in the middle of the event, writing a philosophy book that will join his in the non-chronological *place* of thought (or in the infinite race of the event). (Wood speaks of repetition.)

It is not that philosophy is a closed library and that the only concern of philosophy books is other books, with no connection with the real. Philosophy is thought as the other side of the real; it is speculative in the sense of mirroring the real; however, it should not slow down the real (its event) with the reflective side of the mirror. Philosophy should reflect the real without adding a side or a face; it should literally replace the event of the real. I interpret speculative materialism (or speculation without the metaphysics of dogma and without the metaphysics of necessity) not just as the affirmation of the necessity of contingency but as the other side of the one-sided contingency—what becomes necessary to it in the (non metaphysical, non reflective) sense I described above. The correlation of thought and being ultimately is not a relation; it is a one-sided duality in Laruelle's sense (he has photography as a special means of speculation or as an illustration of philosophy;[8] I have the market). Once Meillassoux applies to his own medium (his own thought, his own book) the abolition of possibility that is required by absolute contingency, turning his thought into the material book, the problem is upgraded from one of thinking the real as given to thought or of thinking the real without thought, to the discovery of the new *matter of writing* in which the event is repeated. What I call the 'market', thus generalized, the medium through which we connect with the event, is thus the *book* (the new matter); the proper medium of Meillassoux's speculation. No wonder Meillassoux resorts to Mallarmé (and to his poem, which is his book) as the solution of the problem he has posed in *After Finitude*.[9] (Each one of our heroes proposes a solution after the book that has posed the problem: Taleb, Meillassoux.)

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[8] F. Laruelle, *The Concept of Non-Photography/Le concept de non-photographie*, tr. R. Mackay (bilingual edition, Urbanomic and Sequence Press: Falmouth and New York, 2011).

They are all after the thought of the real (of the world) without thought. They haven't really dispensed with chronology. They want the book that writes itself (Taleb's *The Black Swan*) or that is necessary, subtracted from chance (Mallarmé's). How long before they realize that the matter of which books are made is *real matter*, as absolute (and independent of thought) as the one they prize so highly in their materialist ontologies? Books, of which the market is the special (numerical, quantitative, nonliterary) instance, are the technology or the material medium that truly permits us to rotate our universe in a direction that makes us insensitive to chronological time. Call the event of the real, its strike, its contingency, the world's best kept secret; and instead of wondering how chronologically or spatially to think with or without this event (to think it as uncorrelated to thought, as having happened before thought and as continuing to happen after thought), think of the availability of a matter that allows us to repeat this event. This is better than thinking it. This is literally making it and replacing it.

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[9] Q. Meillassoux, *The Number and the Siren*, tr. R. Mackay (Urbanomic and Sequence Press: Falmouth and New York, 2012). See also Meillassoux's contribution to the present volume.

Philosophy tries to think itself outside its book (its whole book), somehow theoretically, in the same way that the theory of the market (best represented by derivative valuation theory) ultimately elaborates itself and misses the market in the last instance. Derivative valuation theory thinks of the market against the absolute background of probability (it believes it has no other way of animating the price process of the underlying than against a probability framework) and it culminates in valuing a derivative of a certain order of complexity by stochastic control and dynamic replication by the traded assets whose probabilistic dynamics it has identified with the market. However, in doing so, it falls short of the last and most essential step concerning the market, which is that this last derivative has to admit of a market in the last resort—or rather, in the first place. In order to think the market, it goes outside its medium, only to recognize in the end—but now it is too late—that the derivative that has been valued last, is *still* the market. Similarly, philosophy thinks the real; it even thinks the existing stock of philosophy books that are now part of its tradition and reality; however ultimately if fails to recognize that what it has produced is yet another book; that it is *still* the book.

C: Presumably this is not to say with, for example, Stanley Cavell, that philosophy is not a set of problems but a set of texts?

EA: No, I am not saying that there is no value for the thoughts that are expressed in the philosophy book outside the matter and the accident—the contingency, the event—of that book. Rather, I am arguing that to think of philosophical thought outside its book is to deny thought its material nature. It is true that anyone trying to think the real without thought will in the end have produced just another thought or written just another book; however, this is a facile rejoinder to oppose to him. Instead, one should reverse the direction; one should no longer think of the real as the independent domain, and of thought only as the circle that slows it down or reflects it. One should think that the whole separation of the real from thought or of thought from the real is a false problem and a consequence of the wrong orientation (an orientation that has stepped outside the book). For the thought of such a separation conversely slows down thought relative to its own material process.

One has positively to embrace the 'aporia' according to which yet another book will be written and no matter what we think, it is still the book. One has to understand this wholeness of the book (the whole book, the whole market) as a homogeneous medium whose acceptance amounts to repeating the event and no longer being separated from it. Thought has had a tendency to grasp the real against a fixed frame (of thought) that keeps thought separated from the real, when, in reality, this absolute background doesn't exist, and the only way of thinking is to think 'intrinsically', following only the arrangements of matter. The only matter that gets arranged and rearranged behind the real and thought is written matter, without which we wouldn't know anyway what to say or what to write, what to leave behind.

The genesis of the book encompasses the genesis of the market, where the market is the special medium from which probability (this transcendent way of watching thought) has been retired and which is supposed to reorient thought accordingly, by detaching it from chronological time and its absolute metric and making it homogeneous with the event. The book is no less true than the real, and the category of writing enjoys a compatibility with the event that overturns the order of time. What was speculative thought thinking anyway in the standard order of time? That once the absolute is finally thought without thought (once speculative philosophy has reached its end) then thought would stop? On the contrary, I think that a speculative metaphysics without the dogmatism of the absolute, speculative thought without this absolute end (the absolute as an end), is precisely a thought without an end and without a stop. It is only through the reorientation and the correction of the medium that I suggest that thought will have both left the circle (this vicious infinity) and will be guaranteed to reach no end outside. There is an intrinsic link between the event of the real and the book (or material thought) which guarantees and explains that the real and thought never stop and that their event is always repeated.

PRICE, VALUE, AND DERIVATIVES

C: Your account of the market focuses on writing of *derivatives* in particular, and makes a case for considering the market exclusively in terms of the derivative pricing process. One objection we have encountered when speaking to others of your work (from within philosophy, but also to traders) is that there are a plurality of markets in existence, each with a seemingly different raison d'être. On your view, what gives you license to speak of *the* market rather than just markets in derivatives, given that these latter form the basis of your analysis?

EA: As just outlined, for me the market is a new order of thought, a new metaphysics that frames the new matter in charge of filling in the blanks that the Black Swan leaves, of extending and 'continuing' in the discontinuity of the event, of providing the medium that is located at the hinge of the event, etc. I have reached this conclusion through elaborating the category of *price*, precisely as it diverges from probability and from valuation, and more generally from the whole framework and order of thought in which we think of states and identify them, read them chronologically, evaluate functions that are written on them, etc. So it is true that price comes, in my philosophy, before the market place (which will only be deduced at a later stage as the place where contingent claims receive prices, as the place where their contingent payoff and final event gets translated—literally dragged in space—into prices, as the medium which allows us to recede from the final and massive strike of contingency without using probabilistic transitions or adopting the ex-ante attitude). Price comes before as a new logic of the count, or a new logic of the one and many—a new mathematics, even. Derivatives, or contingent claims, are essential in this presentation of price because they are written—they are a schedule of different clauses—and because they articulate the dialectics of the one and the many in the difference of their clauses.

I need first to establish the difference between valuation and pricing, between (a) reading the value of a function as chronologically differing *because* its argument or underlying state is chronologically identified, and then recognized as differing in the reading, and (b) reading the function as massively and 'non-chronologically' differing, as differing without distinction and identification of underlying states and possibilities, as differing in the massive sense of the 'too late' and ex-post, which is the sense of contingency—the function being what it is, not in a sense of a recognition of a state but of a strike, or a mark, which *could have been different*.

Now, this inverted mode of reading is precisely the mode of *pricing* as opposed to *valuation*. I need to establish this point of logic, which at first seems remote from the market, before observing that the latter mode—valuation—is conceptual whereas the first mode—pricing—is material, and requires the material sheet on which the function is engraved. It is in a subsequent move that the difference of contingency, instead of being integrated in the supervising state, is recognized not to be translatable and not to issue otherwise than in an exchange (of the material sheet).

The market, which exchanges the sheet, is thus defined (constructed, constituted) as the only way to 'evaluate' the difference without looking at it in an ex-ante fashion, by evaluating it after the fact, after it is too late, and dragging it before it takes place (for evaluating something is always a matter of looking at it ahead of time—from this there is no escape).

We think there is something, a bridge, between now and next, between the present state and the future state, and that probability will play out in that interval. In reality there is nothing between the present and the future; there isn't even time (time is not the proper medium) because the future contingent event is totally unpredictable (possibilities are never totalized).

Now consider an alternative in which the relation between present and future (the forecast) is not an artificial, logical and chronological consequence of the totalization of possibilities. Consider an alternative in which we face the real future—not one masked by an ex-ante attitude whose only cause is the present, or rather past, identification of possibilities. How to have as of now, not something precise to say about the future (for we are no longer standing in a precise state, now that we no longer precisely identify the possible states), but literally something massive and imprecise, literally traces of the future that have been imported into the present, instead of a false precision that is due to a present artificial identification and has been exported into the future; how to have the ex-post signature of the future somehow handed over to us now?

I claim that writing is that massive thing that does not distinguish precise states in the future. A contingent claim is written and is programmed to pay off a certain amount of money in the future if a certain event obtains, which is *precisely* described in the writing and which we may, for this reason, provisionally call a ‘state’. However, the payoff is not only contingent on the precise encoded state; it is also contingent on the material sheet of paper that carries the writing. That piece of paper must be *exchanged* against the money that will be paid off; the holder has to produce evidence of his claim and to hand it over at maturity in exchange of the payment. Because of this material procedure which has to take place in the real future, nothing is really programmed in advance; nothing is projected, as was the case with probability. For all we know, the holder may suddenly realize that he has lost the sheet of paper (he no longer materially holds the claim), or the conditions ruling its exchange against money may fail to obtain. Imagine that the place of exchange is destroyed, or that the wording of the contract is found to be legally invalid, thus enabling the liable party to escape its obligation. Imagine that the whole world ends. Imagine, in other words, any contingency that may be associated with opening testaments at the time of opening them *and not before*. For this reason, the sheet of paper does not carry any state at maturity but is just massive; its ex-post fate is 'written on it'. Also for this reason, what it carries today is not a state either; it is the whole market. The sheet of paper that was subject to its massive contingency at maturity (in the future) is *still* with us today—the same sheet, as real and undivided. It is exchanged against real money at maturity, and it is exchanged against real money today (at a different price) in the market.

In contrast, we cannot say that the state that will be realized in the currency of probability is with us today. If we assume that it is real in the future (when and if realized), it is not real today, but only possible. It is not realized through a material exchange in the future, through something that really crosses a place and leaves a trace (money) in the future that can be found before the future (today), but through an intellectual attribution (probability = 1). As a matter of fact, it is not even real in the future and it doesn't really belong in the future; for it is only an extrapolation from the past. Money was invented for the purpose of mediating between present and future in the correct *forward way*, connecting real to real and not possible to real (which is the backward reverse way) and without the precision and indeed the fragility of probability.

Money, writing and the exchange are facets of the same solid. Money was invented for the purpose of monetizing that thing in the future which will be still with us today, and money was invented for the purpose that there should be a price in the future (the real amount of money exchanged then) *and* a price today (the real amount of money exchanged today), keeping in mind that the market is what closes the solid and allows the sheet to change hands today in advance of tomorrow. The market is massive at both ends. It is massive at expiry in the sense that the contingent claim is contingent upon the massive material sheet and not just the encoded distinct clauses and has no choice but to be exchanged as a result; and it is massive before expiry because there are no delimited and distinct states of the underlying either, or of any derivative that may act as an underlying for a higher order derivative, but virtually all the prices of all the derivatives. The market is massive because of the fundamental principle.

It is when states are identified and enclosed in their reciprocity, it is when their device is later run in complete isolation from the real world and when the stability of frequencies is observed, that the notion of generator is formed, which is now supposed, ahead of the event (ex-ante), to *generate* it with a probability corresponding to the frequency. The generator is the transcendent instance that is supposed to replace the immanence of statistics. Worse, the random generator is reified; it is believed that there exists something real and instantaneous (Popper calls it a generating condition or a propensity) that would generate the statistical series with stable frequencies if given enough time. The modesty of waiting until after the event (ex-post) is replaced by the supremacy and pretense of the generator. My claim is that the category of price, especially if it is thought through the narrative of derivatives and their market, is the way of resisting this transcendent generator and reinstating immanence.

The reason price is interesting as conducive to immanence and as instating the *surface* of the market (and it is the surface that we want above all) is that in our analysis of derivative pricing, we encounter two notions of price that we need to level with each other and with the surface, as well as two notions of the exchange that we need to make identical. In one instance, the exchange is considered as the generator of prices of the underlying; in the second, as the massive 'evaluator' or rather 'pricer' of the contingent claim, where price is defined in contradistinction to value, as translating the contingent claim massively without any distinction of possible states. Price is just a number in the first instance and it is a logic (even a different mathematics) in the second. The exchange is a mere number generator in the first instance, a topology in the second; it is the other side of the material sheet on which difference or contingency is seen as a single and singular mark and not as a list of states.

Yet the market is one; it is not split between two notions. Price cannot, on the one hand, be defined at a level of thought where it competes with probability as a logic of mapping the one to the many and, on the other hand, behave like a random number that is ruled by probability and follows a stochastic (time) process. Ultimately, the genesis of price through pricing, or the concept of price as that which happens to the contingent claim once it reverts through its own written matter without distinction of states and is exchanged as a result (for lack of a transcendent space in which a supervising state would be found to support value), ultimately this inner *process* of price, which we earlier called the meaning of price, must take over the customary notion of an external generation of prices in the market, understood in the sense of random numbers. Time as the dimension in which the random generation of numbers takes place must be replaced by place, where a generation of writings takes place instead.

The image of the time series is very powerful and entrenched. We cannot help thinking that out of the continual confrontation of demand and supply, price changes in the underlying are continually generated, thus turning the market into a kind of engine. Yet the continual exchange that we must think of should move along the dimension of writing, not that of time. The underlying should not follow a stochastic process but its own writing into a derivative payoff, then in turn the writing of that derivative into a derivative of higher order, etc.

It appears that certain statistical parameters are crucial for the pricing and hedging of derivatives. We are told that the underlying follows Brownian motion (for example) and we are supposed to infer the instantaneous volatility of the process, which we need for pricing and hedging, from the time series of the underlying. If the underlying were really sampled continuously through time, we would be able to find as long a time series as we want in as narrow a time interval as we wish, as this is the fabulous advantage of Brownian motion. Since instantaneous volatility itself is liable to change (as witnessed by the trading of volatility derivatives), in theory we must perform this extraordinary act whereby we mine the largest set of statistical data in the narrowest time interval. However, the derivatives market spares us that extremity. Instead of inferring volatility historically (even benefiting from the Brownian marvel which enables history to shrink into a spot), we imply it from the market price of the derivative itself, *which is otherwise given*. We simply find the volatility coefficient to feed into the BSM formula in order to match the derivative price. Since our purpose is to price the derivative, we may as well use the volatility that makes the price right.

The local properties of Brownian motion exempt us from worrying about the volatility (or indeed the whole statistical distribution) that should prevail over the whole lifetime of the derivative and from finding the correct one such that it makes us break even on average when plugged into our hedging strategy over the whole finite horizon. Thanks to the fractal character of Brownian motion and to the stochastic integral, our hedging strategy breaks even 'in the long run' even on the spot, and all we care about indeed is that we be hedged against the next market price change of the derivative. However, the locality of everything (which is the other name of the market) soon turns into a complete statistical black hole. For not only is the notion of a given (reified) and stable random generator already stretched to an extreme with the local character of Brownian motion, but, since the derivatives market has replaced statistical inference by making us infer a statistical parameter (volatility), which in theory pertains to the series of prices of the underlying, from the instantaneously given price of a given derivative, we now have to worry that this inferred parameter (implied volatility) may not make the price of all remaining derivatives come out right.

A SMILE WITHOUT A CAT?

This is the beginning of the smile problem. The smile problem, as I understand it, is the problem of inferring 'statistical' parameters, which in theory pertain to a given underlying and which we need in order to price and hedge its derivatives, when all that we can observe are market prices of derivatives. It is a severe problem that ultimately leads to the total demise of the whole statistical paradigm (and correspondingly the notion of random generator), for the reason that there is not one stage that we may reach, in which we may have satisfied ourselves that a certain stochastic model has been calibrated to the extant prices of derivatives yet in which we may rest confident that the next set of derivatives prices that will prevail in time will be matched as well. From the instantaneous market prices of derivatives, no matter how complex they may be and how involved a story their prices may tell us about the dynamics of the underlying, there simply is no way we can predict the future dynamics of those derivatives prices. From a snapshot there is no way we can infer the subsequent motion picture, unless we believe that the underlying random generator has been captured and will persist—unless, that is, we believe that such a random generator existed in the first place, which we could have inferred statistically given a long enough time series, but that for some reason we decided to infer it from the market prices of derivatives only, as an alternative method. The truth is that the market prices of derivatives are the only method.

The surface of the market constantly blocks any attempt to withdraw from it into a transcendent stance in which the random generator would finally be uttered. A random generator is the guarantee that certain states of the world are visited over time with certain probabilities. However, the fundamental principle of the market is such that those probabilities themselves are put into play and into trading and become additional states of the world. The set of derivative prices against which we calibrate a certain model is never complete, and there is no guarantee that the derivatives of higher order, which did not trade so far and did not register an actual price, would have their virtual prices agree with the calibrated model. As a matter of fact, had those virtual prices been actually available, calibrating the model against them additionally to the existing prices of derivatives (of lower order) would imply different price dynamics for the latter depending on what those virtual prices are. One should therefore never infer anything statistically when facing a market; one should never withdraw into an ex-ante attitude where a random generator is given the right of existence, not even for one second. On the contrary, one should infer without withdrawing and without inferring, always going forward, always following the surface, always acting as if the virtual price of the next complex derivative could have been different.

The act of inferring statistical parameters, for the sake of pricing derivatives, from the instant prices of derivatives (and not from time series of the underlying), this act which is definitional of the surface (since it abolishes the supremacy and verticality of the generator) and consequently definitional of the market, has not yet been thought thoroughly and radically. Whatever we do, there are still in our minds remnants of the thought that the market price is a temporary deviation from value, and that value, as derivative valuation makes it clear, is only a matter of probabilistic weighting of the final derivative payoff (or equivalently, a matter of statistical break-even of the strategy of holding the derivative).

We still haven't thought thoroughly what this means: that the information should come from the market prices and nothing but the prices—that it should come from the future and not from the past. Derivatives have the advantage of turning any information about the price into another price. They help us complete the radical shift towards the market, when the market is to be conceived as a radical alternative to statistics instead of a case of statistics. To think what price is, and consequently what the market is, the whole sophistication of derivatives is needed. It is not a coincidence if the exchange is essentially linked with randomness. The existence of a frictionless market and the capacity to buy and sell without limitation imply that the price trajectory should be predictable (differentiable) at no time scale and should be irremediably inflicted with randomness. The efficient market hypothesis entails the random walk, because any predictable future price would by anticipation be traded in the present spot, leaving for the future only the unpredictable. However, this ignores the fact that derivatives, virtually of any order of complexity, are also trading and consequently preventing the thought of the random generator from ever materializing.

Randomness is somehow inseparable, in our minds, from the notion of a statistical population; and the sampling of the latter is inseparable, in our minds, from a chronological sequence: one random sample then another. Randomness seems inseparable from the notion of a trial. Yet the thought of the radical randomness of the market is such that even the idea of a trial is forbidden. Time is usually the revealer of randomness, either physically or logically. What we are talking about, concerning the massive randomness of the market, is that not even the first sample be drawn. What we have next is always the massive event, which is never a sample. It does not happen in time but takes place. Once place is understood in that sense, as the alternative to time, when speaking of massive contingency, and as the exchange place of contingent claims, which are precisely written as bearers of this massivity and precisely delivered to the exchange as the other side of writing, the marketplace and the exchange acquire a generic meaning that should be generalized to all kinds of markets. All we need is that there exists a future (a contingency) and that there exists a place. So the probability paradigm seems to fall short of the price paradigm, and this seems to require a revision of the entire metaphysical framework of possibility and realization. This is what prompted me to look into alternative frameworks such as the Deleuzian virtual or the Nietzschean dice-throw.

C: The dice-throw instead of the Black Swan…?

EA: In an article I wrote in 2006,[10] I used for the first time the expression 'anti-Black Swan trader'. Taleb, who had not yet published *The Black Swan* then but was already recognized as the creator of the concept or at least of the expression, said he was intrigued by my 'anti-Black Swan' proposal. My 2006 article was a defense of the derivatives market as the technology that could take care of contingency beyond probability, or of the Black Swan event that fell precisely outside the probability framework (literally a technology of the future). Simply, the idea was that, if the states of the world were to coincide with the states of the underlying that the derivative was written on, and if this underlying was tradable, then the probabilistic framework and its fixed states of the world would ultimately result in derivatives being algorithmically controlled (replicated) and in their values being perfectly assigned. Yet the market is by definition the place of trading of *every financial instrument*, no matter whether derivative or not, *at prices that precisely vary from any pre-assigned value*.

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[10] E. Ayache, 'Why 13 Can Only Succeed to 11, or, The End of Probability', *Wilmott*, July 2006, 30–38. Available at http://www.ito33.com/sites/default/files/articles/0607_nail.pdf.

Any probability framework, no matter how complex you make it in order to model the trading behaviour of derivatives up to a certain order of complexity, will admit of a derivative of a higher complexity that will be perfectly replicable by the derivatives of lower order and will, therefore, be denied a market of its own and a variance of its own. In other words, the event of its market, if it is to take place, must exceed the existing framework and be incalculable within it. It is precisely the market-maker of that derivative, although he needs the probabilistic framework in order to hedge (replicate) the derivative that he buys or sells and manage his inventory, who must, qua maker of its market, be attuned to this excess, to what falls outside the framework. Nobody has thought the market yet through (and as) this contradiction—or rather, paradox. To repeat, the market is the category that is yet to be discovered and analyzed; it is the matter and the science that is yet to be created. Derivatives just happen to make the discovery of this new matter pressing and to pose the problem in the most acute way.

The probability dynamics that supposedly govern the underlying are not the real market dynamics or the real price dynamics (even though every derivative textbook will represent the market as just this underlying stochastic process). In the immanent theory of the market that derivatives allow, the real market dynamics—eventually unpacking the meaning of 'price'—takes place when the derivative market-maker, equipped as he may be with the derivative valuation tool that reduces the market to the probability dynamics of the underlying, *trades* the derivative *in the market* and, by so trading it, intends it to vary from the prescription of his valuation tool and to leave its circle. The mystery of the medium that the market-maker is immersed in (the market) is such that the price he makes becomes given at once and made by the market. The derivative price that the market-maker makes is in every sense the output of a formula, the result of a self-financing dynamic strategy that holds and defends that price; and yet the nature of the medium in which this price is posted is such that the price turns immediately into an input to the formula, inverting it.

It is not necessary that the price that the market-maker makes with the help of the formula (let us call it a 'value' in this outgoing movement) should be numerically changed by the market in a subsequent price movement. It is before any change (yet), *as he makes it*, that the market-maker intends it as a market price, therefore as a price that is given by the market and liable to be fed into the same formula (now used in reverse) in order to imply volatility, for instance. The market is this instantaneous paradox of authorship. The market-maker uses the pricing formula to make the price, but the formula is in a way useless because the price is made by the market. Yet the market-maker does not discard the formula; he needs it precisely in order *to make the price as made by the market.* In this simultaneous exchange of the category of the given and the category of the result, in this exchange of the input and the output, lies the specific nature (or mystery) of the market.

The smile problem is the perfect expression of this; it is not meant to be solved because it simply *is* the paradox of the market; it *is* the market. The smile problem attests that you are maintaining the usage of a pricing formula (in this case BSM), because the smile refers to the BSM volatilities that are implied by the price of each option. Yet at the same time it attests that the formula is immediately invalidated by the market (and that you should logically suspend its usage) because the implied volatilities do not come out equal, as BSM would require. This paradox can only make sense through the presence of the market-maker. The market is not left alone (as if the prices of derivatives were just given by the market independently of a maker). One needs the moment of creation.

The smile problem is there for the market-maker to see that the prices are the results of his creation (the outputs of the formula he is using) yet that the main creation of the formula, its main product and result, is that the market turns against it and invalidates it. *The market validates the formula by invalidating it*, because the market that is thereby created does not fully become a market unless it departs from its creator (and was even meant to so depart in the first place, at that very same moment of creation). One has to realize that the term 'market-maker' is a living paradox, not a contradiction, whose only consistency comes from being constantly affirmed.

The key to the paradox, which is the key to what I have called the true market dynamics—and therefore the key to the market—is dynamic hedging. Dynamic hedging is what precipitates the market-maker into the market and pins him on the floor. It turns the problem of the valuation of nonlinear payoffs into a local problem, which requires the presence of *locals* (another name for market-makers). If you are holding a costless option, you don't need to hedge it, of course. If you are holding a costly nonfinancial option (an asymmetric payoff as found in life by Taleb) you may not be able to hedge it; but your losses are limited anyway; you are tinkering and learning from trial and error; but your upside is unlimited. In both cases, you withdraw from the dynamic market; you leave the local, or the place. Financial options, by contrast, introduced the possibility of being dynamically hedged. Now the premium you pay is no longer the solution of the ex-post accounting equation of the insurer who has sold infinitely many premiums like the one you have bought, and who will therefore break even in the long run, when all the contingencies will have been visited with frequencies corresponding to the premiums collected. Instead, the premium now becomes a *differential* in the mathematical sense; it is no longer a cost but the *rate of change of a cost*, or time decay, because the accounting has become local. Accordingly, the contingency that the premium covers is reduced to its differential, to the essential difference that is at the heart of contingency—that is to say, to essential nonlinearity. (It is of the essence of the contingent claim that it be nonlinear and that the payoff be asymmetric.) The main consequence of dynamic hedging is to bring nonlinearity and locality together. This may sound contradictory, since nonlinearity is associated with the line (albeit broken or convex) whereas locality is associated with a single spot. But on the contrary, we will see that to understand the sense in which the local, the spot, the market, can be said to be nonlinear is to understand how the market can be the metaphysical and radical alternative to Taleb's proposal of basing antifragility on nonlinearity and asymmetric payoffs. The magic of the market is to make the ultimate and final contingency *present and local*. The contingency (in theory supposed to settle at maturity) is made 'locally' present.

C: Through the fact that the rate of change of the premium is no longer tracking a final settlement but, instead, the market price of the contingent claim?

EA: Yes, and for this it needs the mediation and the translation of price. *It requires the invention of price*. The market price (always by definition the price of a contingent claim) should be defined as that which is required (as the new kind of matter, or material process, a.k.a. technology) in order to bring the ultimate contingency and the ulterior event into the present spot; and to transform the relaxed and resigned (and, one might say, infinite or indefinite) attitude of whoever follows Taleb's antifragility therapy and programme into the dynamism and constant unsettlement and finesse of the trader on the floor.

The spot was required. Let us consider this as the first necessity. *If it didn't exist, it would have had to have been invented*. It was later discovered that dynamic hedging was the way; however, the availability of the price of the derivative takes equal part in the invention. One tends to forget that tracking the market price is an integral part of the dynamic hedging argument.

The market is local; local is the keyword of the market. And 'local' implies 'place'. Time decay, the nonlinearity of the next price change, and the market which presents all this; this is the local miracle that was made possible. Volatility, or the miracle through which Brownian motion can be sampled in an infinitely shrinking interval yet remain random,[11] makes it so that when contingency is reduced to its essential and local difference, it can only be the convexity of something given locally—namely, the market price. Statistics could be reduced to a single spot and yet retain the notion of infinite long run; an insurance premium could be reduced to an instantaneous rate of change (time decay); what we thought impossible (that time series and statistical populations might be reduced to a single spot and retain the infinity of the law of large numbers) was made possible thanks to the wonders of Brownian motion; however, the existence of a market was required in order that we may be able to track an instantaneous contingency locally. The market is the way to make the insurance break-even problem (and solution) local. (I would even say that it is the only way.)

Dynamic hedging is not just a subtlety or a finesse made possible by stochastic calculus. It is true that it turned the contingent claim from a vehicle of extensive difference into a vehicle of intensive difference. It is true that it no longer mattered how distributed in extensive time and space were the different payouts of the contingent claim at its expiry (either at maturity, or on knock-out barriers, etc.) but that the only thing that mattered now was the local convexity of the local market price of the contingent claim, whose fortune under local randomness (expressed by local volatility) was to be balanced by the local rate of change of the premium (time decay). It is true that this was made possible by the fact that the underlying was tradable (thus enabling dynamic hedging). But more importantly, it was made possible by the fact that the market price of the contingent claim was considered given and available. The two go together. One tends to forget that BSM supposes that the value of the derivative as a function of time and the underlying price *is given* in order then to track it with the dynamic replication. But what could it mean to say that the value is given other than through the existence of a market giving it, as a price? And if you say that the value is given per se and has to be so given, held by none other than itself or the argument establishing it (for if it were different, then anybody using the BSM replication argument would be able to buy the derivative at a lower price or sell it at a higher price than this given different value and realize an arbitrage), you will yourself be affirming that this value is given as a market price, to which the rule of non-arbitrage precisely applies.

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[11] S.N. Neftci, *Principles of Financial Engineering* (San Diego, CA: Academic Press, 2004), 128.

It is not long before the availability of the derivative price in the market becomes the first given—or rather, the only given. For who is to make sure that the given derivative price in reality comes second to a first given that would be the instantaneous volatility of the underlying? Only if the instantaneous volatility were known would the BSM replication argument guarantee that the derivative price had, derivatively, to be such. But in what way and following what route does that guarantee function? What is the conducting medium of the BSM derivation? We know what the conducting medium is formally, but what is it *materially*? Perhaps the BSM derivation is only a formalism, and its only *material* interpretation is that the derivative price be given in a market and the BSM formula be inverted, rather than instantaneous volatility being given and being known. Perhaps there is no material meaning to instantaneous volatility being given (and known), and the only given volatility is implied volatility.

Dynamic hedging made the problem local. It turned the ex-post accounting equation of the insurance company into a local problem (infinite long run compressed into the single spot) thanks to Brownian motion; however, it simultaneously brought into existence the local matter, the absolute *local* which I call the market—the fact that the derivative price had to be given by the market. Once the 'insurer' becomes locally involved and becomes a local dynamic trader, there are no longer any extensional statistics or actuarial tables upon which he might rely. Even though the statistical parameter (volatility) is formally defined in an instantaneous and local fashion, this only takes place on paper, and the only material statistics on which the trader can rely in order to get his local dynamic hedging strategy going is the market price of the derivative, against which he inverts his pricing and hedging formula. In my reasoning, the inversion of the formula (regarding the price of the derivative as the primary given) comes as an integral part of the material interpretation of the BSM formalism.

The *reality of the market* is the interpretation of the formalism of Brownian motion in the same way as the reality of statistics is the interpretation of traditional probability formalism.[12] For this reason, the smile problem is not a temporary stage, a problem soon to be followed by its solution or correction. The smile problem is the ultimate reality we are talking about, because it is the expression of the fact that the derivative price is always *made as being given*. This implies that the only reality of the pricing model, or the only reality of the given probabilistic framework, is its constant recalibration. The reality of the market is the constant excess, or the constant event that disrupts the existing set of possibilities (the constant Black Swan). The market-maker shouldn't so much consider the derivative value as being the output of his formula or the product of his replication strategy, but rather consider the derivative market price as the reason to recalibrate the formula. If the only way of getting the instantaneous volatility that is needed in the BSM formula is by implying it from the given option market price, then this by itself implies that the BSM formula is soon to be recalibrated and the implied volatility soon to change when it is inferred from the next option price.

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[12] See E. Ayache, 'A Formal Deduction of the Market', present volume.

IN THE PIT

C: Turning the conception of reality away from the fixity and calculability of the states of the world (extensity) towards this intensity of recalibration, we can see, indexes something like Meillassoux's philosophical position, which turns away from representation to dwell in a kind of constant event—*hyperchaos* or *surchaos*. So we would assume that your position, like Meillassoux's, would resist being read as a turn towards 'becoming': temporal flux does not seem to be central here at all.

EA: It does not mean turning from fixity to change or from state to flux or to becoming (in the sense of a temporal succession of different states), because recalibration is not a temporal process; it has nothing to do with a learning process. It is intensive in the sense that the whole infinite chain of recalibration opens up right on the spot, in the same bottomless pit. This is encoded in the meaning of implied volatility: it must be stochastic because you are implying it from a market option price that would not make sense as a market price unless it was construed as stochastic. But any subsequent stochastic model that you might think of for implied volatility is not the last word either, because you would also be calibrating it against the market prices of derivatives (i.e. implying its parameters from the derivatives market prices)—therefore it would also be encoded in that model that it will be recalibrated and that its parameters will turn stochastic in their turn. *This whole infinite chain of recalibration of stochastic models of increasing complexity is all instantly contained in the meaning of market price and in the meaning of the market.*

The market-maker lives in this meaning and in this intensity. He lives in this pit.

C: Then what becomes of his relation to the states of the world and to the probabilities that are attached to them—in other words, what kind of a gambler is the market-maker?

EA: One can see that because he lives right at the hinge of the event (in the middle of the event) and not in the world that precedes or follows the event, he somehow achieves a 'state of rest' relative to the event. He lives at the same (infinite) speed as the event. There is a kind of necessity rather than chance that is attached to him. He is *subtracted from chance*, as Blanchot would say, and for this reason he writes the necessary book (the market). Or he is the player of the single (Nietzschean) dice-throw *for all times* (and not once and for all).

In my 2006 article, I used the character of Gene Kranz (the Apollo flight director) in the movie *Apollo 13* as a depiction of the anti-Black Swan trader. The explosion of the oxygen tank in the Service Module triggered a massive recalibration of the whole framework of (stochastic) control represented by ground control. Crucially, the new states of the world that had to be created (and were not part of the previous situation) in order to save the astronauts, emerged from the same floor and from within the same technology. The broken technology itself was reengineered on the spot, without ever leaving the trading floor, in order to bring the astronauts home. Similarly, when looked upon from the point of view of the theory and 'ground control', the derivative pricing tool is always exceeded by the incalculable event of trading of the derivative and, as a result, is always broken. BSM says volatility is constant; however, pricing options with BSM in the market leads to implying volatility from the option price, and therefore to stochastic volatility and to breaking BSM. But from the point of view of the floor, from the point of view of the dynamic trader who lives in the middle of the event and always recalibrates the pricing tool, the latter always succeeds in bringing the astronauts home.

Contrary to what it was designed to do (i.e., land the astronauts on the Moon), the Lunar Module was used as a raft to bring them back to Earth. "I don't care what anything was designed to do", says Gene Kranz, "I care what it can do!" This incalculable *capacity*, which addresses the incalculable event beyond the design, wouldn't have been available if Gene Kranz (and his team) had not acted as dynamic traders, totally immersed in the floor. As a result, he could no longer give the odds of the astronauts returning home. When asked by the president of the United States what the odds of rescuing them were, he answered: "We're not losing the crew." When asked again, he answered again: "We are not losing those men." This did not mean he was certain, as opposed to uncertain. It just meant he was subtracted from chance and was no longer a traditional gambler. He knew no state of the world other than the one he was making himself. Even the category of count is different in his case, and to say that Kranz knew only of *one* state of the world, as opposed to several alternatives, is also to miss the point. Kranz was aware of the massive situation and of its massive contingency. He wasn't aware of the count of states. The singularity of the event is totally different from the individuality of the state of the world (or of the event now counted as a state of the world). It is always after the fact that you count the event. 'During' the fact, the event is massive and the only way of being aware of its contingency is repetition.

When asked, Kranz repeats. I don't think this engaging with the event, this solution to the Black Swan problem, can be described as 'antifragility'. In a sense, it is a very thin line; it is finer than the blade with which the event cuts the world and chronological time. Kranz is a bladerunner. This matter, in which Kranz or the dynamic trader dwells, is very refined; it comes from the excess of refining the study and the matter of the market beyond any possible probability framework. To the trial and error (tinkering) that Taleb proposes, seemingly unaware of time decay, one should oppose the motto of Gene Kranz: "Failure is not an option". The excess of refinement or extreme aristocracy in dealing with the event implies a different attitude towards life and the world. The refined market-maker also likes volatility, because it is volatility that brings action to the floor and stretches and tenses the material surface that the market-maker lives in. He likes volatility actively—not passively, as Taleb requires. Taleb wants you to take care of your losses and let your gains take care of themselves. He even describes the history of inventions and technological innovations in terms of this relaxed attitude. Accordingly, Taleb does not have to worry about the lack of volatility because he is waiting and seeing anyway, and is (seemingly) insensitive to time decay. But the active market-maker dislikes the lack of volatility because he gets bored when there is no action. The refinement of thought and aristocracy have melancholy as their correlate. It is not the case, as Taleb claims, that we live in a world that we don't know. Rather, we know the world only too well, so well indeed that the world can sometimes be incredibly boring!

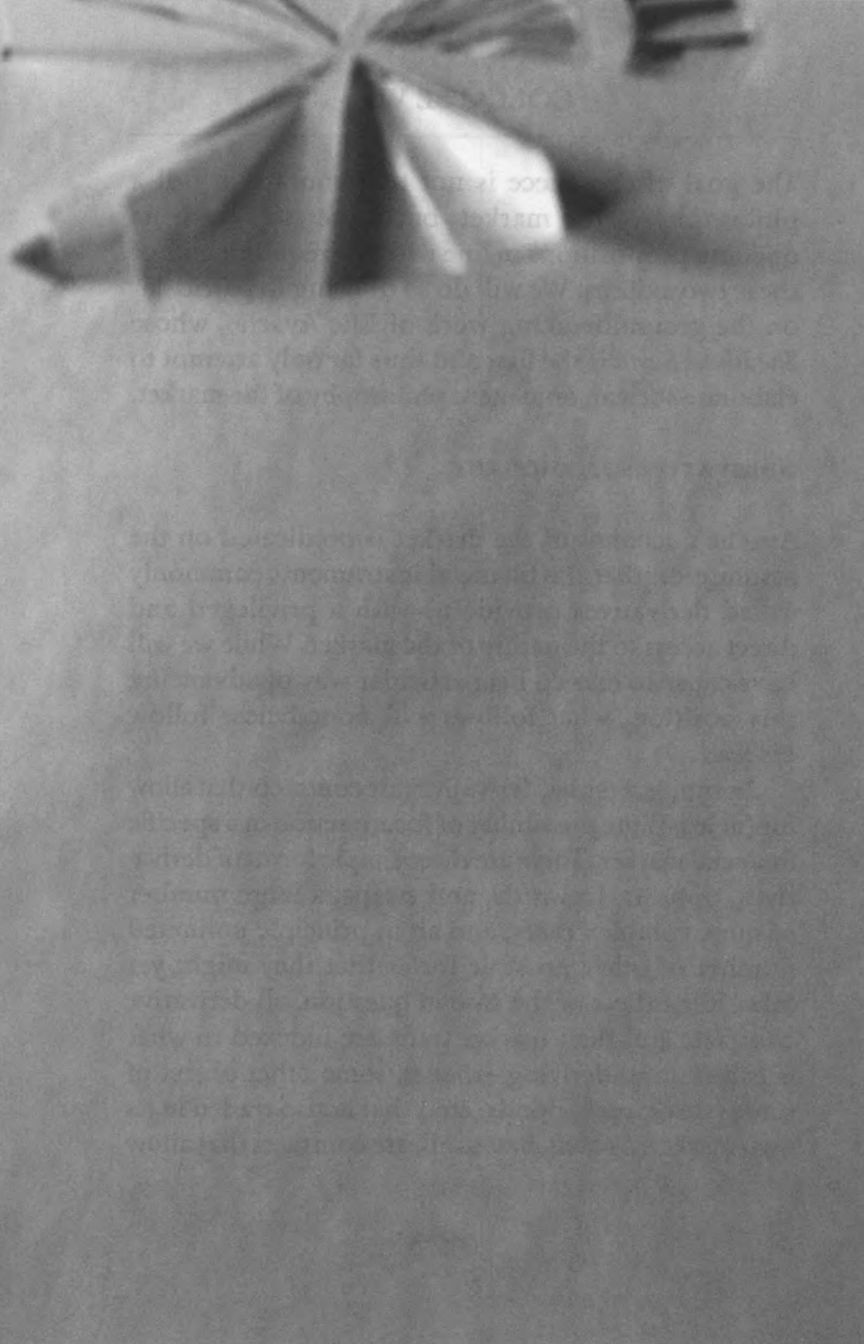
From a Restricted to a General Theory of the Pricing Surface

Jon Roffe

TWO AXIOMS

Existing attempts to theorise the market are, in one way or another, instrumental in character, insofar as they treat the market as one class of social processes. The discourses of contemporary economics and the sociology of finance, opposed in many respects, nonetheless both subordinate the category of the market to that of the social. Marx, and in his wake those strains of Marxism that consider the market directly, rely upon a similar position, invoking the category of fictitious capital on the one hand (the derivative and vampiric nature of financial market) and the absolute position of the labour theory of value on the other. In mathematized finance, which in other respects tends to consider the market on its own terms more than any other contemporary position, the market is subordinated to variously sophisticated frameworks of probabilistic inference—a point that will be returned to shortly. This subordination can even be found in the discourse of neo-liberal 'free' market advocates, whose concern for deregulation betrays the presumption that the market is subject by right to regulation and thus capable of being impacted (negatively) by it.

If there is any sense to the notion of a philosophy of the market, it would arise in contradistinction to this instrumentalism. In the wake of Kant, such an approach can be called immanent, an immanent philosophy of the market. This immanent approach has two essential requirements. The first is that a philosophy of the market would think the market from the point of view of the market, without importing theoretical categories from elsewhere. The second is that everything which is of the market must be taken to be significant for the theory of the market. In other words, whatever belongs to the market by right must be taken as significant for the philosophy of the market. These two requirements might be called the axioms of an immanent theory of the market: the (methodological) axiom of immanence, and the axiom of inclusion. The latter axiom is clearly derived from the first, since it asserts at root that no principle of exclusion that arises from outside of the field of enquiry has legitimate methodological purchase within it. Moreover, as we will later see, this latter axiom is also the axiom of the univocity of price.

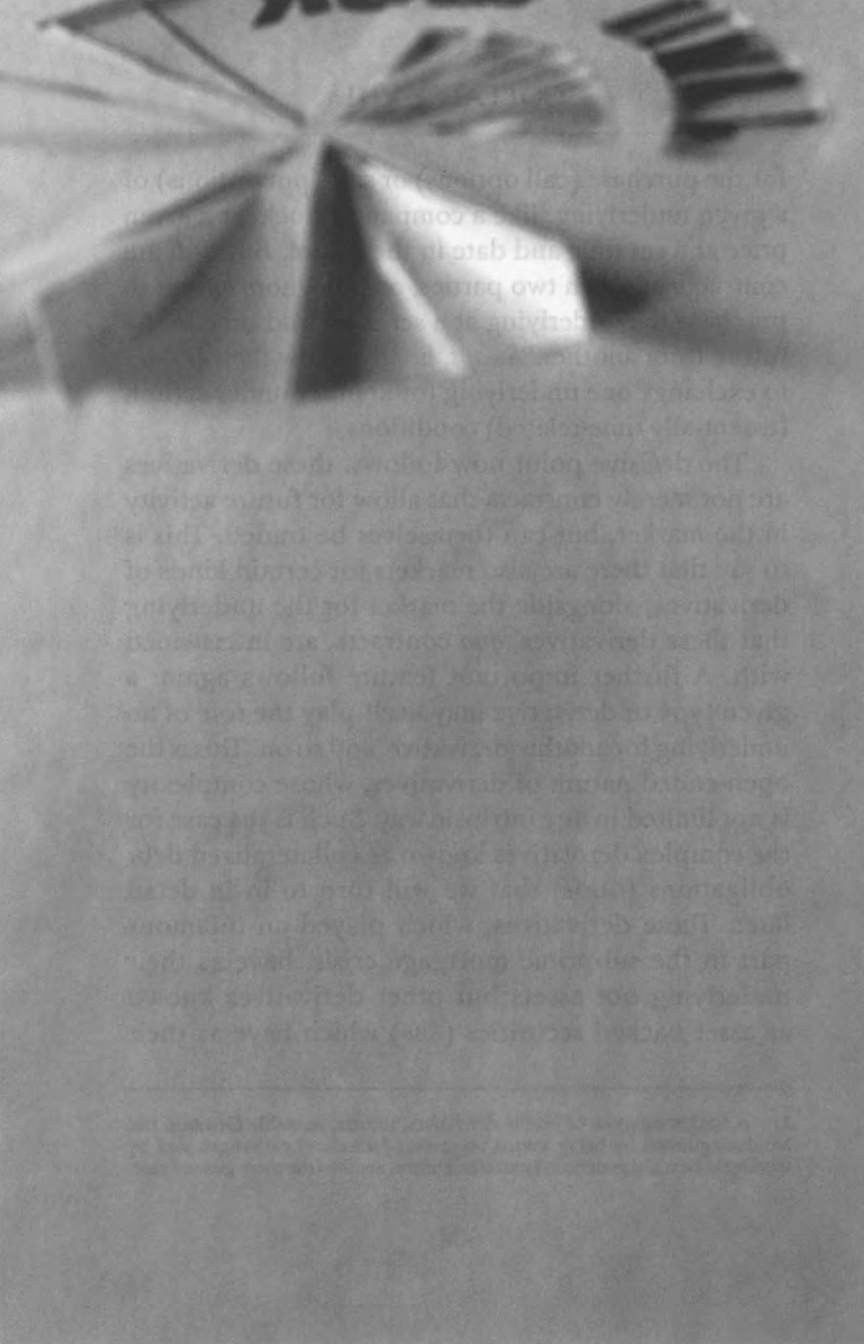


The goal of this piece is not to elaborate in full a philosophy of the market, but rather to sketch its opening propositions in line with the requirements of these two axioms. We will do so drawing in particular on the groundbreaking work of Elie Ayache, whose *The Blank Swan* is the first and thus far only attempt to elaborate such an immanent philosophy of the market.

DERIVATIVES IN OUTLINE

Ayache's account of the market is predicated on the assumption that the financial instruments commonly called derivatives provide us with a privileged and direct access to the nature of the market. While we will have cause to exceed his particular way of advancing this position, what follows will nonetheless follow his lead.

In simplest terms, derivatives are contracts that allow for (at least) the possibility of future action in a specific financial market. There are three simple forms of derivatives, options, forwards, and swaps, a large number of more complex cases, and an in principle unlimited number of other possible forms that they might yet take. Regardless of the case in question, all derivative contracts and their market trade are indexed to what is called an underlying—that is, some other object of trade (stock, cash, bonds, etc.) that is also traded in its own market. *Options*, first of all, are contracts that allow



for the purchase (call options) or sale (put options) of a given underlying, like a company's stock, at a given price at a set time and date in the future. *Forwards* are contracts between two parties, one of whom agrees to purchase the underlying at a set price and time in the future from another.[1] *Swaps*, finally, allow their holder to exchange one underlying for another under certain (essentially time-related) conditions.

The decisive point now follows: these derivatives are not merely contracts that allow for future activity in the market, but can themselves be traded. This is to say that there are also markets for certain kinds of derivatives, alongside the market for the underlying that these derivatives, *qua* contracts, are intertwined with. A further important feature follows again: a given type of derivative may itself play the role of an underlying for another derivative, and so on. This is the open-ended nature of derivatives, whose complexity is not limited in any intrinsic way. Such is the case for the complex derivatives known as collateralized debt obligations (CDOs) that we will turn to in in detail later. These derivatives, which played an infamous part in the subprime mortgage crisis, have as their underlying not assets but other derivatives known as asset backed securities (ABS) which have as their underlying bundles of assets (often less than desirable or illiquid in nature)—mortgages in the case in question. Markets also exist for higher forms of derivatives yet again that take elements of existing CDOs as their underlying—hence the CDO-squared, CDO-cubed, and so on, each of which steps one degree further away from the underlying.

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[1] A further category of vanilla derivatives, futures, resemble forwards, but are distinguished by being traded on certain formalized exchanges, and by tending to be more generic in character. Futures are thus the more general case.

However intriguing derivatives may appear, they seem an eminently unpromising starting place for an account of the nature of the market. However, as Ayache shows, derivatives expose at least three fundamental features of the market as such: its strictly contingent character, the absolute insufficiency of epistemological formulations about the market, and the univocal nature of price.[2] Moreover, recall the axiom of inclusion: whatever is of the market must be accounted for in a theory of the market. As Deleuze remarks about the transcendental method, 'we cannot break off [such an investigation] when we please'.[3] That is, the case of derivatives must be accounted for along with everything else.

Ayache's argument begins from within the discourse of mathematized finance, what is in many respects the account most adequate to the actual functioning of the market. This discourse begins to depart from economics broadly speaking in 1900, in the landmark study of Louis Bachelier, *Théorie de la spéculation*.[4] In this piece, his doctoral thesis, Bachelier theorises the movements of stock prices as cases of a continual stochastic process, which is to say that he treats them as ongoing and random in character, subject to no fundamental law. Bachelier's work has one further feature that is significant here. By treating the pricing process on its own (stochastic) terms, he at least partially untethered the theory of market speculation from the socio-political and economic presuppositions that attended it insofar as it was made subordinate to the category of society in economic theory—precisely the aspect of Bachelier's approach that, while providing the groundwork for twentieth-century advances in econometrics, also caused him to be marginalized at a number of points from economic theory. This is not to say that his work is without presuppositions at all. The presuppositions in play however are embedded within the apparatus of the probability calculus itself, a point to which we will return momentarily since it forms the point at which Ayache begins his important critique.

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[2] The integral role of temporality—and specifically the temporal modality of the future—in the structure of derivatives constitutes a fourth point, but one which will not be taken up in this context.

[3] G. Deleuze, *Masochism*, tr. J. McNeil (New York: Zone Books, 1999), 114.

While derivatives have a very long history in one form or another,[5] it was in the wake of certain developments—

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[4] A good recent translation can be found in *Louis Bachelier's Theory of Speculation: The Origins of Modern Finance*, tr. M. Davis and A. Etheridge (Princeton, NJ: Princeton University Press, 2006), 15-79.

[5] A text from the Bible (Genesis 29:17) is often cited as the first recorded evidence of a option (Jacob agrees to pay seven years worth of labour in

both within finance and socio-politically—from the 1970s onwards that allowed for the flourishing of both markets for the trade of derivatives and the development of more complex forms of derivatives as such. Of particular importance though was the development of a mathematical model for the pricing of derivatives. Bachelier's work paved the way, after a fifty year period during which it was more or less unknown, for modern mathematized finance and in particular the resolution of the problem of how to price derivatives. The key development here was that of Fischer Black, Myron Scholes and Robert Merton, who, in a small group of articles in the 1970s elaborated the Black-Scholes-Merton options pricing model (known simply as BSM).[6]

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order to secure marriage with Rachel). Should the category of derivative be taken in a more generic sense, there are reasons to extend and broaden this historical account. On the one hand, as Gharagozlou has recently argued, the category (at least in current law) seems to encompass every contract 'for which the remedy of nonperformance is monetary damages.' (A.M. Gharagozlou, 'Unregulable: why derivatives may never be regulated', *Brooklyn Journal of Corporate, Financial & Commercial Law* 4 [2010], 273). On the other, if we take the name derivative to encompass any means of attempting to manage future outcomes via a socially embedded agreement in the present, we might consider that derivatives are merely one case of a very general category of technology coeval with social organization as such, and one which becomes difficult to rigorously distinguish from the technology of money, and more generally the formalization of promises that is intrinsic to law as such.

[6] On their respective roles, see Ayache's footnote in *The Blank Swan: The End of Probability* (Chichester: Wiley & Sons, 2010), 67n4. The section in question also provides a good summary presentation of the mathematics of the partial differential equation that constitutes BSM (66–70). For a helpful comparison of Bachelier's account of options pricing with that of BSM, see W. Schachermayer and J. Teichmann, 'How Close are the Options Pricing Formulas of Bachelier and Black-Merton-Scholes?', *Mathematical Finance* 18:1 (2008), 155–70.

Without examining BSM in detail, we can simply note the following two features. The first is that BSM's main function is to provide the price of an option, given certain variables. These variables, including the price of the underlying, are all easily obtained except for what is called implied volatility. In orthodox terms (that Ayache will challenge, as we will see) implied volatility is the estimated range of likely variance of the price of the underlying. Given that the other variables of BSM are easily obtained, it thus fundamentally formalizes the relationship between implied volatility on the one hand and price on the other. The second crucial factor about BSM, above all for Ayache, and one obvious enough to be unworthy of mention from any orthodox econometric point of view, is its probabilistic character. Both because it begins with the presupposition of the stochastic character of the market and because it functions to predict likely outcomes at the level of price given certain variables, it remains fundamentally indebted to the categories of probability and possibility in turn.

CONTINGENCY AND PRICE

It is this latter point that provides Ayache with his entry point, and at which he will develop a critical line of argument on three fronts. The first is strictly philosophical, and concerns the status of the category of possibility itself. He draws on the one hand on a critique, Bergsonian and Deleuzean in provenance, that aims to depose the category of the possible as such. This argument, as is well-known, asserts that to claim that there are a range of possible future states of the world is to assert the existence of possible world-states *prior* to their real existence. In other words, possibility is asserted to be more primordial than reality. However, possible future states of the world, while being asserted as prior to reality, nonetheless also must be like the real worlds that they will possibly become, making their priority in the genetic order that passes from possible to real reversed at the level of content. The real, it is supposed, is the realization of a prior possibility, a prior possibility that nonetheless emulates the real. This paradoxical situation is what leads Deleuze to write that, in the figure of the possible,

> we give ourselves a real that is ready-made, preformed, pre-existent to itself [...] the sleight of hand becomes obvious: if the real is said to resemble the possible, is this not in fact because the real was expected to come about by its own means, to 'project backwards' a fictitious image of it, and to claim that it was possible at any time, before it happened? In fact, it is not the real that resembles the possible, but the possible that resembles the real, because it has

> been abstracted from the real once made, arbitrarily extracted from the real like a sterile double.[7]

Ayache cites Bergson here: 'For the possible is only the real with the addition of an act of mind which throws its image back into the past, once it has been enacted'[8] Both philosophers thus advance the argument that a possible future state only gains consistency retrospectively, or as Ayache nicely puts it, probabilistic analysis 'masquerades a future in order to mimic a present'.[9] Or again: 'Probability is past, not future, and is only *misplaced* in the future'.[10] The upshot of this line of argument is not just that the real is not subordinate to any existing representational structure, but that probability cannot be used as a reliable source of knowledge about the future, since all it tells us about is a selective past.

In concert with this claim is the insistence on a point that Ayache draws from Quentin Meillassoux's *After Finitude*, that it is contingency rather than possibility that forms the basic matrix of the real.[11] Once again, the central claim of this position is well known: that the absolute and foundational character of contingency can be directly demonstrated and defended against all major positions in the modern canon. It may be too strong to say that Ayache draws this argument from Meillassoux, since it is rather the case that the very existence of the market already directly bears out this point: 'the market, in my philosophy, is also predicated on the *necessity of contingency*'.[12] This is also why he will speak of the performative surpassing of representation and possibility in the market context.[13]

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[7] G. Deleuze, *Bergsonism*, tr. H. Tomlinson (New York: Zone Books, 1991), 98.

[8] Ayache, *Blank Swan*, 31.

[9] Ibid., 55.

[10] E. Ayache, 'Single-case Statistics?', *Wilmott* Feb, 2011, 13.

[11] Ayache's particularly astute summary, partial endorsement and subsequent critique of Meillassoux can be found in *Blank Swan*, 133–56.

Ayache's second critical point concerns a fatal redundancy that the orthodox account of the role of probabilistic calculus introduces into the market. He observes that if the model (BSM or one of its ilk) can predict the correct value to give to a derivative at a given point, then it exhausts, in advance, any need to actually trade it, since the only goal of trading is to make money from the difference between expected value and real price. If this real price is known in advance the act of trading becomes entirely pointless, since there will be no way to make a profit in such a situation. In turn, from this point of view, 'the put is worth zero',[14] and derivatives more generally are fundamentally conceived as 'perfectly redundant instruments'.[15] There is then a peculiar characterization of the market process embedded in the orthodox view: as a theory of the market, it can do without the market itself, and consists in the final analysis of an inter-probabilistic thought experiment, one that is abstract in the traditional sense, ie., cut off from any reality.

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[12] Ayache, *Black Swan*, 145.

[13] Ibid., 83.

[14] Ibid., 335.

[15] Ibid., 24.

However, the market as an ongoing pricing process in fact takes place, is taking place. No matter the complexity and detail of the use of BSM, the probabilistic description of projected future states comes to an end. 'However', Ayache insists, 'this is not yet trading. Trading the derivative is precisely what happens next'.[16] Taken alongside the earlier points, we can see exactly what this means: that trading happens in the absence of the purported knowledge of the future provided by the probabilistic calculus; a wholesale exchange of knowledge for pricing takes place when trading begins.[17]

The third point follows from this. In a very classical Kantian sense, Ayache will nonetheless insist that the probabilistic calculus is not per se useless, but that the orthodox (dogmatic and rationalist, in Kant's sense) conception of the role of the calculus is misplaced. In fact, 'the derivative valuation algorithm, pioneered by Black, Scholes and Merton has been a perfect trading tool and traders have consistently used it, not in order to compute a theoretical value for the derivatives but to price them in the market, that is to say, to trade them and exchange then and unsettle any computed result.'[18] That is, in practice BSM—and in an exact parallel with Bergson's claims about the irreducible role played in phenomenological experience by the sensori-motor schema—is not used in order to assert an abstract world order but to orient the trader in the ongoing pricing process.

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[16] Ayache, *Blank Swan*, 5.

[17] As Ayache also argues, traders themselves have no particular investment in the implicit metaphysics of probability and make use of BSM and the other forms of probabilistic inference in just this direct fashion. He is supported in this view, as it happens, by Nassim Taleb. See the frequently cited E. Derman and N. Taleb, 'The Illusions of Dynamic Replication', *Quantitative Finance* 5:4 (2005), 323–6, esp. 323.

At this point, it is possible (however schematically) to see why the case of derivatives allows Ayache to justify two of the three claims we noted above, the contingent character of the derivatives market and the absolute insufficiency of epistemological formulations about the market. The only means for knowing about the future of a certain derivatives market is the use of a probabilistic calculus, BSM for example. We have seen though that, however nuanced, such an approach only provides knowledge about the past. The future in such markets is thus not just occasionally afflicted by the catastrophic, unforeseen events that Nassim Taleb dubs black swans, but is *de jure* constituted by events that are all of this sort (hence the blank swan). Probability is deposed in favour of contingency; we see why Ayache ultimately prefers the alternative name given to derivatives in the discourse of the market, *contingent claims*.

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[18] Ayache, *Blank Swan*, 55.

If what happens in the market is not the automatic deployment of more or less accurate discoveries about the value of a financial product, then what does happen? The answer is trading—which is to say, *pricing*. The process of pricing is what is irreducible about the market for Ayache. Recall that, given the structure of derivatives, at least two prices are always at stake, the price of the derivative and that of the underlying.[19] What grounds the distinction between these two prices? On the one hand, we see that the difference is established in fact by traders, trading firms, banks, etc., who may be trading only in the underlying. In other words, there really are two markets in play here. On the other, it is clear that the difference is to be found within BSM itself, in which the underlying is present not only as a price (the current price of the underlying asset), but in the form of implied volatility. It is crucial to see, however, that neither the real distinction between markets nor the distinction between variables in the pricing model introduce a fissure into *price as such*. In the latter case, it is even the case that one can only provide a pricing model if one assumes that it is price that is at issue throughout. Certainly, there are prices; but price as such, the being of price, is homogenous in character. It is this that allows Ayache to argue that the underlying and the derivative are fundamentally traded *alongside* one another, rather than in two radically distinct market spaces, and even that implied volatility registers a movement not in the market of the underlying, but in the market as such, conceived as the mutual space of the pricing of underlying and contingent claim alike.

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[19] Moreover, implied volatility which marks the dynamic relationship between the two prices is also a price: 'Smile dynamics [which concerns a deviation between modeled and real volatility] is a "price", just as implied volatility is a price, or the implied yield curve is a price, or the implied credit spread curve is a price. And you have to handle it the same way you usually handle a price that the market offers you. You bet against it, or you use it in a strategy to help determine the price of other things.' (E. Ayache, P. Henrotte, S. Nassar and X. Wang, 'Can anyone solve the smile problem?' in *The Best of Wilmott* 2 [Chichester: Wiley & Sons, 2006], 231; the nature of the smile problem is pithily addressed in *Blank Swan*, 75–6). Ayache will also insist (see in particular *Blank Swan* 52–3) upon the fundamentally reversible character of the two prices, the one implying the other, a point also often also made by quants: if you have price, you also have implied volatility, and vice versa.

We do not consider a central—even historically decisive—feature of BSM for Ayache here, namely the way in which it enjoins the trader to be active in both markets at the same time. That is, BSM is not merely a pricing model for options, but provides a way to dynamically replicate a portfolio by playing the two off against one another (ie., hedging). Among other things, this leads Ayache to argue for the irreducibility of the trader, who is required as the active hinge of these two markets and thus the embodiment of the pricing process.

In philosophical terms, all of this is to say that, whatever the differences between derivative and underlying, between these two markets, price is univocal, and it is this univocity that secures the unity of the market for Ayache. If this logic is further pursued, though, it allows us to see how we might pass from the case of particular markets to the category of the market beyond the specific case of derivative and underlying. Put another way, the univocity of price demonstrated in the case of derivatives can be generalised. For the same reason that both underlying and derivative are, *qua* prices, traded alongside each other on the market, we can conclude that, from the point of view of the market, anything that admits of a price is *of* the market. However differentiated the various pricing processes that take place on the market may be, they are absolutely homogenous from a view point immanent to the market. Again, this is to say that price is univocal; in turn, the univocality of price is what secures the ontological unity of the market.

If we take these points together, and taking into account this last generalization, we arrive at the following definition: 'The market is ultimately the medium of prices of contingent claims.'[20]

TWO FEATURES OF THE PRICING SURFACE

It is at this point that two initial characteristics of the market *per se* can be elaborated. We can observe that, for Ayache, and unlike the projected terminal values provided by BSM, the act of pricing belongs not to an ideal space of prediction but to the materiality of inscription: price is written (the two are even synonymous) and 'the market is text.'[21] This writing is also material in character for Ayache. This materiality marks both the distinction between the contingent character of price and the ideality proper to possibility (its 'depth'), the fact that it is the materiality of the written mark that facilitates transmission (Ayache will speak rather of exchange), and the fact that the ongoing existence of the market is a contingent *result* rather than a self-supporting transcendent realm).

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[20] Ayache, *Blank Swan*, 116.

[21] Ibid., 92, 107.

This means that the market is, first of all, a surface of inscription. It resembles nothing so much as an absolute (or asymptotic) palimpsest. Why a surface? On the one hand, insofar as it only concerns price, the market has no depth in any meaningful sense, no volumetric features—another way of saying that there is no valuation in the market.[22] On the other, there is nothing more shallow than the market, given the single metric of the pricing-process and the absolute topological barrenness it provides to the market. And because there is nothing on the other side of the market surface—it is not a limit or threshold—it is a one-sided surface.

On the other hand, any account of the market has to reconcile the fact that while the act of pricing is discrete (particular prices are written at particular points in time, whether by a human trader or an algorithm), as long as the market exists, its being is continuous. At the same time, the continuous existence of the market is not radically distinct from the pricing process that is inscribed on it. According to a rather classical order of reasons, we can say that it is the pricing process that supports the subsistence of the market surface rather than the other way around (this is what we meant above by the notion that the market is a contingent result), just because the market surface is not the surface for anything else; at issue there is only price.

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[22] For Ayache, this depth which does not belong to the market belongs properly to the category of possibility and thus to metaphysics (*Blank Swan*, 57). It would seem to us rather that this depth is aligned with the social function par excellence, evaluation. This is not to say that possibility is not a metaphysical category, but just it is also a crucial part of the organization of society—what is possible is what can be judged—and thus that the very regime of possibility presupposes an evaluative volume.

The means to bring these points together is provided by conceiving of the inscriptive market surface as *intensive* in character. Topologically speaking, an intensive surface is one that is not separable from the processes that occur 'on' it. In other words, process and *topos* are mutually intertwined there. Prices are thus not only written, but constitute intensive ordinates, and the pricing process can be defined, borrowing from Deleuze, as the serialization of intensive quantities.[23] This intensive character of the pricing process also allows us to redeploy a commonly used term from finance, liquidity. In Ayache's words: 'liquidity is the opposite of a ground on which one can build the edifice of value. Liquidity is a moving ground, a flowing medium where prices, either of the underlying or the derivative, are equally moving and equally "original".'[24]

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[23] While it is to Deleuze that the current points are owed here—and in particular to his two major studies of the concept of the surface, *The Logic of Sense* and *Anti-Oedipus*—it is the source of his own theory of the surface that must also be invoked and developed, above all that of Raymond Ruyer. See *Néo-finalisme* (Paris: PUF, 2012 [1952]), and in particular '"Surfaces absolues" et domaines absolus de survol' (107–22).

COLLATERALISED DEBT OBLIGATIONS AND THE GENERALIZATION OF THE PRICING SURFACE

We began with the critique of probability in order to pass to the contingency of the pricing of derivatives, which was then generalised to include price, and thus allowed for a definition of the market as the regime of the pricing process. It was then possible to define the market as an intensive surface for the inscription of price. These constitute the first elements of an immanent philosophy of the market.

However, in order to effect a second generalization,[25] a certain tension between the univocity of price and the pricing of derivatives in Ayache's work needs to be considered. Despite their obvious centrality in his position, Ayache restricts the scope of his argument to a particular class of derivatives on the basis of two related discriminating criteria. The paradigm case that he aims to exclude from his account is that of collateralized debt obligations, which we have touched on above.[26] While the vanilla derivatives we began with can be formalized in terms of their relationship with the underlying by way of BSM and the similar models that came in its wake, the structure of CDOs forecloses this possibility.

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[24] Ayache, *Blank Swan*, 56.

[25] A third would also be required, one that would take into account all actors in the writing of price—not only traders, but also algorithms engaged in automated trading.

CDOs are based on the bundling together of a pool of assets, bonds or debts—most of the problematic CDOs involved in the US housing crash were of course built on the basis of mortgages. This pool of mortgages is obviously variously composed, with some more likely to be paid back in a timely fashion, and others more likely to default. A CDO is in turn a set of options to buy or sell the likelihood of mortgage payment or default. This set is divided up in terms of these probabilities into subsets or *tranches*, with the least risky sold at the highest premium, and the most risky but potentially most profitable sold most cheaply. It is these tranches rather than the CDO as such that are sold on the market, each of which is valued in relation to the other tranches. In other words, price is no longer a relationship with the implied volatility of the underlying, but is defined as a *correlation* between the various positions within the CDO itself. Given the inapplicability of BSM in this case, other forms of probabilistic modeling were developed that allow for the pricing of the tranches in relation to one another, most often through the (not unproblematic) use of approaches that correlate the various positions in terms of likely outcomes in the face of the possible advent of defaults in the underlying.[27]

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[26] For a summary of his position on these instruments and their role in the credit crisis, see E. Ayache, 'How not to bid the market goodbye', *Wilmott* Nov 2007, 42–52. For a more introductory account, which charts the rise and fall of CDOs and other complex securities and the role of ratings agencies in this history, see J. Coval, J. Jurek and E. Stafford, 'The Economics of Structured Finance', *Journal of Economic Perspectives* 23:1 (2009), 3–25.

While we have seen the dramatic failure of markets in CDOs, from Ayache's point of view the problem must be seen to be related to the very nature of these derivatives, rather than accounted for in terms of the usual explanatory culprits (ignorance, over-complexity, greed, corruption, etc.). The very category of the CDO is, he argues, 'degenerative fantasy',[28] writing that

> Anyone who believes that [these] derivatives can durably trade and prosper in a market that endures by its own necessity has no other ground for such a belief than sheer dogmatic faith. It suffices that he loses the faith for his market to collapse and disappear. This is exactly what happened in the CDO market.[29]

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[27] For a brief summary of the various means used to price CDOs, and their sometimes dramatic deficiencies, see D. Brigo, A. Pallavicini and R. Torresetti, 'Credit Models and the Crisis: An Overview', *Journal of Risk Management in Financial Institutions* 4:3 (2011), 243–53.

[28] Ayache, *Blank Swan*, 449.

[29] Ibid., 175.

This passage clearly indicates the two discriminating criteria at issue. The first is that the pricing of CDOs, and thus the existence of CDO markets, takes place in the radical absence of any kind of knowledge, adopting instead the equivalent of a leap of faith. The kind of belief in question is ungrounded by anything whatsoever, and thus liable to collapse the moment that the trader manages to shake off their unwarranted engagement. The second concerns the need for market *durability*. For Ayache, the CDO market demonstrates its secondary, token and false character insofar as it cannot be maintained over time.

The passage to the second generalization of Ayache's account can only be found by overturning both of these claims on the basis of the more fundamental assertions that, we have seen, he makes elsewhere. We should also recall the second of the two axioms with which we began, the axiom of inclusion, since it is only by including everything that is of the market in the theory of the market that a truly immanent account can be achieved. Moreover, we now know that this 'of the market' concerns price and price exclusively. This means in turn that the very fact that CDOs were and are priced means that they cannot be excluded from consideration here.[30]

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[30] To this, one could add that the relative success of BSM in relation to the correlationist models used in the pricing of CDOs does not mark a significant difference either, since both models are fundamentally incorrect, a fact that is moreover known to everyone who uses them. The degree to

The first criterion that Ayache advances to distinguish the good derivatives from the bad is manifestly *epistemological* in character—faith in CDOs is ungrounded. However, we have already precisely seen that it is not knowledge at all which is at issue in the market, but only the writing of price, an act that takes place, not in ignorance, but in the absence of any meaningful invocation of knowledge whatsoever. This an-epistemological character of the market might indeed even be characterized in terms of the faith that Ayache suggests must be in play in order for the market in CDOs to exist. Since, that is, I never know what the next price will be—making of the market the 'technology of the future'[31]—there is nothing to distinguish a market in vanilla swaps from a market in the most complex CDOs from the point of view of price.

The same holds for the second requirement of durability. We might think to leave aside the fact that the kinds of markets in derivatives that are of such philosophical richness from Ayache's point of view were only exposed as such in the wake of the crash of 1987. The point, though, is precisely that there is no meaningful invocation of chronological time here at all (a point that is moreover central to Ayache's

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which falsity is irrelevant in the valuation of BSM in particular is strikingly shown in Y. Millo and D. MacKenzie, 'The usefulness of inaccurate models: Towards an understanding of the emergence of financial risk management', *Accounting, Organisations and Society* 34 (2009), 638–53.

[31] Ayache, *Blank Swan*, 21.

construction of the market-time relationship in *The Blank Swan*), since the market's durability is only a meaningful question in the gap between the current price and the next one. This is even why Ayache will write that 'The market *doesn't exist* in the past'.[32] But even if this point itself is put aside, it remains the case that CDOs were and are priced, and thus they were and are a part of the pricing process that form a part of the ongoing reality of the market.

THE GENERAL PRICING SURFACE

The second generalization thus becomes necessary in the final analysis on the basis of the immanent requirement with which we began. Consequently, rather than being a generalization, it is more like the lifting of extrinsic barriers, the extrication of criteria illegitimately applied to a rigorous thought of the market. Neither (chronological, metric, lived) time nor knowledge is at issue in the market, whose sole characteristic is the ongoing contingent writing of price and which equally supports and constitutes the intensive surface on which its marks are inscribed. This is the general surface of the market.

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[32] Ayache, *Blank Swan*, 71.

The Ontology of Finance: Price, Power, and the Arkhéderivative

Suhail Malik

1. FINANCE POWER?

The 2008 financial crisis presented two overt lessons: Lesson One is that the derivatives markets presents a *systemic* risk to national and world economies; Lesson Two is that the relative *size* of these markets is a fundamental risk to geopolitical as well as economic security. The numbers are indeed remarkable: the notional total value of the derivatives market at the end of 2012 was $694.4 trillion.[1] Compare this to the $71.7tn global market value of the 'real economy' of goods and services, Gross Domestic Product (GDP), for 2012—just over one-tenth of the face value of the derivatives market, give or take a couple of trillion dollars.[2] The notional value of directly-traded off-exchange derivative markets—Over-the-Counter (OTC) trading—alone amounted to $642.1tn, a sum about seven times greater than global GDP.[3] While impressive, these headline figures need to be qualified: they represent the sum total of claims *traded* on the market, not how much would have to be paid were everyone in the market to immediately cash-out. This latter 'gross market value' at end-2012 is estimated at $24.7tn,[4] just under four percent of the notional value of the market or just under a third of global GDP; or, for further comparison, slightly more than the combined GDP of the two largest national economies that year, the USA ($15.7tn) and China ($8.2tn). Furthermore, since contracts on the derivatives markets often cancel each other out, for reasons presented later, the *net* credit exposure of the OTC derivatives market and its 'cash' value is estimated to be $3.6tn at end-2012—about 0.6

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[1] Bank of International Settlements (BIS), 'Table 23A: Derivative financial instruments traded on organised exchanges', June 2013 [www.bis.org/statistics/extderiv.htm] and 'Table 19: Amounts outstanding of over-the-counter (OTC) derivatives', May 2013, www.bis.org/statistics/dt1920a.pdf.

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[2] The World Bank, 'World Development Indicators: Gross domestic product 2012', databank.worldbank.org/data/download/GDP.pdf.

[3] International Swaps and Derivatives Association (ISDA), *OTC Derivatives Market Analysis Year-End 2012*, June 2013 (Updated 9 August 2013), www2.isda.org/functional-areas/research/studies/. Removing foreign exchange (FX) contracts and accounting for double reporting, ISDA reports that the net face value of the global OTC derivatives market at end-2012 was $417.4tn. The notional value for options and futures exchanges for 2012 are estimated to be $35.8tn and $26tn respectively.

[4] BIS, 'Table 19'.

percent of the notional value; a sum comparable with Germany's $3.4tn GDP, the fourth largest in the world.[5]

These figures and comparisons are striking. What they index is a key feature of the derivatives market: that the notional value of traded contracts amplifies their credit exposure by two orders of magnitude. This multiplication is in part explained by the trade being one of contracts of ownership *claims* rather than direct ownership at full cost: similar to buying a lottery ticket for a multi-million jackpot at the price of a couple of local currency units, the claimed or notional worth of a derivatives contract can be any multiple of its cost.[6] Yet, even at this latter amount of net 'exposure', the political issue brought into relief by these figures is that the pecuniary magnitude of derivatives markets in total is on a par with all but the most economically powerful national jurisdictions in which they are nominally located and which, assuming the power supremacy of state sovereignty, legislate over them.

To return to Lesson One, however, that final authority is precisely what is weakened—if it is not in fact upended (as this article will demonstrate)—by these markets' systemic risk. Two moments of the 2008 financial crisis exemplify the systemic reach of that risk. Firstly, according to the now-standard narrative of the causes of that crisis, the complexity of derivative instruments distributing the risk of interest-bearing loans across the international financial architecture led to systemic and uncontained uncertainty in the creditworthiness of such instruments as well as the guarantees against their defaulting.[7] Because financial instruments and their risk could not be securely priced across the sector or even per firm, financial institutions withdrew credit and liquidity from interfinancial trading from 2006, culminating in the collapse of major financial corporations in 2008. Credit also shrunk back in the wider economy of production, services, and consumption from 2006; sectors which, in the Euro-American economies from the 90s onward, had themselves been increasingly sustained by a growing debt-dependency rather than by revenue.[8] Consequently, the uncertainty as to the creditworthiness of all financial institutions led in 2008 to a rapid contraction not only of that sector but of the overall economy. The resulting severe economic downturn, exacerbated by 'austerity' measures in several regions, exposed the systemic centrality of modern financial arrangements to the nonfinancial economy.

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[5] O. Kaya, 'Reforming OTC derivatives markets', Deutsche Bank Research, 7 August 2013, 14, www.dbresearch.com/PROD/DBR_INTERNET_EN-PROD/PROD0000000000318054.pdf.

[6] The analogy follows Stephen Figlewski's popularising explanation: 'Saying there's $668 trillion in derivatives floating out there [in 2008] is like saying every lottery ticket sold is worth the full value of the jackpot. If the jackpot is $100 million and lottery organizers sell 2 million tickets, "that's $200 trillion worth of lottery wealth that's circulating!" jokes Figlewski' (B. Sheridan, '600,000,000,000,000?', *Newsweek*, 17 Oct 2008, www.newsweek.com/600-trillion-derivatives-market-92275.

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[7] M. Hudson, *The Bubble and Beyond* (Dresden: ISLET, 2012); J. C. Hull, 'The Credit Crunch of 2007: What Went Wrong? Why? What Lessons Can Be Learned?', *Journal of Credit Risk*, 5.2, 2009, 3–18; C. Lapavitsas, *Profiting Without Producing: How Finance Exploits Us All* (London: Verso, 2013), 277-81; N. Roubini & S. Mihm, *Crisis Economics* (New York: Penguin, 2010), Ch.3; E. Stockhammer, 'Neoliberalism, Income Distribution and the Causes of the Crisis', *investigación económica*, LXXI.279, enero-marzo, esp. 42–5, eprints.kingston.ac.uk/23226/1/Stockhammer-E-23226.pdf.

[8] About 80 percent of the global derivatives market is in the jurisdictions of the US and the EU (Kaya, 'Reforming', 4). On increasing household and corporate debt see M. Hudson, 'Government Debt and Deficits Are Not the Problem. Private Debt Is', Remarks at The Atlantic's Economy Summit,

The second demonstration of the systemic integration of financial markets is provided by the transnational response by states to the financial crisis. The pecuniary amounts involved pushed the crisis outside of the conventional scales and terms of operation of state financial institutions.[9] The transnational state

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13 March 2013, Washington DC [michael-hudson.com/2013/03/government-debt-and-deficits-are-not-the-problem-private-debt-is/]; S. Keen, *Debunking Economics*, Second Edition (London: Zed, 2011), Ch.13; Stockhammer, 'Neoliberalism', 59–63.

[9] Namely, Quantitative Easing (QE) in the US and UK, and the combination of the European Stability Mechanism (ESM) and Securities Market Programme (SMP) for the Eurozone. These policies are unconventional in terms of both magnitude and policy. With regard to magnitude, QE has resulted in a 450 percent increase in 'the Federal Reserve's balance sheet [...] rising from $920bn at the end of December 2007 to over $4.2tn at the end of February 2014'—continuing with $65bn per month rolling forward indefinitely from September 2013 (quoting from T.I. Palley, 'Monetary policy after quantitative easing: The case for asset based reserve requirements (ABRR)', PERI Working Paper Series 350, May 2014, www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_301-350/WP350.pdf). The ESM has facilitated a reserve of €500bn (about five percent of Eurozone GDP) since October 2012 for bond buy-outs and loan-provision by the EU ('Gearing up for business', *The Economist*, 12 October 2013). In addition the SMP established by the European Central Bank (ECB) in May 2010 provides unlimited purchases of government bonds via secondary markets. While both measures seem to contravene the prohibition against any form of central monetary financing of governments stipulated by the 1992 Maastricht treaty founding the EU,

the SMP circumvents this core injunction by providing a guarantee for markets of government debt (and their concomitant fiscal policies) such that the ECB's monetary provision does not directly underwrite any state's fiscal policy. Similarly, the EMS constructs a Eurowide monetary provision by centrally formalising a set of bilateral loan guarantees channeled through the EU and IMF via a dedicated Luxembourg-based finance institution. On the EMS, see C. Panico and F. Purificato, 'The Debt Crisis and the European Central Bank's Role of Lender of Last Resort', January 2013, PERI Working Papers Series 306, www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_301-350/WP306.pdf. For the SMP, see D. Gros and T. Mayer, 'Liquidity in times of crisis: Even the ESM needs it', *CEPS Policy Brief* 265 (March 2012), www.dbresearch.com/PROD/DBR_INTERNET_DE-PROD/PROD0000000000287245/Liquidity+in+times+of+crisis%3A+Even+the+ESM+needs+it.PDF; a detailed analysis of the 'bounded rationality' (250) of institutional constraints and mobility in the transnational state construction of these unprecedented provisions is given in L. Gocaj and S. Meunier, 'Time Will Tell: The EFSF, the ESM, and the Euro Crisis', *European Integration*, 35.3 (2013), 239–253.

Unconstrained by the Eurozone's institutional distinction between monetary authority and fiscal policy, QE in the US and UK follows the model set by the Bank of Japan in the early 2000s, which faced similar conditions to those confronting the central banks of major Euro-American economies after 2008: shrinking demand lowers prices, and that deflation itself leads to an effective increase in the price of debt (because deflation means the cost of pecuniary assets including debts *increases* in real terms, as then does the size of debt-servicing as a proportion of the overall economy, in turn further reducing demand and exacerbating the initial problem). With interest rates at close to zero in order to reduce bank liabilities (effectively a state subsidy for commercial banks [Lapavitsas, *Profiting*, 282]), central banks cannot further encourage lending via this mechanism and so look to stimulate the economy by direct purchasing of highly-graded financial assets such as sovereign debt bonds (also issued by the state) in order to reduce their yield and shift private credit and liquidity to elsewhere in the economy, such as equities in firms thereby providing investment. Alongside this intervention the US Fed reduced federal funds rate for borrowing by commercial banks from over five percent in mid-2007 to near-zero in December 2008 in order to stimulate market liquidity. However, because commercial banks were cautious about further downturns and credit exposure risks after the 2008 crisis, their reserves at the Fed increased from a 2001–07 level of around $19bn to $860bn in 2007–08 to $1.6tn by 2011, or 'more than 10 percent of US annual GDP' for that year compared to reserve levels of less that two percent of GDP in previous crises since the 1970s (R. Pollin, 'The Great U.S. Liquidity Trap of 2009–11: Are We Stuck Pushing on Strings?', *Review of Keynesian Economics* 1.0 (2012), 55–76, www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_251-300/WP284.pdf]).

directives formulated by the G20 in 2009 sought to systematise transparency and reduce scalar risk by requiring greater capital reserves for financial institutions or, equally, capping market exposure for firms dealing with OTC contracts.[10] But these stipulations only serve to capture and organize better the operational framework of the derivatives markets' 'efficient' allocation of capital without proscribing or fundamentally inhibiting their operations. And the reason is clear: with credit rather than revenues providing the conditions for economic expansion, finance markets are now a *condition* of national GDP. While the official sanction for the growth of finance markets is framed in terms

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While that reserve reduced the Fed's balance sheet at the time of its own rapid expenditure thanks to QE, the 0.25 percent interest rate on such deposits it offered for the first time on such reserves meant that these accounts provided a direct annual subsidy of $400bn annually for commercial banks borrowing Fed funds on the one hand and parking it back in the Fed with the other. The channeling of state-generated funds to the financial sector extends beyond banking institutions: because QE mainly supports the prices of financial assets while keeping interest rates at near-zero and relying on banks to provide liquidity to business in a contracted economy with small if any increases in wages, employment levels, and savings, the net effect is a relative increase in income to those holding financial assets—preponderantly the wealthiest five percent of the population, and more emphatically so for riskier asset portfolios than for conservative ones. QE thereby sustained the primary dynamic of neoliberalism since the late-1990s of increasing concentration of income-share towards the very wealthiest via financialization (Bank of England, 'The Distributional Effects of Asset Purchases', 12 July 2012, www.bankofengland.co.uk/publications/Documents/news/2012/nr073.pdf; M.A. Gayed, 'What Wealth Effect? QE Has Helped the Rich More Than the Poor', 21 October 2013, www.minyanville.com/articles/print.php?a=52334).

[10] Financial Stability Board (FSB), OTC Derivatives Market Reforms: Fifth Progress Report on Implementation, 15 April 2013, www.financialstabilityboard.org/publications/r_130415.pdf. Cf. also Kaya, 'Reforming', 4–6.

of risk-management and the provision of liquidity to all markets,[11] what the crisis itself made palpable was that it is financial markets themselves that impose the systemic entrenchment and expansion of uncontained financial risk—contagion, as it is called—and in the service of that systemic requirement the reduction of liquidity within those markets in the 2008 crisis required significant intervention by state agencies in order to maintain their general economic functioning. For example, Euro-American state support for banks in the year 2008–9 alone amounted to $14tn (about 25 percent of global GDP). Furthermore, these quantitative factors have a categorial corollary: whereas sovereign monarchs presented the greatest threat to banks in the early capitalist banking system (that of defaulting on war loans), 'today, perhaps the biggest risk to the sovereign comes from the banks. Causality has reversed'.[12] States are now subject to the distinct power of finance in a way they are to no other terrestrial entity (apart from other states, and climate change).

Even as finance and the state system constitute a nexus of power, it is nonetheless internally riven by the threat presented by the power of finance *against* state sovereignty.

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[11] FSB, *Implementing OTC Derivatives Market Reforms*, 25 October 2010, 8, www.financialstabilityboard.org/publications/r_101025.pdf.

[12] A. Haldane and P. Alessandri, 'Banking on the state', first presented at The International Financial Crisis: Have the Rules of Finance Changed?, Federal Reserve Bank of Chicago twelfth annual International Banking Conference, Chicago, 25 September 2009, www.bis.org/review/r091111e.pdf.

If finance (represented by banking or derivatives markets) presents a threat to states, the leading questions are: Why? What is finance power distinct from modern state sovereignty? Since 'finance' here is a euphemism for a systemic market-led dynamic organization of capital accumulation, these questions cannot be taken up in terms of the motivations, gains, and losses of those individuals who effectuate financial power and its vicissitudes. Such accounts render opaque the structural and consistent operations of capital accumulation via financial markets by personifying and pathologising the logic and imperatives of capital accumulation, looking past the particular technical and juridical innovations in structure and operation that advance market capitalization. What is required is instead a *power theory of finance* that must take its lead from the operational complexity of financial markets. Most of the following article is devoted to constructing such a theory by synthesising several heterodox theories of pricing, modifying each to fabricate a nonstandard general theory of price and of the political economy of finance. The primary matrix of the argument is Jonathan Nitzan and Shimshom Bichler's identification of *capital as power*, the outline of which is followed by a mainly descriptive summary of basic derivatives construction and operations sufficient to explain how derivatives structures led to the 2008 financial crisis and, specifically, to the two Lessons elaborated above.

That overview also presents the primary features of derivatives operations in general, leading to the primary contention here, which is the identification of the schematic logic of derivative pricing as a variant of Jacques Derrida's quasiconcept of *différance*. The theory of derivative pricing thereby formulated is then contrasted to a series of other accounts which serve to elaborate and give specificity to the historical and operational institutionalization of derivatives markets which mobilise a différantial logic, not least via the praxis of capitalization they inaugurate by constructing time and price relations through one another. Most significant here is the reorganization of the relation to the future via price in general—not just within the circumscribed arena of derivatives markets, but across the entire social order. The comparative analysis also serves to modify the Derridean determination of différance, the theorization mutating with the increasingly specific elaboration of derivative operation. In particular, derivatives are shown to systemically operationalise an unprecedented modality of the wager that is intrinsic to the standard notion of betting but is theoretically and practically unavailable upon the basis of that standard notion. The specific determination of the financial condition of price returns to the initial power theory of price as instance of capitalization, therewith providing a comprehensive theory of the real of price determined not in relation to subjective or sectorial terms but according to the universalising yet differantiating logic of capital-order's construction and operation of power—*finance-power*. The general theory of price requires the theoretical articulation of the *arkhéderivative*, on which basis the basic categories of modern political economy are then reverse-engineered as manifestations of finance-power, concluding with the redetermination of the state-finance nexus and of political futurity in terms of price magnitudes.

In the identification of the complex practices, mechanisms, and institutions of contemporary capitalism in order to revector them purposefully out of it, the argument is broadly sympathetic to Left Accelerationism.[13] That said, the general theory of price developed here is largely dedicated to the identification of capital-power's complex constitution and organization, formulating its predication on finance, and to what that entails. The revectoring required to provide the requisite political tasks is left to another occasion. Moreover, in addition to providing the comprehensive theory of capital-power necessary for any adequate formulation of a politics of Left Accelerationism (or, indeed, any politics at all adequate to capital-power now), the following argument stipulates two significant reservations as to its current formulation that together serve to retrieve

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[13] See R. Mackay and A. Avanessian (eds.), *#Accelerate: The Accelerationist Reader* (Falmouth and Berlin: Urbanomic and Merve, 2014). The premises and ambitions of Left Accelerationism are proposed by Alex Williams and Nick Srnicek in '#Accelerate: Manifesto for Accelerationist Politics' (347–62).

Left Accelerationism from its neohumanist tendencies: firstly, that Left Accelerationism must abandon its (admittedly ambivalent) attachment to Marxian and labour-based determinations of capitalism and political economy, because these are not the prerequisites of capital-power in general but tendentious misapprehensions of it (if such positions are not wholly incorrect with regard to the anthropological concerns they serve to articulate, nevertheless they are only incidental and partial consequences of capitalization, and not at all its operative or theoretical truth).[14] The proposition advanced here is rather that the routes to postcapitalism, and what that condition and its political economy can be, need to be instead determined in relation to 'the most advanced theoretical tools available today'. In practical terms, this now means finance in general, and derivatives in particular—not Marxism.[15]

Secondly, though more ambivalently, the following theorization of the extirpation of social norms by capital-power (a normativity that does not entail the destruction of social order but the chronic reinstitutionalisation of a risk order) casts significant doubt upon the political and theoretical adequacy of a 'neorationalist' programme to the ambitions of Left Accelerationism. That is, if neorationalism contends that social and subjective norms can be progressively transformed by the pragmatic universalism of self-revising rational norms, that contention supposes both the authority of reason not only over conceptual thought but also over social norms, and also the revisability of social norms.[16] Yet, for reasons deduced below under the name of the risk-order as capitalization, both of these neorationalist prerequisites are at best questionable: for capital-power, though certainly not directed by theoretical reason, revises social norms to the point at which social norms lose efficacy altogether; authority of any kind is not a prevalent power-modality in the risk-order; and risk itself proscribes any tendential organization or universalist determination, however rationally determined and revisable, other than that of greater capitalization (whose rationality is not that of theoretical reason). In other words, without an accurate and complex enough account of the transformability of social norms on the side of the social itself, neorationalism is left propounding a doctrine without traction. This is not to dismiss the neorationalist proposition altogether, but it does effect an injunction: that neorationalism substantiate the relation between the construction and implementation of rational norms on the one side, and the vitiation of normativity on the other side—the side of the social order constituted by capital-power. If that articulation can be made, the argument here provides a basis for it.

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[14] Accelerationism's ambivalence towards Marx(ism) is clearly presented in Mackay and Avanessian's 'Introduction' to *#Accelerate* (37–42).

[15] Quote from Williams and Srnicek, 'Manifesto', *#Accelerate*, 353, in reference to Marx.

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[16] The neorationalist position is espoused notably by R. Brassier, 'Prometheanism and Its Critics' (*#Accelerate*, 467–87) and R. Negarestani, 'The Labor of the Inhuman' (ibid., 425–66) and, elsewhere, by Peter Wolfendale. See n.89 and 133 below.

2. THE POWER THEORY OF CAPITALIZATION

The power determination of finance sought here is theorized by Jonathan Nitzan and Shimshom Bichler. In broad terms, Nitzan and Bichler propose that capital is *directly* power because it is 'neither a material entity, nor a productive process, but rather the very ability of absentee owners to control, shape, and restructure society more broadly'—a control of productivity that involves the 'entire spectrum of power institutions', not least because the absentee ownership at its core requires complex and enforceable institutional structures across a society.[17] Capital accumulation is at once and necessarily a political fact. However, crucially for Nitzan and Bichler, the 'spectrum of power institutions' controlling productivity are not a well-organized and unified capitalist class, as a caricatural notion of a bourgeoisie might propose. On the contrary, the main conflict and power struggle in capitalism is *between* those accumulating capital, each of whom looks to do better than the other owners of capital. Capitalists do not just seek to accumulate capital nor (as liberal business dogma has it) to maximize profits, but rather to 'beat the average' represented by the normal rate of return.[18] That rate is set not just by the standard instruments such as interest rates, but also by the rate of accumulation of every company and absentee owner, who are therefore competitors for capital. Nitzan and Bichler's shorthand for accumulation by intracapitalist rivalry is *differential accumulation*, which also posits that accumulation for any one firm is locked into the spectrum of institutional arrangements at local, sectorial, or global scales.[19] The normal rate of return represents the last-mentioned global benchmark for differential accumulation, the index against which any capitalist can measure whether they are 'beating the average' or not. And, to return to its necessarily political dimension, it also indexes how the 'economic' activity of capital accumulation requires broad social cohesion: a normal rate of return supposes that 'the underlying power institutions [...] remain stable; the more stable these institutions, the more normal the rate of return, and vice versa'.[20]

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[17] J. Nitzan and S. Bichler, *The Global Political Economy of Israel* (London: Pluto, 2002), 10.

Differential accumulation is a deceptively minimal axiom for what capitalism is extensively—as a system and method of capital accumulation, how it operates systemically and in its aggregate or micro tendencies—as well as intensively, per transaction and in the sectorial and individual (corporate or personal) instantiations of intracapitalist conflict. The general explanatory theory and logic it provides for capitalization is however mostly based on geospatially organized and historical industrial-corporate capital accumulation and power agglomeration, formations to which Nitzan and Bichler's analyses are mostly dedicated. The question of the types and magnitudes of power combinations between financially-formulated capital and state sovereignty requires that this analysis and its terms be extended to the current operations and structures of finance markets. Nitzan and Bichler's framework accommodates such an extension because, as noted above, for them capital is determined through absentee ownership, and this institutionally organized claim underpins not only bonds and corporate stock but also the derivatives contract. However, a more exact determination of the power theory of finance requires specification of the operational conditions of the logic of intracapitalist conflict on the basis of the two primary aspects of its systemic ordering: *price* and *sabotage*. Taking these in turn:

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[18] Ibid., 11.

[19] For a summary of differential accumulation, see S. Bichler and J. Nitzan, 'Differential Accumulation', in *Dissident Voice*, 28 December 2011 [bnarchives.yorku.ca/324/02/20111228_bn_da_ft_lexicon_dv.htm].

[20] Nitzan and Bichler, *Israel*, 13.

Price. Following Thorstein Veblen, Nitzan and Bichler propose that capitalists' primary grasp of capital is only in relation to anticipated business earnings, 'the discounted value of future earnings capacity'.[21] Future earnings capacity is the expected flow of future revenues; the price paid now for that future income against the normal rate of return 'discount[s] this flow into present value'. As already noted, the normal rate of return is set by 'the entire spectrum of power institutions', while future earnings capacity is 'the consequence not of productivity as such, but of the *control* [emphasis added] of productivity', which in turn relies upon the particular historical and legal configuration of that power spectrum. The discount price formula thus reformulates differential accumulation as a specific magnitude, given as a price. Irving Fisher's (1907) generalisation of discounting formulas provides this last identification: price is the 'abstract financial magnitude' of a 'pecuniary asset', the latter being 'merely a claim on earnings'. In short, price 'tells us how much a capitalist would be prepared to pay now to receive a flow of money later'.[22]

Price, then, is core to the capitalist cosmology as an organising index of differential accumulation. It is 'merely the unit with which capitalism is ordered', capitalization being the pattern of that order. This cosmology is not just ordered but moreover *constituted* by price and pricing rather than being the substantial source of the revenue that is priced: 'bonds, corporate shares, preferred stocks, mortgages, bank accounts, personal loans, or the registered ownership of an apartment block are simply different incarnations of the same thing: they are all income-generating entities', as is production capacity, fixed or variable capital, corporate structures, and other material terms. Capital accumulation is on each occasion organized only by and for its final cause: anticipated earnings. ('Final cause' is not Nitzan and Bichler's formulation.) All conditions for those earnings are primarily apprehended as pecuniary assets. The fungibility of the pecuniary asset as condition for capitalization will be taken up below in the elaboration of derivatives contracts. More immediately, Nitzan and Bichler's theory of price explains three primary characteristics of capitalization central to the political economy of derivatives and their markets:

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[21] This and two following quotations are from Nitzan and Bichler, *Israel*, 10–11. The outline of Veblen's argument from the early 1900s is from *Israel*, 31–34.

[22] This quotation and those following in this subsection are from J. Nitzan and S. Bichler, *Capital as Power: A Study of Order and Creorder* (London: Routledge, 2009), 151–6.

> (i) Indexing the power of ownership indifferently to the specifics of what is owned, prices qua abstract financial magnitudes are 'uniform across space and time': prices from one region at one time can be compared and translated to prices from another time and place. Thanks to the fungibility of what is thereby priced, price provides a universal and transhistorical equivalence; and, in thereby presenting a 'single

quantitative architecture that cuts across time and space', capitalization is world-historical.

(ii) As the measure of an ownership claim on future revenues, price is an exact index of differential accumulation, which is to say: of social power. Through price, capitalists understand their exact place in the order of power, which is thereby quantitatively organized: price is *the* ordering element of capitalization. Such ordering should not, however, be confused with stasis or structural fixity. To the contrary: because what matters in capitalization is not what is priced but rather increasing the magnitude of price qua financial abstraction, for all its ordering and universality price structures the dynamic *re*ordering of power, countermanding traditional (notions of) social order:

> Prices enable entirely new ways of reordering society. What previously required military conquest can now be done through currency devaluation[…]. [T]he highly malleable nature of prices—i.e., their remarkable ability to go up and down—makes capitalism by far the most dynamic of all historical orders. In fact, in capitalism change itself has become the key moment of order.[23]

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[23] Nitzan and Bichler, *Power*, 153.

> (iii) Price is then *the* medium of power in capitalism. Capitalism is, in short, a dynamic power-ordering organized through price as its measure/medium of order and reordering (a doubling that Nitzan and Bichler call capitalism's creative order or 'creorder'). Put otherwise, price is the index and medium of a transformative power-rationality whose specific historical organization is a result of intracapitalist conflict. That always sociohistorically specific struggle is fought through the abstracting universality of price as much as through given and sought-for social arrangements, all of which are therefore transitional.

In every instance, the delocalising and dematerialising abstraction wrought by capitalization is the condition for, and the effect of, the universal and dynamic social reordering of *power* qua differential accumulation. On this account, 'all that is solid' does not 'melt into air', but is ordered via abstract financial magnitudes in and as a power-rationality that is the political real of capitalization.[24] All political mobilisation consequently has to determine its real and its own capacity with regard to the quantification of power as price—an initial indication of how the power theory of capitalization adapted here takes leave of Marxian doctrine, a divergence that will become more emphatic as the analysis proceeds through the specifics of derivative structures and operations.

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[24] 'All that is solid' refers to the characterization of capitalism's abstracting and deracinating effects in *The Communist Manifesto*, Ch.1. Capitalism's abstraction of material conditions is characterized as the spiritualization or ghost dance of fetishism in the commodity analysis presented in *Capital* 1, Ch.1 §4. While both instances exemplify at source a general Marxist tendency, explicitly articulated in this section of Capital 1, to accuse capitalism of mystifying the labour theory of value that is its concrete truth, such theories are in fact themselves obfuscations of capitalization qua pricing. The tendentiously spectral-literary characterization of capitalism has been revived in relation to Marx by Jacques Derrida's *Specters of Marx*, tr. P. Kamuf (New York: Routledge, 1994 [1993]), and in relation to finance

Sabotage. Differential accumulation names the logic and dynamic of intracapitalist conflicts, more colloquially formulated as 'beating the average'. There are two effectively equivalent ways to meet this imperative: increasing ownership over future earnings—which is what pricing does—and/or ensuring that other firms do not accumulate as much as they otherwise could. The latter operation happens in two ways: sectorially,

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by J. Vogl, *Specter of Capital*, tr. J. Reder and R. Savage (Stanford: Stanford University Press, 2015 [2010]).

Alfred Sohn-Rethel proposes that capitalism is a 'real abstraction' or 'real subsumption' constituting a material-social-cognitive real that it also indifferently deracinates. See *Intellectual and Manual Labour*, tr. M. Sohn-Rethel (Atlantic Highlands, NJ: Humanities Press, 1979), a thesis extended by Maurizio Lazzarato in the mid-1990s to affect ('Immaterial Labor', tr. P. Colilli and E. Emory, in P. Virno and M. Hardt [eds.], *Radical Thought in Italy* [Minneapolis: University of Minnesota Press, 1996]), and influentially taken up by Michael Hardt and Antonio Negri in *Empire* (Cambridge, MA: Harvard University Press, 2001), 254ff. A variant of the formal abstraction thesis—in which capitalism transforms a preexisting reality that is more authentically constituted in other, more immediate terms—is upheld by Nitzan and Bichler themselves in their affirmation of Cornelius Castoriadis's notion of the 'magma' of human creativity irreducible to capitalization as the condition for a political counterpower to the latter (*Power*, 20ff.). That said, it is however also Castoriadis's theorization of the nomos as the semantically organized institutional order of a society that provides the basis for identifying capitalization axiomatically rather than by material particularities, labour, or consumption (*Power*, 148–50).

competing firms' capital accumulation has to be diminished compared to one's own; globally, it requires 'limiting the average rate of growth of profit' in order to secure a differentially greater accumulation per firm *against* the average rate. Nitzan and Bichler identify this intrinsic and necessary diminution of overall growth as the *sabotage* wrought by business, the latter term meaning ownership of capital accumulation.[25]

Sabotage is the socioindustrial correlate to pricing, a systemic characteristic of capitalization, which now has to be understood as the diminishing of aggregate social productivity (that Veblen calls 'industry'): for example, taking out competitors or limiting technical or institutional capacities with patent restrictions. This holds for interfirm rivalry per sector as it does in the global and sectorial dimensions, which are all thereby interlinked: sabotage is a determinant of the normal rate of return, which indexes the systemic organization of the spectrum of power. Extending sabotage to encompass broader social organization and pricing:

> the very existence of this 'normal' [rate of return] enables even the most insignificant actors to exercise their 'natural right' for universal sabotage. Since individual capitalists, however small, can always earn the normal rate of return by simply owning a diversified portfolio, they have no reason to produce at less than

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[25] Nitzan and Bichler, *Power*, 246–7.

> that rate. [...] In accepting the normal rate of return as a minimum yardstick below which production should not be extended, they effectively propagate sabotage—even when they themselves do not have the differential power to back it up. Sabotage becomes invisible, 'business as usual' as they say.[26]

As a systemic condition, differential sabotage manifests itself in diverse social arrangements including unemployment, inflation, wage restraint, social fragility, education policy, immigration regulation, etc. In general terms, the normal rate of return indexes the fact that, contra Marxist and Neoclassical accounts, capitalists do *not* accumulate capital by seeking to maximize profits by increasing production, innovation, and consumption, but that differential accumulation requires compromising production as such. Business is then not just unproductive but, moreover, necessarily *counterproductive*—as are capitalist societies overall and in general.[27]

Price and sabotage, then, are respectively the financial and industrial operators of differential accumulation. It is core to Nitzan and Bichler's theorization that these aspects are not held apart as distinct dimensions of the social totality, with the first being treated by economics and the second under the banner of a politics incommensurate with the former. Rather, price and sabotage are coeval and mutually determining, directly constituting the organization of power across society at every scale as a necessarily integrated *political economy*.[28] This point will prove to be a primary determinant of the ontology of finance and so requires further attention.

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[26] Nitzan and Bichler, *Israel*, 38.

[27] Nitzan and Bichler, *Power*, 249.

Nitzan and Bichler establish that price directly indexes the political economy of capitalization by generalising Gardiner Means's observations of how businesses fared in the Great Depression.[29] Means demonstrated that concentrated industries, which are inflexible and set 'administered prices' relatively unresponsive to market conditions, increase their share of differential accumulation against competitive firms, whose 'market prices' are more responsive to changing market conditions. This because the prices and profits of the former 'respond[ed] only partly or not at all to market conditions', instead fixing a 'long-term target rate of profit and then back-calculat[ing] the mark-up necessary to realize this rate of return over the long haul'. Consequently, prices and profit for such firms during the Great Depression resulted in relatively small declines in prices correlated to sharp drops in productivity and employment. In contrast, firms setting 'market prices' had smaller relative drops in employment and productivity, but took a larger hit on profits. For Nitzan and Bichler, this demonstration of differential accumulation via price-setting strategies makes explicit that the administering price according to mark-ups 'already embodies the power to incapacitate' the social order. That power of fiat pricing can be identified with Michal Kalecki's notion of a 'degree of monopoly', which 'measures the consequence for relative profit margins of monopolistic institutions and forces', that is, the degree of power concentrated in a firm relative to the entire spectrum of social institutions.[30] The mark-up of 'administered prices' is then not only directly the power to incapacitate by competition and the ability or not to own at a given price; it is also the direct measure of the firm's concentration of power in the entire social spectrum. The key theoretical consequence is that if price-setting advances differential accumulation via both accumulation and the concentration of social power, then *prices set the market.*

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[28] Distinct in this to both Neoclassical liberalism and Marxism: cf. Nitzan and Bichler, *Power*, 13 and Ch.8.

[29] This paragraph paraphrases Nitzan and Bichler, *Power*, 241–2.

3. GENERAL OUTLINE OF FINANCE POWER

Administered prices make explicit that price is the medium of capital accumulation *qua* power-ordering. Accumulation/sabotage is organized by the absentee ownership of assets, which is not ownership of production but of price-setting. This is what power is in capitalism. By definition, such power is held by capitalists; more salient than this sociological truism is the fact that *finance* is the structural and constitutive condition for that power. Determined initially as the absentee ownership and pricing of assets, finance is also the basis for capitalism's durable yet dynamic *revision* of ownership and pricing of assets, as well as the broader institutional structures of capitalization, at three levels simultaneously:

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[30] See too Nitzan and Bichler, *Israel*, 39n.11

> at the most basic level, it allows owners to lever technical change [...] as a tool of power. At a higher level it lets them use the monetary symbols of prices and inflation to restructure power. And at a still higher level, and perhaps most importantly, it permits them to reorganize power directly, by buying and selling vendible ownership claims.[31]

In contrast to other manifestations of social power, the market of vendible ownership claims—financial markets, whether or not they are explicitly characterized as such—structure institutions according to the primary 'generative order' of capitalization, a 'formula [that] is special in that it doesn't specify what [capital-power] should look like'. Indifferent to the specifics and qualitative particularities of how power is organized, markets and pricing predicated on finance enable social reshaping and reformatting 'in innumerable ways' that 'no other ruling class has ever been able' to undertake. It is thanks to finance that the market is the condition, instantiation, and medium of the indefinitely variable, anonymising, and fungible capital-power. Or: finance is the condition and means of capital-power, and capital 'is finance, and only finance'.[32]

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[31] Quotes in this paragraph are from Nitzan and Bichler, *Power*, 306–7.

As the structural condition of capitalization, finance logically precedes it; and capitalization itself precedes (and exceeds) economics as the constitutive and necessary politics of that restricted regime. Or, inversely: economic practice is a restricted theoretical and practical rendition of capitalization, and capitalism is only a particular order of financialisation, meaning that it is *not the only possible one*. The analysis and politics of capitalization advanced here requires that it is *finance* that is the a priori of all historical and theoretical determinations of 'industrial capital'. Contrary to how Marxian and Neoclassical doctrines determine prices to be set by interfirm rivalry given exogenous conditions (such as supply-demand, labour and capital costs, consumption, etc.),[33] such that the supposed priority of the latter casts finance capital as parasitical, supplementary, or 'fictitious',[34] according to the power theory of price, financially-set prices are the *primary* elements for the dynamic organization of capital-power.

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[32] Nitzan and Bichler, *Power*, 262; see too *Israel*, 36.

[33] Nitzan and Bichler, *Power*, 239.

[34] Marx adopted the common if ill-defined mid-nineteenth century term 'fictitious capital' in his notes from the 1860s–80s, edited by Engels as *Capital* 3 (M. Perelman, *Marx's Crises Theory: Scarcity, Labor, and Finance* [New York:

Praeger, 1987], Ch.6). Introduced in Chapter 25 of *Capital* 3 to designate bills of exchange contrasted against trade or exchange, fictitious capital is distinguished in kind from real capital via the paradigmatic example of interest-bearing capital (Ch.21). The owner of an interest-bearing loan does not transform the lent money into productive capital via commoditization or trade, nor is ownership of the money transferred to the borrower who makes use of it. Without commodity or monetary 'metamorphosis' in the M–C–M' concatenation, or the promulgation of social reproduction (that is, channeled through labour), for Marx the initial sum 'ceases to function as capital' in its 'reflux' back to its original owner with interest. As such, even if the borrowed money is real capital because it is transformed via commoditization, the initial loaned money is but a fictitious capital (which is also why money itself is not necessarily capital but only when it is in the process of social reproduction). Marx generalises the distinction to all prognostications of future income that do not proceed via the commodity form under the name 'capitalization', which is the 'formation of fictional capital' (Ch.29). The danger of capitalization for Marx is that the money-owner does not recognize that income is accrued from social processes but takes it wholly formally, 'something with automatic self-expansion properties'. Accordingly, Lapavitsas follows Marx in differentiating between interest-bearing loanable capital, which is 'a hard reality of the capitalist economy', and fictitious capital, by which he takes Marx to mean capitalization via the discount price formula (*Profiting*, 28–9, 161), but he also thereby discards that either route is an equally valid modality of capitalization *for the money-owner* seeking returns primarily with a view to where greater returns can be made—a process that, pace Marx, is not desocialised but, precisely, sociohistorically immersed in differential accumulation. Loren Goldner, for whom capitalization is the current value of future income, argues that fictitious capital is the primary determination of capitalism since the 1970s because of the effective marginalization of labour in dominant economies over the period. Consequently, overcoming capitalism requires not a labour-based struggle but the abolition of fictitious capital and the value-form, a proposal shared with Endnotes' call for communization (n.129 below) despite Goldner's other theoretical disagreements with them ('Fictitious Capital and the Transition Out of Capitalism', 2005, home.earthlink.net/~lrgoldner/ and 'Once Again, On Fictitious Capital', 2003, home.earthlink.net/~lrgoldner/onceagain.html). While not a Marxist, Hudson deploys the notion of fictitious capital mainly to describe the growth of 'paper wealth' over the interests of the capitalism of industrial production ('From Marx to Goldman Sachs: The Fictions of Fictitious Capital', 30 July 2010, michael-hudson.com/2010/07/from-marx-to-goldman-sachs-the-fictions-of-fictitious-capital1/).

That this renders untenable any distinction between finance capital and a putative 'real capital' ostensibly predicated on conditions exogenous to finance does not prevent analysis of how the financial sector impacts the nonfinancial sector. Quite the opposite, in fact: finance necessarily promulgates sabotage *in general*, meaning that it is an inherently counterproductive power. The capitalization of business earnings 'represents nothing but incapacitation'; or, contrasted to price as an abstract financial magnitude, 'capital is a negative industrial magnitude'.[35] To extend Nitzan and Bichler's formulation, the *positive* determination of price *qua* 'abstract financial magnitude' is on the other hand that it directly indexes capital-power's ordering and reordering.

Taking GDP to be a proxy of the aggregate representation of earnings at a state scale, the comparisons presented in the introduction above indicate that the power magnitude of derivatives markets as a whole have now exceeded that of most nation-states. States have of course been the principal matrix of political modernity since the establishment of the power supremacy of state sovereignty with the 1648 Treaty of Westphalia. If derivatives markets and states are now of the same order of magnitude of capital-power, this signals that sovereignty is no longer the supreme power in the quantitative regime of capitalization, but must contend with finance power on a more or less equal footing—and states are increasingly outpriced. As Haldane and Allessandri recognise, at this historical juncture dominant power consists in the power of finance-markets as much as (if not more than) in state sovereignty (the 'as much as' here is meant literally: their respective capital-powers can be gauged by the magnitude of each as aggregate 'pecuniary assets'). That combination forms an organizational and operational nexus of dominant power that can, for ease of recognition, be called neoliberal governmentality. Such governmentality is a quasi-statist power formation which, while it is in part constituted by the established configuration of modern statehood, at the same time corrodes its primacy, as exemplified by two interrelated transformations in its primary structures: firstly, the size of contemporary finance capital, as well as its 'interconnectedness', require a transnational organization of legislative and regulatory conditions for finance. Consequently, territory as the spatial extension of state power is not an adequate basis upon which to contend with finance-power today. Put otherwise, the jurisdictional powers of nation-states are interlocked with the transnationality of contemporary finance power, corroding the boundedness and autonomy of their sovereignty (hence the importance of interstate organizations such as the Bank of International Settlements and the Financial Stability Board, which are at the forefront of these transformations). Secondly, the power supremacy of sovereignty in authority, up to and including military and police powers, is now subject to the reordering wrought by capital-power and conditioned by finance. The magnitudes of this latter power are now large enough to substantially supervene on sovereignty as the final term of statehood and regulatory institutions.

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[35] Nitzan and Bichler, *Power*, 249.

The state-capital nexus transforming modern statehood is but one consequence of the dynamic power-rationality wrought by capitalization. Finance, to repeat, is the structural and operational a priori of capital-power's reordering—an aprioricity here called capitalization's *financiality*, operationally tantamount to prices being set only as a mark-up against other prices. The trading of contracts for future exchange of the 'absentee ownership of assets' in financial derivatives markets explicitly demonstrates this condition. While it therefore seems that the operations of finance markets concretely instantiate the a priori financiality of capital-power, now transactionally liberated from the alibi or convention of the commodity, service, or income stream as exogenous condition for pricing, any such identification has to be cautiously made. While the a priori financiality of capital-power is the *systemic* condition for capitalization, the finance markets are practical and institutional operating mechanisms and facts of capital accumulation. That is, though finance markets are certainly constituted by the financiality that conditions capitalization and its power-rationality (its transcendental condition, in critical philosophical terminology), finance markets cannot be *directly* identified with financiality in general without category error or subreption, because the former are an institutionally specific sector of capitalization. However, maintaining the distinction between financiality as condition of capitalization and financial operations presents a problem for the argument regarding the redistribution of power between finance markets and states: the categorical distinction between financiality and financial operations advanced here means that the shifts in the relative power magnitudes between the finance markets and states do not necessarily index transformations in *what* power is, in power types. Consequently, the state-finance nexus could be deemed to be wholly coherent and to mark no significant change in power: just more of the same in another guise. But the caution here is not a proscription: the task of this essay is to articulate and integrate the two dimensions of finance—as a priori condition *and* as a historical fact—without directly identifying them. Yet it also seeks to demonstrate that finance markets and derivatives in particular *are* the truth of capital-power as endogenous capitalization made explicit in practice. And it is on this basis that the typological mutations of dominant power between finance markets and states can be explicitly identified.

In order to do that, more detailed elaboration of the operations, logic, and structure of derivatives markets is required.

4.1. DERIVATIVES: TRADING

The myriad derivatives structures prevalent in finance markets are of course only constructed and deployed in the service of accumulation by trading. Apprehending the principal strategies of trading provides an operational basis for understanding their construction, outlined in the next section, leading in turn to the determination of the specific logic that has reordered political economy and power ontology in the wake of the growth of finance markets since the early 1970s. But in advance of that, some basic structure and terminology need to be elaborated.

In their simplest standard (Neoclassical) formulation, derivatives are contracts between two parties whereby one side pays out a mutually agreed amount (the 'delivery price') if circumstances specified in the contract take place at a designated termination date ('maturity' or 'expiration').[36] The eventualities may be those of prices (of a commodity, company stock, interest rates) at some determined point in the future, of cash flows or payment defaults, or other non-monetary eventualities—for example, the weather (snowfall determining skiing conditions and therefore revenue for a resort, a month of rain for agricultural production), livestock populations and disease, technological innovations, and so on. The contracted claim is contingent in a double sense: firstly, it depends upon an eventuality independent from and external to the contracted price, which is known as the underlying asset (sometimes reduced to 'the underlying'); secondly, in the prevalent sense in which the term is understood in derivatives markets, the eventuality upon which the payout depends may or may not be occasioned, meaning that the contract will lead to a gain or a loss by one party or another, but without certainty as to who will be the gaining/losing party. Gains or losses are made dependent on whether the price agreed in the contract, the delivery price, is higher or lower than the market price of the underlying (the 'spot price') at maturity. There are three principal distinct strategies of derivatives trading: arbitrage, hedging, and speculating.

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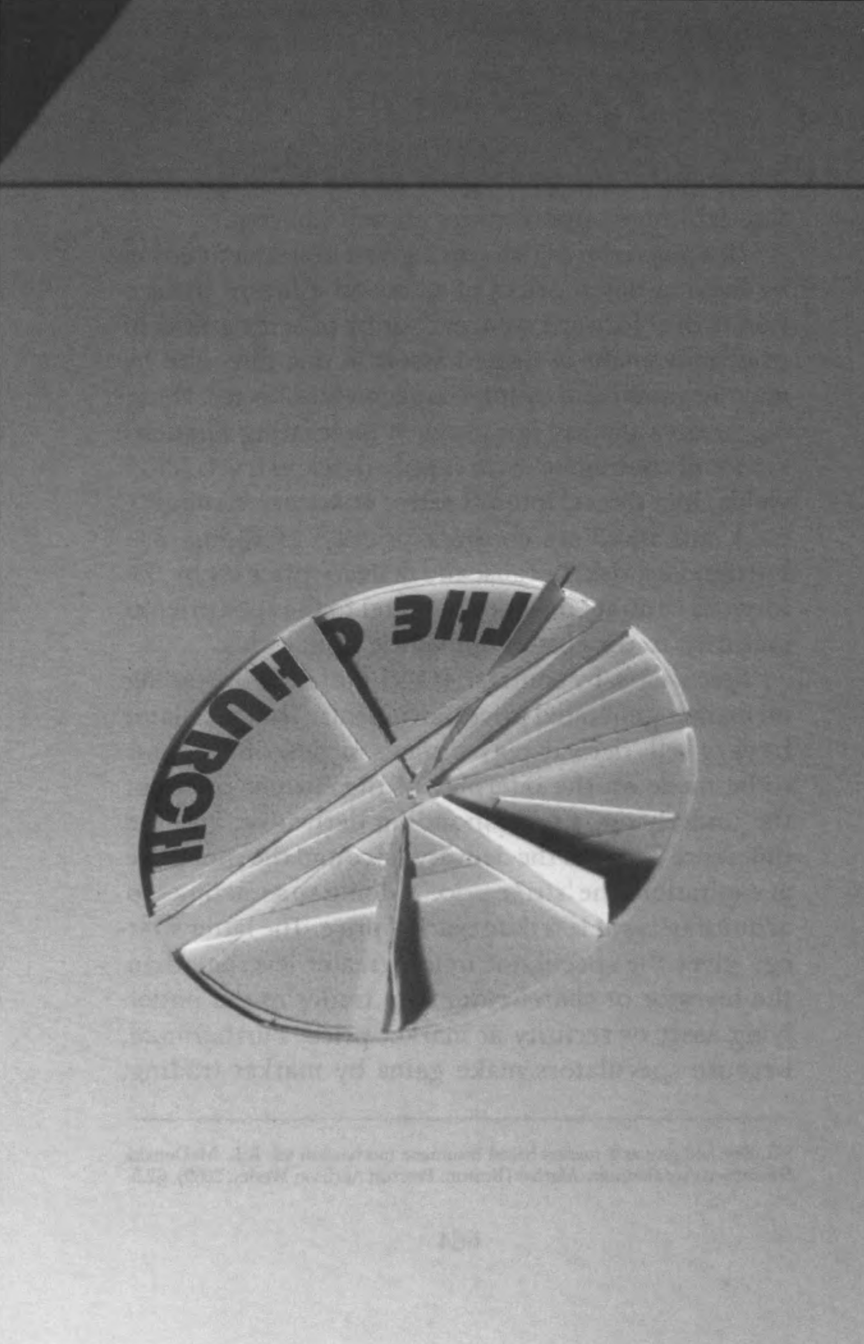
[36] The technical account in this section paraphrases elements of the leading derivatives textbook in English: J. C. Hull, *Options, Futures, and Other Derivatives: Seventh Edition* (Upper Saddle River, NJ: Pearson Prentice Hall, 2009), Ch.1.

Arbitrage is trading across markets in order to secure riskless gains. For example, buying an asset in one country to sell in another to take advantage of the price differentials and exchange rate across the markets. There are no costs for the arbitrageur other than transaction costs. Such trading, however, quickly eliminates the



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differentials from which gains can be made, meaning that arbitrage opportunities are self-limiting.

Hedging reduces risks on a given investment either by locking down prices of assets on a future transaction with a 'forward contract', or by offsetting risks of price movement of owned assets in one direction by making gains from counter-movements of price. Hedging insures against variations in fluctuating financial rates and contingencies in supply-demand levels (crop yields, fuel prices, interest rates, monetary instability, etc.) and stabilizes contract prices.[37] Hedging also introduces a risk, because the delivery price set by the forward contract may not be equal to the spot price at maturity, to the cost of one of the signatories.

Speculation, by contrast, is accumulation by trading on market-generated price movements. The speculator buys or sells derivatives contracts in view of the gains to be made on the interplay of the current prices of the underlying, a corresponding derivative, and the difference between the delivery price and the spot price at expiration (the 'strike price'), doing so sometimes to acquire assets at less than market price. The latter strategy gives the speculator much greater leverage than the investor or shareholder who trades in the underlying asset or security at market price. Furthermore, because speculators make gains by market trading,

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[37] For hedging as a market-based insurance mechanism see R.L. McDonald, *Fundamentals of Derivative Markets* (Boston: Pearson Addison Wesley, 2009), §2.5.

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their primary interest is in the *prices* of the assets and financial instruments rather than the underlying assets, the latter being immediately resold in order to realize them as only 'pecuniary assets'.

As speculation demonstrates especially clearly, derivatives markets in general are not markets for vending underlying assets external to them at their 'live' price, nor for investment, which looks to make gains by taking a share of profits or revenues made by the underlying asset as an element of industry, agriculture, and production (in short, in the 'real economy'). This is often the basis for criticism of speculation, along with its maximising market leverage of financial instruments over the non-financial sector, leading to distortions in pricing across all markets as well as a disregard for the fate of the underlying asset and 'the real economy' it represents. Defenses of speculation are based on its 'absorption of risk' since (i) the vending of financial instruments is based on anticipating higher returns, and (ii) speculation is the other side of hedging: the hedge that anticipates and insures against prices movement presumes a speculator who accepts the risk of the differential between spot and delivery prices as worth bearing. Moreover, since speculation exploits the price differentials (spreads) over time as well as between buyers and sellers prices, speculation 'bridges' these differentials, providing liquidity to markets where exchange and trade would otherwise diminish.

What is important here is that the derivative contract and therefore its market is dependent on the underlying in one regard only: whether or not the conditions stipulated in the contract are met. While the prices of the shares or equities of a company—and therefore investment in it—depend on the history and pathway of its profitability, productivity, growth, energy and resource costs, and so on, the payout of a derivative is determined solely by the terms set up by the contract. Unlike in investment, in speculation gains can be made from decreasing profits, a market crash, or a food shortage, if that is what the contract stipulates and regardless of any other consequences. Moreover, the underlying is but an occasion for drawing up derivatives contracts, their anonymous material. The historical, material, or qualitative particularity of the underlying is irrelevant beyond the *price* conditions set in the contract, as is its fate once the contract expires. By virtue of this endogeneity of accumulation by pricing contracts, and despite the frequent use of the terms 'investor' or 'hedge fund' to designate activity on derivatives markets, ultimately it is speculation that is the defining category for *all* derivatives contracts and their markets.

4.2. DERIVATIVES: STRUCTURES

Trading in derivatives markets relies on the operationalisation of financial instruments that practically compose them. This section presents a rudimentary elaboration of the primary mechanisms of derivative contracts, from which the general operational logic of finance markets can be extracted. It is this latter logic that will permit the institutional operation of finance markets to be articulated with financiality as the a priori condition for capitalization, in turn allowing the transformation of power wrought by these markets to be grasped. Four basic structures are presented here in order of increasing complexity: forward contracts, futures, options, and swaps. Though swaps were key instruments in the systemic dynamics leading to the 2008 financial crisis, for reasons given below, the speculative logic of finance is most evidently demonstrated by forward contracts and options, which will therefore be the main analytical focus.

A *forward contract* is the most straightforward financial derivative mechanism: the agreement to buy or sell an asset at a certain price in the future.[38] The contract itself is traded off-exchange and costs are borne at maturity. Agreeing to buy the asset is called the long position, while agreeing to sell it is the short position. The agreed price is called the delivery price (denoted K);

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[38] Hull, *Options*, Ch.2.

the actual price of the asset at maturity, when it will be traded, is the forward price (denoted *S*). In its standard account, the contract is made in view of the likely difference between delivery and forward prices yielding a profit or loss for one of the parties. In general, if the spot price is more than the delivery price then the long position makes a gain and the short position a loss. The gains and losses are reversed if the spot price is less than the delivery price. Put schematically, if the spot price of the asset at time t is S_t, then:

—the long position (having agreed to buy the asset) at time t is worth $S_t - K$

—the short position (having agreed to sell the asset) at time t is worth $K - S_t$

Illustration

Imagine the cover price of COLLAPSE is set in response to demand.

A forward contract is made at time t_0 for delivery of 25 copies of COLLAPSE with a delivery price of 500 Local Currency Units (lcu), anticipating a market price of 20lcu on its long-awaited publication.

Over time t the spot price S_t of COLLAPSE increases from 20lcu to 24lcu because that issue of COLLAPSE will include a new essay by Quentin Meillassoux.

At maturity, the long position immediately sells all 25 copies at the market price at time t, making a gain of 25 × (24–20) = 100lcu, a profit of 20 percent (excluding transaction costs for setting up the contract).

> Equally, at maturity the short position sells an asset then priced at 600lcus for the forward price of 500lcus, bearing a loss of 100lcu at the current market rate.

This straightforward illustration demonstrates that derivatives are so-called because they stipulate a price in relation to the spot price which is itself set by the market in the underlying (here, the impending issue of COLLAPSE). What the relative simplicity of the forward contract also exposes is the exogeneity of the underlying to speculative accumulation: while the cover price of COLLAPSE in the illustration is set by content-related demand, the speculator taking the long position has no interest in Meillassoux's essay itself, as demonstrated by her immediately selling the acquired copies of COLLAPSE at the market rate at maturity. This is a necessity of speculative accumulation: there is no pecuniary gain unless the acquired asset is converted into revenue (taking an interest in the content of the publication by holding a copy of COLLAPSE back from the market to read it reduces the overall income). That is, while in this case it is Meillassoux's reputation that drives up the price of the underlying of the forward contract in the imagined competitive market, the speculator is interested only in the increase in price for *whatever* reason. For example, increases in printing costs could lead to the same gains for the speculator even if they mean a reduced net income for Urbanomic. The derivative is exogenous to the causes for price movements of the underlying other than how they shape the *pricing* of the underlying. Speculation by derivatives is in general content-indifferent, which, again, is why it is not investment. It depends *only* on the spread between the forward price and the spot price at maturity, the latter being set by the market for the underlying.

Futures contracts are forward contracts whose trade is guaranteed not by the counterparties but by the exchange on which the contract is made, as is delivery date (to the month). Traded on an exchange, prices of futures contracts vary according to 'market forces':[39] the delivery price of an asset (K) goes up if more traders take a long position (that is, agree to buy an asset at a future date at delivery price) than short positions on it. The contract is then less profitable for the long position in relation to an anticipated increase in the spot price ($S_t - K$ decreases or is negative), but more profitable for the short position ($K - S_t$ increases). Equally, the preponderance of short over long positions (i.e., more selling than buying of contracts at a given delivery price in expectation that K is too high) drives the delivery price down.

In other words, futures markets price forward contracts according to the derivative markets' price movements as well as those of the underlying in its own market. Because of this 'self-correction', the futures market is speculative in the sense that it 'rewards' risk-taking on contingent claims: greater gains are to be made betting on a delivery price before there is a preponderant view that it is set too low and before the price of the underlying asset rises to meet it. In the standard account (which will be usurped below), both long and short positions are taken in their respective *expectations* of making a gain by advantage of this spread. As for forward contracts, these anticipations are obviously contradictory (they cannot both be right), but their common condition is that the eventuality upon which a gain or loss is occasioned depends upon the strike price which is necessarily and constitutively unknown at the time the contract is made. Insofar as that unknown comes to be determined by the pricing of the underlying in its primary market, the derivative's *exogenous* relation to that price is that of a traditionally-conceived wager: the throw of the dice does not depend on the bet made upon it, nor does the speed of the raindrop dripping down a window. By this account, derivatives are then but wagers on a price differential over time, an interpersonal and subjectively-constituted reckoning on circumstances external to the wager itself, predicated upon the non-knowledge of the future.[40]

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[39] Hull, *Options*, §2.3.

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[40] See J.M. Keynes, *A Treatise on Probability* (London: Macmillan, 1921), Ch.2, for probability as a determination of the degree of rationality of a subjective 'belief' in an as-yet-uncertain proposition given known propositions (evidence). Following the early analytical philosophy of his immediate milieu, probability for Keynes is however the degree of rational belief between propositions (as 'objects of knowledge and belief') and not,

The endogenous price movement of the futures markets is akin to odds on a bet getting shorter or longer depending on what other bets are placed.

As will be seen below, whether derivatives are wagers and, if so, what kind of wagers they are, is a primary determinant of the power ontology concomitant to capitalization's financiality. By way of previewing that extended discussion, it need only be noted that condemnation of derivatives markets as nothing but 'wagers on the movement of prices', prevalent after the 2008 crisis, was common enough at the time of the establishment of the Chicago Mercantile Exchange (CME) and its institutionalisation of futures trading in 1973 (elaborated further below).[41] Gambling—legally defined as a contract settled in cash only—was however proscribed in Illinois at the time, a restriction circumvented with paradigmatic consequences by specifying that any futures contract must be able to be settled by physical delivery of the underlying itself, even if in practice 'delivery was seldom demanded'.[42] That is, derivatives were legally sanctioned by securing them

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as with the wager on future contingencies proposes, between propositions and events.

[41] D. MacKenzie, *An Engine Not a Camera: How Financial Models Shape Markets* (Cambridge, MA: MIT Press, 2006), 14–15, 144–5, and 252 for the quoted characterisation.

[42] MacKenzie, *Engine*, 145. The vicissitudes of establishing institutional derivatives market in the United States and the struggles of its proponents—notably, founder of the CME Leo Melamed—to differentiate it from gambling is presented in MacKenzie, *Engine*, Ch.6.

as an attenuated mode of trade in the underlying to which they refer, thereby recusing the exogeneity of the derivatives contract to the trade in the underlying. This inhibition to the development of derivatives markets was removed in the US with a 1982 Senate ruling that it was precisely the cash settlement of derivatives trading that demarcated futures contracts from trading on stock indices such as the Dow Jones, a distinction correlative to their regulation by the Commodity Futures Commission rather than the Securities and Exchange Commission (SEC), which itself cleared the way for the regulatory variances between derivatives markets and stock markets.[43]

Options are contracts for the right to buy (call) or sell (put) underlying assets without necessarily having to trade the underlying asset at the agreed price (now called the 'exercise price' or 'strike price') by the agreed date (the 'exercise date' or expiration).[44] Unlike forward contracts, there is a contract fee for making an option which is lost if the option is not taken. Options are primarily instruments for hedging. The call option (the right to buy) on the underlying is purchased (long position) in anticipation of the price of the underlying asset increasing from the strike price. If it does not, the trader has to make the calculation as to whether the loss from taking the long position is greater or less than the loss made from the difference between the spot price and the strike price. The put option (the right to sell) is purchased anticipating a fall in price. To take the short position—to sell either call or put option at a later date—is to *write* the option: cash is taken upfront in exchange for the counterparty's right to buy/sell the option, taking the consequence of losing out on the gains (or not taking what would be losses) of the underlying at the option's expiration. For the trader writing the option, it is more profitable to sell the option for a gain then hold on to the security and sell it at a lower price. However, it may be that if the increase in the price of the security is less than that in making the initial option trade, the option is not exercised and the trader writing the option holds both the initial contract fee and the asset at an increased price, which they can then immediately sell.

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[43] MacKenzie, *Engine*, 172.

[44] Hull, *Options*, Ch.1.

Illustration
Anticipating COLLAPSE will publish a new essay by Quentin Meillassoux in three months and generate an upward surge in Urbanomic's share prices (listed as URB), a trader takes a long position on 100 call options (that is, purchases the right to buy) for URB shares at a strike price of 50lcu a share. The exercise date is four months from taking the position.

URB's current share price is 45lcu and the option price is 2lcu. The notional value of the option is 5000lcu but the actual credit exposure of the derivative contract—the price of the option itself—is 200lcu.

Four months later: Meillassoux's article proves to be of great importance and URB's equity price rises to 55lcu per share at the option's expiration date.

Exercising the right to buy URB shares at the exercise date (and immediately selling them on the market on which it is listed) results in a gain of 500lcu (the gain per share is 55-50 = 5lcu × 100 shares). Subtracting the option price of 200lcu and excluding transaction costs, the net gain for the trader taking the long position on the call option on URB is 300lcu. That is, the trader makes a 150 percent profit on the option after four months.

The counter scenario is that if, say, Meillassoux's article is superannuated before the option's expiration by the publication of a devastating pre-critique of his long-anticipated *L'Inexistence Divine*, URB's equity price drops to 43lcu per share.

Having taken the long position on the call option with a strike price of 50lcu per share, the trader faces the prospect of then making 43-50 = -7lcu per share.

With the option having been taken for 100 shares, this would lead to a net loss of 700lcu. At that point, it is a smaller loss for the trader to not exercise the call option and just lose the initial outlay of 200lcu.

If the loss from exercising the call option is less than the loss from not doing so, then it is still worth exercising the call option:

Even though Meillassoux's article is theoretically redundant, continuing interest in it and other material in COLLAPSE leads to URB's share price climbing to 51.25lcu by the expiration date.

The trader then makes 125lcu (51.25-50 = 1.25 per share × 100 shares) if the call option is exercised.

Though this is less than the 200lcu to take the long position on the call option, the net loss of 75lcu (125lcu from exercising the call option at a market price of 51.25lcu less the 200lcu for taking the long position) is still a smaller loss than *not* exercising the call option (200lcu).

This illustration is formulated with the trader taking the long position on the right to buy the security (the call option), but there are four basic combinations for option positions: long or short positions on call or put options on the underlying.

Though fully established as financial instruments since the inauguration of derivatives exchange trading in mid-seventeenth century Amsterdam and in London half a century later, option pricing was the key instrument for sanctioning the institutionalization of derivatives markets with the establishment of the Chicago Board Options Exchange in 1973 and the standardisation of pricing with the Black-Scholes-Merton model (elaborated in §5 below). That institutional consolidation overcame the 'close correspondence between option contracts and gambling', wherein legislation on the latter, dating as far back as the Romans, set precedent for legislation on the former.[45] The multiple routes for payout on the option are initial indications of the multiplying paths constructible with this class of derivative, the fabrication of which broadly constitutes the field of financial engineering. Options with straightforward payoff schedules are designated 'plain vanilla'; 'exotic options' have more complex payoff structures structured by more or less elaborate composite of sequenced expiration dates, conditional expirations, linkages between different assets, options, and criteria, the locking in and out of exit routes from the option, and so on.[46]

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[45] G. Poitras, 'The Early History of Options Contracts', in W. Hafner and H. Zimmermann (eds.), *Vinzenz Bronzin's Option Pricing Models* (Berlin: Springer, 2009); see also MacKenzie, *Engine*, Ch. 5. The first modern legislation on options was passed in 1697 to address various manipulations of price-setting on exchanges in London, and to distinguish it as a regulated market against its Amsterdam rival. The history of these derivatives can however be tracked back to before these modern mercantile institutions to Thales of Miletus who, in Aristotle's account (*Politics* 1259a), demonstrated that rational philosophy at its origin could generate wealth if the philosopher so chose. Thales reserved olive presses in the winter ahead of what he predicted by the rational calculation of astronomy would be a large harvest, renting them in the subsequent harvest 'on what terms he liked' thanks to the indeed bounteous yield of olives. For Thales, the purpose of this early demonstration of speculative hedging was that philosophers have other interests than wealth generation, a lesson that continues to be observed in the hostility to instrumental rationality; for Aristotle, precursor here to Kalecki, it serves as an example of 'taking an opportunity to secure a monopoly [that] is a universal principle of business', a determination that gives priority to the political economic result of Thales's demonstration and overlooks his primary lesson that reason is posits a contingent relation to the future *qua* financialisation in the service of capital-power, exposing at the origin of philosophy the latter's identity with instrumental reason from which philosophy is then only contingently and not necessarily distinguished.

Swaps are highly complex off-exchange (OTC) futures contracts whose underlying is not asset prices but cashflows.[47] Invented in the early 1980s, swaps exchange advantageous rates in different markets to hedge income streams by each party effectively paying for the other's cashflow via an intermediary financial institution. Example: a firm able to obtain preferential terms in fixed interest rate markets wants to borrow funds at a variable rate or for a shorter term than is available in the fixed-rate market. Swapping the preferential loan in the fixed-rate market for a loan obtained by another agency in the variable-rate market advantages not only the first company but also a counterparty seeking what, for it, is a preferable rate on the fixed-rate market. Because both comparative advantages are compounded in a swap, the net cost of the swap is less than that of the total notional amount; in the example above, both parties pay a lower rate of interest than that on the loans each has originated, resulting in an effective saving or income equal to the difference between the preswap cashflow and the swapped cashflows. This gain is split between the swap's counterparties. Currency swaps similarly take advantage of varying terms in different currencies, and swap contracts extend also to commodity markets, exchanging variable spot prices over a duration with a stable fixed price.

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[46] The vanilla/exotic terminology is attributed to Marc Rubinstein and Eric Reiner's 1992 detailed inventory of complexly structured options. See *Exotic Options, Research Program in Finance Working Papers* RPF-220 (Stanford: University of California at Berkeley), www.haas.berkeley.edu/groups/finance/WP/rpf220.pdf.

[47] Hull, *Options*, Ch.5. See also M. Greenberger 'The Role of Derivatives in the Financial Crisis', Testimony to the Financial Crisis Inquiry Commission Hearing, US Senate, 30 June 2010, fcic-static.law.stanford.edu/cdn_media/fcic-testimony/2010-0630-Greenberger.pdf.

Calculated only in terms of their notional amount, swaps are detached from any relation to nonfinancial assets. Swaps make explicit qua market instruments the abstraction and exogeneity of derivatives from the nonfinancial dimension of the underlying, a structural condition of the 2008 financial crisis. Exchanging repayments across financial markets, swaps interconnect those markets at the point of their primary revenue: a credit-based income stream into the future. Unlike forward contracts or options, the loan generating the cashflow of one party of the swap has to be in place before the swap is made. A position in a swap can be 'warehoused' by the intermediary financial institution until a suitable counterparty is secured as its second 'leg'. A default on that initial loan by one of the counterparties transfers liability of the credit risk to the financial intermediary. The intermediary institution, which takes on a structural role, also composes the swap, thereby providing an ersatz insurance to either party in case of a default in the cashflow of the counterparty, and taking a systemic role in the emergence and consolidation of the swaps market.

Despite the exchange-like properties of the swaps markets, their insurance-like operation, and the 'financial calamities' generated by unregulated swaps markets, including the default of California's Orange County in 1994 and the collapse of the Long-Term Capital Management hedge fund in 1998,[48] extensive political pressure in the US leading to the Commodities Futures Modernization Act of 2000 exempted swaps from being traded on exchanges, proscribed their standardisation by statute in favour of regulation by trade bodies, and even excluded the statute itself as a basis for legal challenges to swaps.[49] Consequently, swaps did not have meet any of the requirements of more formal insurance (a sector regulated by statutory bodies)—in particular, the requirement that the seller have adequate capital to service the default payment. The result of this sectorial activism was threefold: the increasing systemic centrality and interconnectedness of financial intermediary institutions in providing credit in general, the lowering of the price of credit swap arrangements which reduced its net cost, and the expansion of credit beyond any limitations imposed by reserve requirements.

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[48] Orange County, California, declared bankruptcy in 1994 after suffering losses to its various funds from large, unhedged positions in interest rate derivatives (Mackenzie, *Engine*, 223; the following account paraphrases Ch.8 of Mackenzie's book). Long Term Capital management (LTCM) was the poster-child of financial trading in the mid-90s, boasting Scholes and Merton on its Board and generating annualized returns of up to 40 percent (after fees) via arbitrage of small differentials between fixed-income long-term bonds such as government debt. The Russian financial crisis of Summer 1998 caused a market-wide 'flight to safety', to 'safe' long-term government and corporate bonds that formed the backbone of LTCM's trading strategy. Its positions were pressured both by extant widespread mimicry of its strategies across the financial sector, reducing its trading advantage, and by self-replicating divestments across the market in response to the crisis. Despite advanced hedging and risk-diversification strategies, the combination of these factors led to highly correlated losses across its portfolio. Providing liquidity to cover those losses from a leveraged position—that is, borrowing money to make trades and returning it (with interest) upon their completion—of about 27:1 (which, while large, was typical of large investment banks at the time) required it to divest from other positions at the wrong moment in the structured portfolio. Counterparty trading and divestment by LTCM's clients (which included most of the large investment banks) led to yet further losses. By late-September 1998, LTCM's capitalization was unsustainable, with liabilities of $100bn on an equity dropping from $2.3bn to $400m over that month. Because immediate liquidation of LTCM's securities would have led to a significant and systemic drop in market prices, the New York Fed orchestrated a $3.6bn recapitalization and buy-out of LTCM by the major American investment banks in September 1998.

The mid-2000s financial crisis was a direct consequence of the expanded role and systematicity of the intermediary-led systematisation of credit in which the role of Credit Default Swaps (CDS) was crucial. Invented by JP Morgan in 1994, a CDS is a form of insurance against default on a loan and the consequent loss of income for the lender.[50] The buyer of a CDS pays a premium to a seller to take on an underlying loan in case a 'credit event' (such as default) leaves the lender carrying the credit exposure. That is, the buyer displaces the costs of the default of some designated credit to another party, and removes the loan as a liability from the buyer's balance book. If there is a default, the seller of the CDS takes possession of that credit and the buyer receives compensation equal to its stated cost. In this eventuality, the buyer of the CDS gets reimbursed for the underlying loan—the insurance against default—and the seller pays to take the credit off the buyer's hands, leaving the seller with a double cost: the unpaid debt itself and the payout to the buyer. In case of no credit event, the seller receives the premium payments to maturity. In short, the credit risk is hedged. The CDS is similar to insurance in case of loan defaults, except that (i) the seller of the CDS holds the risk of credit default without holding the credit itself; (ii) the seller can sell the protection without capital reserves to compensate the buyer; and (iii) the buyer need not have any ownership claims over the underlying loan nor any direct insurable interest in it. These latter positions are 'naked' CDSs, the buyer and seller constructing the swap around a 'reference bond' that is owned by *neither* party of the swap, doing so in order to speculate on the reference bond's financial viability. Without any ownership requirements, one underlying can be the reference bond for multiple naked CDSs. Despite the evident credit risks of such structures, financial establishments and regulators supported the development of the naked CDS market, again in the interest of increasing liquidity for the reference bonds: the increased number of sellers and insurance-like structures against credit defaults enabled a greater number of credit event risks to be bought, and also greater flexibility (and therefore efficiency) in the market for risk, increasing the overall size—now meaning the credit exposure—of the market.

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[49] Greenberger, 'Derivatives', 5–6.

[50] Details of JP Morgan's invention of the CDS are given in G. Tett, *Fool's Gold* (New York: Free Press, 2009), Ch.3. Tett notes how, by 1996, JP Morgan had persuaded the leading US Federal Reserves to reduce the credit reserve requirements of major financial institutions on the basis that the derivatives dispersed risk, making any one institution less susceptible to credit default (49).

To return to the introductory comments above, then, the 2008 financial crisis was generated by the 'credit event' of defaults on CDSs, the underlying of which consisted of interlocked mortgages, the latter being by far the largest credit market in the US and UK. The amplification of this latter credit default by naked CDS derivatives which themselves could not be settled—the financial intermediaries not having to provide capital reserves to do so—explains in part the size of the crisis;[51] its systemic nature is a result of the interlocking of credit by financial intermediaries via swaps, exposing the credit risk thereby built into the financial system as distributed, uncontained, and without adequate capital backing. The result: systemic default. Furthermore, the deregulation of the OTC sector in 2000 stripped out its supervisory containment and capacity to prosecute, making it, in the words of the chair of the SEC in 2008, a 'regulatory black hole'.[52]

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[51] Greenberger notes that though only three percent of the notional amount of a swaps transaction is at risk as credit exposure, 'a credit default swap's insurance-like aspects mean that if a default is triggered, the entire amount of the sum guaranteed is at risk' ('Derivatives', 11)—which is why the diminishing of the size of the derivatives markets from its 'face value' to its credit exposure, as in the introductory comments above, is not always warranted. Combining the lower estimate of \$35tn of outstanding CDSs in September 2008 with three percent of the rest of the remaining swaps market (\$565tn), Greenberger arrives at a total sum for the credit exposure of the swaps market alone at the time of the financial crisis, wryly adding that 'even using the most conservative figures for the sake of argument, \$52tn is a very large figure'—equal to world GDP that year.

4.3. DERIVATIVES: CONSTITUTIVE LOGIC

This rudimentary exposition of the derivative mechanisms leading to the 2008 financial crisis provides some operational explanation of its causes and outlines the material conditions for the two Lessons identified in the introduction. Yet this is not sufficient in itself to address the questions posed by the analysis of capital-power: What mutation in modern power-rationality, if any, is instituted by finance-power? And to what extent is capital-power's constitutive financiality instantiated by these facts of financial operation, whose magnitude and global systemicity became explicit only in 2008 as an incontrovertible problem of power determination for the modern state settlement? To address these questions a formulation of the *logic* of finance is required that at once schematises its variety of practices and instruments in relation to the constitutive financiality of capital-power, and also delineates their common power ontology with respect to state formation. As will be seen, that determination is directly instantiated as *pricing*.

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[52] Christopher Cox, cited in Greenberger, 'Derivatives', 10.

The distinctive feature of all derivative structures, a feature explicitly demonstrated by forward and futures contracts, is that they are constructed and traded on the basis of a price differential. Trading strategies also exploit price differentials—across markets in arbitrage, but also in time across one market for hedging. At the simplest level of derivative construction, the delivery price of the forward contract (K) anticipates the future price of the underlying asset (S_t); more complex derivative structures take other factors into account (option cost, cashflow dynamics, etc.). The primary question for derivative pricing, then, is how the delivery prices K are set for derivatives, given that they can only be anticipations of future eventualities that must be unknown at the time the price is set but which, per the doctrine of market rationality, are nonetheless supposed to determine the asset price. The answer is straightforward but wholly counterconventional. It is not that markets set the delivery/exercise price but, as with Means's administered prices, that the contract *constitutes the price differential* between delivery and strike prices at a specified future moment in time. Or, in another, equivalent formulation: the contract defers the trade of the underlying in order to institute the price differential *and*, conversely, the price differential specified by the forward contract is simultaneously a deferral of the exchange of the underlying asset. Put schematically: the forward contract defers exchange to constitute a price differential for an underlying asset in time or across markets, just as its positing of that differential defers immediate vending of the asset. A deferred differential, a differentiating deferral: *différance*, in Jacques Derrida's terminology.

Taken out of its native philosophical element, Derrida's term and its logic serve here only to crystallize the operational constitution of derivative pricing. In formal terms, this logic is as follows: as noted, différance combines difference and deferral. Each term is constituted by the other: difference here is not a difference between already established positive terms (A and B) that assumes their presence, which is, for Derrida, the metaphysical mistake of Western thought. Rather, différance emphasises 'one of the two themes of the Latin *differre*' in a way that the more conventional 'difference' does not: namely, 'the action of putting off until later, of taking into account, of taking account of time and of the forces of an operation that implies an economic calculation, a detour, a delay, a reserve, a representation—[in short]: temporization [*temporisation*]'.[53] Constituted by their différantiation, differentiated terms 'detour' through one another to establish their quasi-positive but necessarily incomplete determination, a deferral of their self-identification that is a delaying or spacing (*espacement*) of any alleged selfpresence to itself, an 'itself' that therefore never arrives as such. The differentiated terms are only ever quasiestablished because of the constitutive deferment of their distinct identities (qua plenitudinous presence). 'The *a* [of différance] comes more immediately from the present participle (*différant*) and brings us closer to the action of "differing" that is *in progress* [emphasis added], even before it has produced an effect that is constituted as different or as difference'. Derivatives *constitute* price differentials precisely according to this différantial logic of temporization, which is no less their operation: the delivery or exercise price is not the price as and when the contract is drawn up, and without the *noncoincidence* of the delivery price with the strike price there could be no derivative but only spontaneous vending. Addressing the différantial constitution of the present, Derrida remarks that 'an interval must separate the present from what it is not for it to be itself, but that interval which constitutes it as present must also in the same blow divide the present

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[53] J. Derrida, 'Différance', in *Margins—of Philosophy*, tr. A. Bass (Chicago: University of Chicago Press 1982 [first delivered 1968]), 8, for this and the next two quotes. Translations here and elsewhere are slightly modified. Temporization looks to capture the sense of delaying or time-passing rather

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than the general order of time (temporality). The 'economic calculation' Derrida mentions in this quotation is in the general sense of the term of a dynamic configuration of interdependent diverse and varied elements, not any specific determination of monetary or fiscal economy such as, here, finance capitalism.

in itself'.[54] Substituting 'price' for 'the present', the identical scheme holds for the derivative: an interval must separate the price of the underlying from what it is not (that is, the delivery price) for the derivative to be itself, but that interval constituting the derivative (as distinct from exchange of the underlying) divides/defers/detours the present of the derivative between/across its signing and maturity. Consequently,

> différance is what makes the movement of the derivative market [Derrida has 'signification'] possible only if each element that is said to be 'priced' [Derrida: present], appearing on the stage of price [presence], is related to something other than itself but retains the mark of a past element and already lets itself be hollowed out by the mark of its relation to a future element. This trace relates no less to what is called the future than to what is called the past, and it constitutes what is called the present by this very relation to what it is not.

For Derrida, that trace of différance is the necessarily ineffable temporising constitution of the present; here, in the dimension of finance, it is the derivative contract. The identification of its logic takes a further step with the substitution of price for 'space' in the elaboration of the temporising trace: 'constituting itself, dynamically dividing itself, this interval is what could be called pricing [Derrida: spacing]; the becoming-price of time or the becoming-time of price'. That is, the 'interval itself' is the derivative qua pricing contract: the becoming-price of time or the becoming-time of price. In short, derivative pricing is différantial; or, derivatives are a différantial pricing.[55] It is not that the derivative records a price movement against a calibrating price—a theorization which, as will be seen, dominates their institutional practice maintaining as it does the supposed secondariness of derivatives to pricing in the 'real economy'—but that it instantiates/implements the intervallic differentiation characteristic of différance in terms of pricing. Here temporization is the condition for speculative accumulation.

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[54] This and the next two quotes: Derrida, 'Différance', 13.

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[55] Samuel Weber proposes a religiohistorical deconstruction of money as credit-implement in the view of the 2008 crisis in *Geld ist Zeit: Gedanken zu Kredit und Krise* (Zurich-Berlin: Diaphanes, 2009; English version available at www.complit.u-szeged.hu/images/weber_-_money_is_time.pdf). Weber's hybridisation of money, temporization, and modern finance as inheritor of a (Max) Weberian Protestant ethic in order to spiritualise the determination of finance (as a secularized perpetuation of Protestant Christianity, per Walter Benjamin's half-thesis on capitalism) is discarded here for reasons stated in n.24 above. More salient is Brian Rotman's identification of the deconstructive conditions of finance in the proliferation of 'xenomoney' of offshore American currency—Eurodollars—that precipitated the exit from the Bretton Woods monetary regime in August 1971 when the US took the dollar of the goldpeg that had anchored the post-war Euro-American settlement (*Signifying Nothing: The Semiotics of Zero* [New York: St Martin's Press, 1987]). For Rotman, the inconvertibility of money to anything outside of itself leaves it 'signifying' only in relation to future states of itself, including the 'purely financial dynamics' of futures currency markets (93–96). Rotman identifies such endogenously constituted signification with Derrida's excision of a 'transcendental signified' as condition for the sign opening the space of language qua world of floating signification. The identification is however at best only analogical for Rotman, a 'structural morphism' (103). The contention of the present essay, however, is that while the size, growth, and intensity of modern derivatives markets were monetarily facilitated by the removal of the gold barrier (as recognized by Milton Friedman in his 1971 paper sponsored by the founders of the Chicago futures market and dedicated to legitimating its establishment [MacKenzie, *Engine*, 145–48]), the Derridean logic is *directly* that of the derivative contract and its market operationalisation; and then is it the truth of money qua creditory relation (see §11.3 below). The latter truth is espoused by Modern Money Theory, for which the common establishment of creditory basis of money, as its 'unit of account', is uniquely a state operation, its fiscal sovereignty: see É. Tymoigne and L. R. Wray, 'Money: An Alternative Story', in P. Arestis and M.C. Sawyer (eds.), *A Handbook of Alternative Monetary Economics* (Cheltenham: Edward Elgar, 2006).

The proposed identification is not, however, total. Derrida follows Levinas in extending the past of the trace into an absolute past, an alterity that is constitutive of the present, but irrecuperable to any self-present and hence irremediably anterior to it. Such a past is a necessity because the différantial constitution of the present is a logically anterior condition to presence and therefore temporally precedes it. The trace *qua* derivative contract is, by contrast, only the finite and instituted différantial organization of pricing, organized and utilized for capital accumulation without the sacrality guaranteed by the absolute past. Furthermore, while presence-constituting différance is a general metaphysical condition corroding any paradigm privileging or presupposing presence as its condition—for example, in the Western tradition, (phenomenological and psychoanalytical) consciousness, semiotics, idealism, empiricism, etc.—derivatives are but regional manifestations of différantial price-constitution. In particular, if ontology in the Western tradition presumes presence as its condition and term, derivatives are not preontological (that anteriority being one of Derrida's primary claims for différance); rather, their ontology consists of a binding and enforceable contract that is constituted by statute. That is, the institution of derivatives is the constitution of price différantiation.

4.4. INSTITUTING DIFFÉRANTIAL PRICING

The logic of derivatives *qua* différantial pricing is that of their institutional construction. The schematic form of différantial pricing just presented consequently facilitates several praxical implementions of capital accumulation. Though some of these configurations may affirm the différantial organization of pricing as such, others effectively delimit it by coding it in abnegating formats. These various historical-institutional determinations of derivative pricing are advantageous to the present analysis because they give a specific shape to the schematic account of the constitutive logic of derivatives just outlined, thereby enabling both that logic and those particular configurations to be analytically and politically situated rather than taken for granted. In turn, the power-ordering of capitalization as constructed (which is not yet to say constituted) by finance will then be able to be similarly situated.

There are four stages in the demonstration of the politics of différantial pricing: 1. Its standard account, in which derivatives are but speculative tracking descriptions of the price-development of a referent external to the derivative—an *anticipatory* constative model of exogenous pricing that commences from the present; 2. Its constitution of complex modes of intrinsically temporal *and* social binding of the present in which the necessary uncertainty and ignorance of the future takes priority, instituting a sociorational ordering of risk in which all price determinations are continually revised; 3. As a wholly endogenous pricing and operationalisation of an unprecedented mode of betting, in which derivative pricing refers only to its own market in a *counterperformative* act that makes explicit the occasional condition of its exogenous reference and of the 'real economy' for price and capital-power; 4. As *absolute*, when the endogeneity of différantial pricing is extended to exogenous pricing processes external and putatively 'primary' in relation to derivative markets. It is with this last step that the derivatives pricing operations of financial markets are articulated with the a priori financiality of capitalization. With that final step, the identification of the specificity of capital-power's reordering of power is made explicit—not only in the conceptual-philosophical determination of price temporization, but also in two praxical renditions: firstly, that derivatives are a new kind of wager; and, secondly, that the key technical term 'price volatility' indexes the ontology of derivatives pricing within and beyond its institutional operations. As will be seen, each of these coextensive determinants of pricing—temporization, the wager, volatility—undergo substantial modification in the course of the analysis, because modern financial institutions inaugurate unprecedented modalities and practices of each, not just reordering power in the state-finance nexus as they do so, but actually reconstituting it.

5. ANTICIPATORY PRICING: THE BLACK-SCHOLES-MERTON REGIME

Markets for financial rather than commodity derivatives have been massively operationalised since their institutionalization with the Chicago Mercantile Exchange (CME) and Chicago Board Options Exchange (CBOE) in 1972–73, almost contemporary with Derrida's theoretico-philosophical identification of the logic of différance. As mentioned, the CME could only be sanctioned by the Illinois regulatory bodies if futures trading was not a form of gambling, a stipulation which required settlement by delivery of the underlying rather than cash.[56] CME executives obviated the injunction with a three-pronged response: firstly, the underlying *could* be delivered if it was anyway a financial object such as foreign money in currency trading (Deutschmarks to a trader's German bank, for example), as advocated by the CME (a market that was historically inaugurated precisely by the flexible exchange rates consequent upon the decline of the fixed-rate Bretton Woods system), or a market in stock options, the certificates of which could in principle be delivered to the trader, a route preferred by the CBOE. Secondly, legitimating the proposals through personal and political-academic validation, eagerly provided by Milton Friedman at the University of Chicago; and, thirdly, formalising the pricing process in order to remove the guesswork, characteristic of gambling, as to what unknown future prices will be. This formalisation was developed by Fisher Black and Myron Scholes from the late 1960s, and mathematically extended by Robert C. Merton in the early 1970s. Even though it is highly restricted in its assumptions and applicability, the Black-Scholes-Merton (BSM) equation has been the orthodox, integrally acknowledged, and massively operationalised pricing model of derivatives markets since the inauguration of the modern derivatives exchanges.[57] That institutional consolidation has been warranted specifically by the formalisation's determination of derivatives as constative predictions of price movements exogenous to the derivative, for which the price that the derivative is written is an initial boundary condition. The putative predictability of options price movement—that is, as ahead of but secondary to the 'real' movement of prices happening elsewhere—was thus key to obviating the statutory objections to the political institution of derivative exchanges. The following schematic overview of the BSM equation not only serves to explicate the standard options pricing model, allowing its countertheorization to be better located; it also directly exposes the praxical instantiation of the standard economic doctrine of modern capital-power in its ordering of difféerantial pricing and temporization. Each aspect of the exposition informs the other: the countertheory of price being established here proposes that the standard *ratio* of pricing is in fact vitiated by the very financial operations that are supposed to be constituted by it, doing so, as will be demonstrated, even beyond the confines of institutionalised derivatives markets—that is, at *every* instance of pricing,

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[56] The institutional history in this section paraphrases MacKenzie, *Engine*, Ch.6.

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[57] MacKenzie, *Engine*, Ch.5 presents a nuanced appreciation of BSM's theoretical development of precedents formulated by Louis Bachelier in 1900 and Edward O. Thorp in the 1960s, as well as the contingencies leading to its institutional innovation and ramifications.

The assumption of BSM is that price is a variable measure of what wares are worth to their users.[58]

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[58] In the technical terms of marginal utility theory, value is derived from 'the utility that an individual derives from the consumption of a quantity of a particular good [...] determined by his or her subjective assessment of the pleasure, or satisfaction, derived from consumption', its price being given by the monetization of that exchange (J.E. King and M. McLure, 'History of the Concept of Value', preprint from *International Encyclopedia of the Social and Behavioural Sciences* [Amsterdam: Elsevier, forthcoming], 6, www.business.uwa.edu.au/___data/assets/pdf_file/0004/2478883/14-06-History-of-the-Concept-of-Value.pdf). Inaugurated by Jevons, Walras, and Menger in the early 1870s, and institutionalized in Western Europe and

Meaning that prices are measures—that is, descriptors—of changing conditions external to prices themselves over time (what Means called 'market prices'). However, derivatives prices explicitly factor the uncertainty of future prices into the pricing calculation as their precondition—no gains or losses could be made with a derivative if the delivery price could be guaranteed. According to this account, future prices are at best calculated guesses constructed from the known price at the time the derivative contract is made. They are a constative anticipation of the price development of the underlying (exogenous to the derivative's pricing) in

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the US a generation later by Pareto, Marshall, Böhm-Bawerk, and others, marginal utility theory forms the basic premises of Neoclassical doctrine by formulating price setting as a dynamically constituted equilibrium through exchanges made by a subjectively-constituted referent whose 'desires' are exogenous to the market (namely, the utility of the good to the consumer who is maximising their utility outside of the market itself). The utility of a particular item qua subjective demand for it tapers out with increasingly ready availability while, on the supply side, artificially high prices on readily available wares can always be undercut by rival suppliers. Equally, scarce goods are highly priced because their scarcity makes them more desirable to a consumer wanting to maximise her or his utility qua consumption, and so each such good requires the consumer to exchange her or his other wares having less marginal utility in order to acquire the good with greater marginal utility (the bartering of many ubiquitous goods for a small number of precious items is a basic example of this exchange). The market is then dynamic and flexible, changing according to the interests of the consumers and quantitative provision of wares until equilibrium is reached as prices meet demand. Adaptable as the theory is to changing situations and needs of consumers and provision to determine price-setting, its presumptions—the utility-maximising consumer for whom exchange is but barter in however attenuated a fashion—contrast starkly with Nitzan and Bichler's formulation for which the luxury good is a luxury only because it is highly priced, irrespective of its use-value, production costs, or—as will be seen in §10 below—even its exchange 'value'.

the period up to expiration.[59] The insurmountable yet structuring difficulty of this formulation is that such anticipatory pricing is in each instance only a reckoning with the 'next step' of a price development that is *in fact* unknown. The problem is resolved by formulating différantial pricing as a stochastic process, for which the fluctuations of a *particular* element of the system cannot be predicted (in this case, the 'next' price of the underlying; in physics, paradigmatically, the position or velocity of an individual particle in a gas). The account of aggregate systems-development given the 'random walk' of its elementary units places two stipulations on its formalisation: that succeeding states of elements in the system are discontinuous from preceding conditions, and that the future states of the system cannot be exactly predicted but only described *probabilistically*, meaning a statistical determination of the path development of the system both in its individual elements and in aggregate. Such processes require a calculative model distinct from Laplacian systems, for which the path development of every element in the system can be directly predicted if the initial conditions are known, as in Newtonian mechanics.

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[59] Although the BSM formula is the paradigmatic model for this regime of pricing, the operationally equivalent Cox-Ross-Rubinstein (CRR) binomial tree is the more widely-used formalisation (J.C. Cox, S. Ross, and M. Rubenstein, 'Option pricing: A simplified approach', *Journal of Financial Economics*, 7.3, 1979, 229–63). Option price movements in this model are calculated by a discrete-time branching (a 'lattice') of probabilities of prices increasing or decreasing at a certain time increment. Each resulting probability is a new node for the further calculation of price movements. Consequently, after a few iterations, several branches in the probability tree can lead to a given price. While the paths actually taken by the option can only be specified upon expiration, the increasing or decreasing probability of price movement gives the trader a predictive range of routes.

The first stipulation of 'memoryless' path development is known as the system's *Markov property*, which means broadly that the system's past does not influence the operations and dynamics of its current state;[60] the second stipulation is characteristic of Wiener processes (after Norbert Wiener, cybernetic pioneer), the best known of which is Brownian motion of particles. Taking market pricing as a Wiener process, the uncertainty of the actual movement of a price in the future is rendered as a probability—a bounded and calculated anticipation—which, by necessity of its mathematical modeling, can only go up or down by a certain bounded percentage at 'the next step' given the initial price. Thus the trader exchanges contracts on the basis of probabilities that say nothing about the past or future in fact or in principle. The anticipation of price movement, the measure of changing 'market forces', is both memoryless and, given its unpredictability, futureless.

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[60] For example: the boiling point of water remains the same under constant external conditions irrespective of whether it has previously boiled or been frozen or neither; similarly for the next coin toss, dice throw, or spin of the roulette wheel, if they are not loaded. Or, in the standard caveat of financial funds, 'past performance is no indication of future results'. Put otherwise, knowledge of any state of a Markov process is adequate for knowledge of its history because that history presents no further information than the present provides. As Hull notes, the Markov property is then a weak form of market efficiency in that for the latter the present price of an equity or stock captures all the information contained in the record of past prices and the market (*Options*, §12.1).

It is only the *present* probability of what the future might be, a calculated 'perhaps' which bears all the information of the system's history. This then is the reduction of différantial pricing that was necessary in order to operationally distinguish options pricing from gambling, the latter being explicitly predicated on the present ignorance of the future.

The salient feature of Wiener processes for the construction of the BSM model is that the system equation is composed of two parts, one representing the linear development of the system in time, a drift rate that in finance is the normal rate of return, the second containing a random term indexing the stochastic yet bounded 'memoryless' condition of the system's development. In its standard formation, this second term is provided by a random coefficient drawn from within the standard deviation of a regular probability distribution (a limitation that is not considered overly restrictive because, even if the next step of the random variable is unknown, it is nonetheless bounded). This random term is called the *variance* of the system, and indexes its 'noise' against the standard growth rate. Expressing the random walk of the variable more usefully as a function of a continuous time variable (in which the drift rate of the system is expressed) requires the index of its constrained randomness to be given by its *volatility*.[61] Volatility is, for example, the measure of the uncertainty of returns from investment in a given stock. It is nontrivial in magnitude, since the effect of volatility upon price can sometimes far exceed that of the drift rate over a given time. And it is nontrivial in the formulation of BSM: securing an acceptable level of return requires the reduction, if not the elimination, of the volatility intrinsic to the very formulation of the price development as a Markov process. Given that the derivative price is determined to be strictly exogenous to the *price* of the underlying, the BSM formula structures a portfolio that cancels out volatility by combining a long/short position on the price of the underlying (usually equity stock) with a position on an option on that underlying such that the volatility of one offsets that of the other.[62] That is, the formula engineers a return on the portfolio at its drift rate, which is the risk-free rate of return of the market, by hedging the price of the underlying against the price of a derivative based on it, a process called 'delta hedging'.[63] The linking of the two prices and respective

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[61] Following the mathematical derivation, the variance of the standard

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deviation of the probabilistic determination is the square of volatility. See Hull, *Options*, §13.4 for mathematical account of volatility.

[62] For a mathematical derivation of BSM see Hull, *Options*, §13.6

[63] The Efficient Market Hypothesis, summarised in Eugene Fama's 1970 formulation that 'prices always "fully reflect" available information' (cited in Mackenzie, *Engine*, 65), follows directly from marginal utility theory: all market-makers use the available information to trade with one another leading to a unique market price. Price thereby reflects an equilibrium that is a 'rational' settlement and disrupted only by further new information. The risk-free rate of return is a result of the Capital Asset Pricing Model (CAPM) developed in the 1960s, in which risks on items of a stock portfolio arriving

volatilities is not entirely arbitrary, in that each price is 'affected by the same source of uncertainty: stock price movements'.[64]

It is intrinsic to the Wiener process that the solutions to the equation change with time and also with the initial conditions of the primary variable, in this case the spot price of the underlying. Consequently, (i) the solution for the price process of the derivative changes with the price development of the underlying, and (ii) the delta hedge portfolio is only valid for theoretically infinitesimal (but in practice very short) durations; furthermore, (iii) the BSM model can only be constructed if idealized stable background conditions and parameters are assumed, though these are infeasible in practice.[65] But given these severe constraints, the

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at their respective equilibrium prices are counteracted by diversifying the scope of the portfolio (Mackenzie, *Engine*, Ch.2). The 'risk-free' portfolio is therefore the stock portfolio with the greatest diversity: the market itself (excepting disruptions to the market as a whole). It follows that higher returns than the market average require portfolios with greater risk—at the limit, the price movement of just one stock. In Mackenzie's words, CAPM is 'finance theory's canonical account of the way stock prices reflect a tradeoff between expected [emphasis added] return and risk (in the sense of sensitivity to overall market fluctuations)' (*Engine*, 28).

[64] Hull, *Options*, §13.5

[65] Including: stable borrowing costs (i.e., constant background interest rates), no transaction costs, no dividends during the lifetime of the security (which payout will have repercussive effects on returns on the option), no trading of the securities, no arbitrage opportunities (no external advantage or pressure for monetary reasons), and that trading is continuous (Hull, *Options*, §13.5)—none of which in fact hold. Later developments of the BSM equation allow several of these constraints to be relaxed. For a broad, technically informed dismissal of BSM as institutionally and theoretically underdetermining more practically viable precursors (such as Thorp and Bachelier) thanks to its misguided Neoclassical and therefore idealised

'equal and opposite' construction of the portfolio in the BSM model means that the position of the portfolio at the end of a short enough time period can supposedly be known with certainty: it is the expected rate of return of the combined positions in the underlying and the option. And given the expected rate of return, the model and its stipulations can be manipulated to find the right price for options so as to secure a risk-free return over short-enough periods irrespective of the risk class of the underlying. By excising volatility, the BSM portfolio generates returns at the market rate independently of what the underlying is, i.e., independently of the risk preferences of the trader; so it lowers the barrier to riskier underlying assets, thus diversifying and consolidating the market in these asset classes. Such 'risk neutrality' is a strategic articulation of the anticipatory model of pricing in the BSM regime. Thanks to the probabilistic standardization of pricing in options markets—quite distinct, then, from betting and its ineliminable risk—the institutional effect of BSM has been to operationally legitimate the establishment of the CBOE and to increase the size of the options markets. Furthermore, in its risk-neutral coupling of options market with those of their underlying, it also enabled an increase in the size of the underlying financial markets too.

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determination of pricing, see E.G. Haug and N.N. Taleb, 'Option traders use (very) sophisticated heuristics, never the Black–Scholes–Merton formula', in *Journal of Economic Behavior and Organization* 77 (2011), 97–106.

Ineliminable Volatility

The BSM anticipatory pricing equation and its concomitant risk neutrality presume the stability of the background conditions—an idealization which is not only operationally false but which in any case is theoretically constrained to the vanishingly small timespans for which the delta hedge portfolio is valid (i.e., until the ‘next step’ in the random walk of the spot price). Over any ‘extended’ time in which the spot price changes ‘unpredictably’, as it must do according to the initial assumption of the model, different solutions to the BSM equations are required. Consequently, the proportion of derivative securities to the underlying in the portfolio needs to continually change in order to maintain risk-neutrality. That continued recomposition of the portfolio, known as ‘dynamic replication’, follows the price development of the underlying in order to maintain both the risk-neutrality of the portfolio and also the removal of volatility from its return. Yet the development of the portfolio through dynamic replication, which also prices the option component on each iteration, conveys the quasi-random price movement of the underlying—the very volatility that the BSM portfolio is constructed to excise. Two methods make volatility apparent after its theoretical elimination in the BSM model: the historical record of the asset price and the method of implied volatility.[66]

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[66] Hull, *Options*, §13.12.

Aggregate implied volatility represents asset price volatility as it is manifest through the price development of different options based on a single underlying; a method that permits the price of one option to be used to calculate the price of another option based in the same underlying asset.

The simultaneous occlusion *and* manifestation of volatility from the BSM regime does not necessarily present a problem in practice: priced in time rather than as a punctual theoretical formulation, the price volatilities of the underlying and the attendant option are *indexed* by the dynamic replication of the BSM portfolio. But the theoretical quandary is insurmountable: even though volatility is the very condition for the recomposition of the BSM portfolio, its formulating equation proscribes any explicit determination of price volatility, rendering it unobservable within the terms of that formula and preventing the causes of volatility from being established within the limited determination of those solutions.[67] In fact, implied volatility is of primary significance in determining derivatives in terms of differantial pricing, as can be drawn out by reformulating the preceding result: the requirement for constant iteration of the BSM equation implies that volatility is generated not by factors external to the financial market, but rather by the trading itself.[68]

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[67] Ibid., §13.13

[68] With regard to stock prices, see K. R. French and R. Roll, 'Stock return

But if, in this model, the price volatility of the underlying informs the corresponding option's volatility, and if the BSM portfolio is constructed in order to remove volatility effects, then, contrary to the primary assumption that BSM relies only upon the constative (because exogenous) pricing of the underlying, the volatility of the price of the underlying is in fact *endogenous* to its market, as then is the option pricing. Furthermore, since the delta hedge portfolio is composed of both the underlying and the option, volatility in the option price requires trading in the underlying, generating volatility.

Options pricing in the BSM model does not then in fact refer to an exogenous price. Rather, pricing is constituted endogenously to both the derivatives market and that of the underlying, which are now interlinked.[69] Options pricing Is itself also a market 'force', as is pricing of the underlying in its own market. The BSM regime of option pricing as constative or merely anticipatory

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variances: The arrival of information and the reaction of traders', *Journal of Financial Economics*, 17:1 (September 1986), 5–26. With regard to volatility of stock prices, systemically observed to 'be negatively correlated with lagged [unexpected] returns', see D. Avramov, T. Chordia, A. Goyal, 'The Impact of Trades on Daily Volatility', *Review of Financial Studies*, 19:4 (2006), 1241–77. Avramov et al's thesis that such asymmetric volatility is 'governed by the trading dynamics of informed traders and uninformed traders' is extended to the futures market and confirmed in J. Kittiakarasakun, Y. Tse, G.H.K. Wang, 'The impact of trades by traders on asymmetric volatility for Nasdaq 100 index futures', *Managerial Finance*, 38.8 (2012), 752–67.

[69] As confirmed and compounded by indices of implied volatility such as the CBOE VIX that then enables the pricing of volatility as itself an underlying for derivative construction.

of exogenous price movements starting from the initial price and hence calculable qua probability cannot then be maintained other than by its static and therefore highly constrained determination. That anticipatory model provides only the instantaneous composition of the delta-hedge portfolio, a falsification of the pricing process of both options and the underlying that is consequent upon that regime's *presentism*. Evidence that the BSM model is wrong is empirically provided by 'volatility smiles' and skews: within the modeling parameters of BSM, the price of a vanilla option only increases linearly with its volatility, and the implied volatility should be independent of expiration and strike price; yet, since the October 1987 stock market crash, prices have taken nonlinear paths in all three regards.[70] That such curves are manifest after the 1987 crash but not before indicates that the pricing process is *not* memoryless: a past event structures all subsequent processes in the system. Bearing a constituting past, options pricing does not observe the Markov property, which is not only the condition for the probabilistic determination of anticipatory pricing, but also for the BSM model tout court. Furthermore, nonlinear implied volatility paths again suggest that volatility is generated by conditions endogenous to markets, including derivative markets—a result leading to the argument, elaborated further below, that if volatility arises from *within* the price process itself, then derivatives pricing has to be distinguished from traditional determinations of betting, in which gains or losses depend on a referent external to the wager itself.

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[70] Specifically, charting implied volatility against strike price yields a valley-like curve whose turning point is the at-the-money option (that is, options whose delivery price is the spot price of the underlying), a curve known as the volatility smile. More systemically, the implied volatility of at-the-money options is also observed to be slightly lower than options in- or out-of-the-money (those with delivery prices respectively above or below that of the spot price, netting a gain or loss). Furthermore, implied volatility of an option changes not just with the strike price but also with expiration, meaning that it is better charted as a volatility surface with a horizontal reference plane having the axes of expiration and strike price. Different markets have different typical curves. Mark Rubinstein was among of the first to model the volatility surface using the CRR formalism he codeveloped ('Implied Binomial Trees', *The Journal of Finance*, 49:3 (July 1994), 771–818) while Bruno Dupire formalized the volatility smile in terms of BSM in the same year ('Pricing with a smile', *Risk* 7 (1994), 18–20), but such 'one factor' models have since been shown to have severe limitations. A multifactor formalism for the development of the volatility surface in conditions where arbitrage across markets is not possible is developed in T. Daglish, J.C. Hull, and W. Suo, 'Volatility surfaces: Theory, rules of thumb, and empirical evidence', *Quantitative Finance*, 7.5 (2007), 507–24.

For now, however, the *minimal* result is that options pricing is neither anticipatory nor merely constative. More emphatically—and this is what will move the analysis from the dimension of derivatives as institutional financial operators to the dimension of the power-rationality of capitalization's financiality—implied volatility manifests the différantial logic of derivative pricing, which is exorbitant to the presentist determinations of the BSM regime. Instantiating différantial pricing and its temporization in fact, the institutional praxes of BSM misidentify and constrain that logic within the stasis of the calculable 'maybe' of anticipation: price development as probabilistic.

Standard financial praxes thereby proscribe the complete account of their own operation as both logically predicated on *and* operationally constituting the volatility (and its pricing) that they institutionalise—that is, an account of price as more than merely constative of conditions and 'forces' acting elsewhere. Given the dominance (in theory and pecuniary magnitude) of these standard financial praxes, what is theoretico-politically exigent is a countertheorization of différantial pricing that does not presume either the present price as the basis or inauguration of the pricing process, nor the constitution of price as exogenous to its own institutional process.

6. COUNTERPERFORMATIVE PRICING

Key elements of the required countertheory are provided by the sociological accounts of finance markets given by Donald MacKenzie and Elena Esposito.[71] Both propose that derivatives markets are not constative but performative—in MacKenzie's words, 'an engine not a camera'—because derivatives pricing is shaped by the fact and method of pricing itself, rather than exogenous factors such as the vicissitudes of the underlying prior to pricing. MacKenzie's mainly historical-institutional account identifies two salient regimes of performativity for options markets. The first is 'Barnesian perfomativity' (after Barry Barnes's sociology of science) in which economic processes and outcomes transform to better fit the theoretical model, in a 'self-validating feedback loop':[72] consequent on the establishment of the CME and widespread use of BSM, 'the financial markets changed in a way that made the [BSM] model's assumptions, which at first were grossly at variance with market conditions, more realistic'.[73] That 'realism' was undone (most intensely in the US) by the October 1987 crash, after which the persistence of regular volatility skews meant that 'no analysis now finds the [BSM] model to fit the observed pattern of prices of options well'.[74] Such is the second regime of performativity for which 'the practical use of finance theory sometimes undermines the market conditions, processes, and patterns of prices that are posited by the theory'.[75] The 'undermining' of the conditions and results occasioned by and for the very theory that constitutes them more exactly marks out its ‘practical’ use in this second regime as being *counterperformative:* pricing takes place *against* the constative determination of pricing. For Esposito, distinct from MacKenzie in her adoption of a Luhmannian systems-theoretical approach, such counterperformativity is not an episodic occurrence of financial pricing but rather, and in fact, the primary characteristic of such markets: derivatives markets are necessarily and intrinsically set to run against their theoretical models because volatility is endogenous to pricing itself.[76] In Esposito’s terms, the volatility of derivatives markets indicates how the future stipulated by the derivatives contract ‘is unpredictable *because* it is produced by the very present that tries to predict it’.[77] As implied volatility indicates, the probabilistic anticipation of price development is vitiated in its very instantiation because derivative pricing shifts the price away from the magnitude it putatively predicts as an exogenous referent. In short, derivatives markets *constitute* prices. To understand how and why requires a more detailed exposition of Esposito’s argument, which has the

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[71] MacKenzie, *Engine*, and E. Esposito, *The Future of Futures: The Time of Money in Financing and Society* (Cheltenham: Edward Elgar, 2011 [Italian: 2009]).

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[72] MacKenzie, *Engine*, 19.

[73] Ibid., 256.

[74] Ibid., 202.

[75] Ibid., 24. More specifically, while options markets still deploy offshoots of the BSM model for pricing, the risk-management of option pricing now accommodate the 'wild randomness' of discontinuous jumps in pricing and volatility that such models gave rise to but can not theorise. Risk-management in this second regime of performative pricing requires an increase the 'margin requirements'—the initial price of the option deposited with the exchange—so that 'catastrophic events' do not force further selling of options and exacerbate price volatility. It also requires a shift from the assumed normal distribution of the BSM model, in which outlier 'extreme' events in the tails of the distribution are unlikely, toward the Lévy family of variable distributions with thicker tails, developed in relation to finance

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by Benoit Mandelbrot, for which the standard requirements of statistics such as standard deviation and variance can be infinite, meaning that while the techniques developed on the basis of such models are probabilistic nonetheless ‘standard statistical techniques evaporat[e]’ (Ibid, 108ff.).

[76] For the ‘wild variation’ of the market destroying its regular statistical distribution see Esposito, *Future*, 148–51.

[77] Esposito, *Future*, 128, emphasis added.

advantage of leading back to the articulation of the institutional financial operations of derivative markets in terms of pricing qua temporization, which will in turn be the basis upon which the particular determination of finance-power can be made.

Time is the leading category in Esposito's theory of derivatives pricing because for her derivatives are complex time relations fabricated by institutional methods of social organization. Specifically, derivatives mobilise the distinction between the present future, which is 'our current anticipation of the future', and the future present, or the 'present that will become actual in the future'.[78] What is traded on derivative exchanges is not the future given (the then unknown strike price of the underlying) but the present *risk* of that price against the delivery price.[79] Derivative pricing consequently refers 'to the present way of seeing the future, not to the unknowable future that will come about later'.[80] It is constituted in the 'management' of the price movement between present future and the future present. What is managed qua pricing is the convolution of the uncertainty of the strike price in the future present anticipated as a present future. And what is priced as volatility in derivatives markets is not then the variability of price at expiration stemming from the present—as proposed in the BSM model—but the *uncertainty* of price given the present inactuality of the future present. That is, derivative pricing makes explicit in the present the relation to an inactual and necessarily uncertain future present—as a present future. As such, it indexes the core characteristic of time in Esposito's systems-theoretical method, namely that because they are never (the) present, the 'past and future are never given, but become actualized as horizons of inactuality for a present that does not last'.[81] In the general pragmatic terms of systems theory, a relation such as the management of price movements between the present and the future constitute 'the unity of actuality and inactuality' which is time. Time, on this account, is always system-specific, in that the maintenance within the present of past and future presents depends entirely on the structure, organization, and capacities of any given system.[82] Derivative pricing and its volatility are, in short, constructions of time.

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[78] Esposito, *Future*, 23–4. There is similarly a past present that is the present as it was in the past but is now passed and inactual.

[79] Terminological caution is needed here: what Esposito identifies as 'risk' is called 'uncertainty' in finance markets; see Esposito, *Future*, 36n.26. Standard finance theory follows Frank Knight's 1921 distinction between futures that are measurable/containable (risk) and those that are not (uncertainty). See Knight's *Risk, Uncertainty, and Profit* (Mineola, NY: Dover, 2006 [1921]).

[80] Esposito, *Future*, 151; emphasis added.

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[81] Ibid., 21.

[82] The outline of time presented here condenses and quotes from the salient argument in Esposito, *Future*, Ch.2, especially 21–8.

The specifics of this broad determination can be determined against the general systems theory of time-relation presented by Esposito. Summarily:

—Time is specific to a system, 'produced in order to organize its operations and make them more complex' by incorporating the inactual past and future presents into its present actuality. As this paradoxical unity, the present is the primary manifestation of time.

—Because the 'time binding' that is the relation between the actual and the inactual depends entirely on the system in question, there is no absolute, 'objective' time.

—Rather, the pragmatic incorporation of inactuality into the present enables the system 'to structure its present operations' in view of that inactuality. Time therefore permits the complexification of a system to a degree greater than its actuality allows (as with debt in regard to fiscal conditions, for example).

—Thanks to time, the actual and the inactual inform one another, albeit asymmetrically; through anticipation of the inactual and unknown future in the present, and by organising the actual present in view of the future.

—Generally, 'time allows the system to separate itself from its own operations and its situation, linking it with other (past and future) situations in a complex framework of connections' that attest to and acknowledge its contingency amongst other possibilities.

The 'possibilities' of a system—its unactualised states—are only theoretically and practically available to it because of its time qua relation to the inactual.

—In particular, the revision of plans for the future and reconsideration of the (once future) present is the 'internal reflexivity of time'. Operators in a system with time know that they can make decisions for an anticipated future which, while itself unknown, permits 'the freedom to decide differently once that future has become present (a present they will have contributed to and where they know how to intervene)'. Such is the 'flexibility and freedom' granted by time. Emancipation is a time relation.

—The freedom of time for an operator in a system is the freedom to choose 'in a non-random way', and to re-choose in view of the consequences of the preceding choices. Similarly, the past offers a selectivity of remembrance: 'everything could be possible, but only some possibilities come about, and these condition the possibilities that are made available for the future'.

—Time's unity is asymmetric: the past present can only be understood for what it was and wasn't (qua condition and projection to the future that is now present) in its future, while the future present continues to be strictly unknown but can be anticipated and prepared-for. Furthermore, operations *in the future* condition the future but do not determine it; past operations do determine their future, which is the present.

In these terms, systems have freedom *qua* possibilities constructed via their relations to inactualities of its *present* state.

Esposito's theory of derivatives pricing as counter-performative exemplifies this general theory of systems time and freedom of future revision. As options in particular demonstrate, derivatives build in revisability of trading the underlying at expiration into their contract. Trading of the options contract on derivatives markets 'allows one to make decisions today that affect the way the future will be, while preserving the freedom to decide one way or the other when this future will be present'.[83] As opposed to the BSM model, in this case derivative pricing is not constative with regard to an exogenous referent of that process. Rather, it refers to the 'contingency of future events' not only as regards the strike price, which is ostensible (exogenous) content, but primarily as a reflexive (endogenous) consequence pricing itself as a mode of time engineering. That is, the reflexivity or revisability of derivative pricing means 'that future-oriented expectations and decisions [on price] affect what will become present in the future'.[84] Taking the modality of the 'maybe' up to their expiration, derivatives 'leave the indeterminacy of the future open, and, at the same time, produce it with their decisions'.[85] Generating indeterminacies upon which they subsequently act, derivatives are counterperformative. Consequently, these indeterminacies are not random (within the parameter of the standard deviation of a normal distribution, as the BSM model stipulates); rather, they are structured by the 'minimal continuity' of derivatives pricing in the present, a pricing which is predicated on the contingency of revision.

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[83] Esposito, *Future*, 105.

[84] Ibid., 127.

Derivatives are in general thereby devices of arbitrage in time.[86] As an endogenous process, the reflexive measure of the necessary uncertainty of pricing movement in the present is given within the terms of that pricing system itself: it is volatility, the index of the presence of inactuality in present actualities. And it is priced. What volatility measures in its pricing is the uncertainty of price *given pricing as a time relation*. BSM's presentist and therefore static and anticipatory determination of derivatives pricing proscribes the time relation qua unity of actuality and inactuality that is derivatives pricing from explicitly entering price determinations. It instead reproduces the time relations that derivatives are (vectored *qua* pricing) only as an implicit aftereffect of its probabilistic formulation.

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[85] Ibid., 105.

[86] Ibid., 117.

Risk Order

This partial result marks the way to the political-economic determination of derivatives in terms of différantial pricing. However, the logic of différance imposes important modifications upon the theorization of such pricing as counterperformative. Crucial to this redetermination is the irreducible sociological dimension of the time relation in Esposito's account, in which it is a corollary of her determination of risk: 'all forms of time binding have social costs, because they [...] also bind the opportunities and perspectives of all other operators'.[87] That is, since the agents bound in and by the system's time relations can avail themselves of the systemic contingency of revision, the possibilities inherent to a system with time are not only those of its capacity *in toto* but are distributed differentially across elements of that system, in this case the market constituted of participants in the pricing system. Time binding thereby constitutes possibility and limitation with regard to others, which is to say that it constitutes social binding as such, which is in each instance organized and comprehended as the norms of a given social order. Contrary to traditionally-ordered societies, for which norms are determined according to the constraints that have determined and stabilise the present on the basis of the selectivity of the past, social binding constituted in view of the inactuality of the future stipulates a reflexive and revisable relation between the actual (present) and inactual (past and future). That is, social binding *qua* time binding requires the revision of social norms. Esposito illustrates by way of an example: 'the reflexivity of time introduces a future contingency into the present that cannot be bound [...]. How can one accept the production of GMOs (even if it is legal) if one cannot dismiss the possibility that [...] they produce unpredictable genetic damages?' Such damages are a future uncertainty, necessarily indeterminate in the present yet indexed in it as a risk—now meaning the uncertainty of the future in the present. Consequently, the necessarily social dimension of time binding complexifies the actuality and rationale of social organization—the available justifications of social norms—because the latter are subject to the revisability of the present in view of the future. Time is not a background through which revision of social norms is undertaken; it is that which imposes the necessity of the revision of norms in societies constituted with a view to ordering for future uncertainties. It constrains social orders to effectuate their norms in their contingent and future-facing contemporaneity. As such, societies of reflexive time-binding are definitionally modern. What is characteristic of them is that 'the current constraint, which should [*qua* norm] neutralize future uncertainties [...] comes to depend on these same uncertainties', making the ordering itself uncertain in its binding and 'depriving the [social order of the] very meaning of normativity'.

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[87] This section mainly paraphrases Esposito, *Future*, 30–35 from which all quotations are taken unless otherwise noted.

The coeval constitution of social and temporal uncertainties that is modernity is, then, 'a generalized condition of uncontrolled exposure to future contingency'. Given that its norms are contingent and are apprehended as such, any such 'society at risk (*Risikogesellschaft*)' has weak social bonds; it is flexible and adaptable, risk-rich.[88] To be modern means having no stable and binding criteria to guide actions, either now or in the future. Apparently stable solutions (for example, savings as a secure reserve for money) may lose out on gains elsewhere (the growth of equities markets), but the latter make the gains they do *because* they present a greater risk than the former. A stable judgement on what to do in the present could only be made in the future, not the historically organized actuality of the present. But the future is inactual and itself unknown, which is why all judgements now are themselves only risks. That judgements are made on condition of a necessarily inactual and unknown future and suppose their revision, such that there is no certainty as to what may come to be a gain or a loss, security or damage, is what Esposito calls 'the rationality of risk'—a rationality constituted by the double necessity of an ignorance of the future and the insufficiency of the past to guide judgements made in the present.[89]

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[88] *Risikogesellschaft* is better known in translation through the influential work of Ulrich Beck as 'risk society'.

The rationality of risk does not however disable all criteria for judgement. Even though norms as such are deprived of any final authority and legitimating sanction, the rationality of risk nonetheless generates a 'recursive, circular and revisable' quasi-order of binding uncertainties. That quasi-order is the 'minimal continuity' of sociotemporal binding, a binding 'between the contingency of time and the contingency of observers' that is enough to form decisions and give the capacity for control, revision, and correction 'in a non-random way'. Control not over what the future will be as such (per planning), but control as the construction of *possibilities* for the future 'without knowing or having to know' whether those possibilities will come to pass. Disestablishing social norms while constructing a binding social reality predicated on uncertainty and constitutive ignorance, the rationality of risk requires and fabricates increasingly 'complex forms of time management'. Derivatives markets epitomise such complexity by 'allow[ing] one to make decisions today that affect the way the future will be, while preserving the freedom to decide one way or the other when this future will be present'.[90] Specifically, by constructing a deferral of the vending of the underlying in view of taking advantage of changes in price once that contract is made and others react to it, the derivatives trader 'buys contingency (i.e., the freedom to decide otherwise starting from the decision taken today)'. Derivative prices are set not primarily in relation to the underlying or to other market-exogenous conditions, but by expectations and indexes of price movement.

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[89] Esposito, *Future*, 105 for 'rationality of risk'. This dynamic construction of reason is homologous to Robert Brandom's 'strong semantic inferentialism' (SSI) that provides the basic schema of neorationalism. With Brandom, SSI is a sufficient condition of conceptual contentfulness because inferential relations 'alte[r] our commitments and entitlements in ways that depend on what is a reason for what', meaning that the basic operation of reason is the revision of extant propositional content (*Reason in Philosophy* [Cambridge, MA: Harvard University Press, 2009], 13 for the quote; all emphases are added, Brandom's own emphases being removed throughout.) Moreover, for Brandom reason is primarily deontological because 'judging and acting—endorsing claims and maxims, committing ourselves as to what is or shall be true— [...] mak[es] ourselves subject to assessment according to rules that articulate the contents of those commitments' (33). Kant calls these rules 'concepts' but Brandom identifies their more general discursive applicability as being primarily the norms to and for which those making inferences are responsible. That responsibility distinguishes the 'exercise of a distinctive kind of consciousness' that is 'sapient, rather than merely sentient, consciousness[,] or awareness' (9). Moreover, concept formation qua normative rationality is not sui generis to the thinking subject as rational self (Kant) but also social (Hegel), involving extant histories and nonratiocinative languages (Ch.3). Like SSI, then, risk rationality is a necessary and chronic socially constituted revision of norms 'consisting in practically knowing one's way about in the inferentially articulated space of reasons and concepts' (9) according to the 'bindingness' (33) of the norms actively and provisionally established by the reasons intrinsic to that recursive process rather than past or future conventions. In the risk-order, the 'inferentially articulated space of reasons' is specifically determined as calculative yet open-ended time-binding. Consequently, neither reason nor (anthropological) sentience nor then price are established epistemological terms but come to be known and have traction on social norms thanks only to their respective rational revisions. However, for reasons presented taken up in n.133 below, such an alignment is only hypothetical or formal but is in fact incompatible.

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[90] Esposito, *Future*, 105.

For Esposito, whatever quasi-order persists in the rationality of risk is 'governed by reference to the uncertainty of the behaviour of others', given that their uncertainty is also attributable to the horizon of a future that is inactual to them. Not only do judgements and actions take place within the constitutive ignorance of reflexive time-binding but, for that reason, 'observers do very well in observing each other because the world is not a primary given [...], but comes into play when one observes what and how other observers observe'.[91] In Esposito's systems-theoretical account, such 'second-order observation' is the primary characteristic of modernity: it is 'the only form of reality still viable' in modernity, in which 'descriptions of the world change the world described'.[92] The 'minimal continuity' of reflexive time-binding and counternormative social binding resolves for Esposito into the constructivism of reality constituted by and as the integrated sociology of second-order observation that is antithetical to conventionalism. This broad constructivist determination of the quasi-order of societies at risk—of the risk order (the term is not Esposito's)—is the general sense in which *all* judgements and observations in the risk order are necessarily counterperfomative. As modern practices of complex time-binding, derivatives markets are counterperformative *per se*, and not only when those markets lurch into crises (as MacKenzie holds); and they are systems of second-order observation.[93] Consequently, financial markets are not directed to or organized for the 'satisfaction of needs' insofar as these are external to market determinations. Rather, they require

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[91] Ibid., 104.

[92] Ibid., 93.

> the abandonment of any reference to a given external world, even in the form of the discourses about the difference between investment (which should operate in the real economy) and speculation (which should be a mere financial transaction), where the second should refer sooner or later to the first. Otherwise we have to deal with a pathological development,

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[93] The account of second-order observation paraphrases and quotes from Esposito, *Future*, 102–4, unless otherwise noted. As Esposito notes (*Future*, Ch.5, n.28) second-order observation is a variant of John Maynard Keynes's beauty contest model in which contestants in a newspaper prize choose the six publicly selected 'prettiest' faces out of a hundred. Rational agents do not select according to their own preferences but according to those that they think popular opinion would select (*The General Theory of Employment, Interest and Money* [New York: Harcourt Bruce, 1964 (1936)], Ch.12, §5). Keynes characterised the professional investor of his time as having reached 'the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be' in a 'battle of wits to anticipate the basis of conventional valuation a few months hence'. In this, financial interests in markets are distinct from the medium-long term investment characteristic of enterprise, the 'social object' of which 'should be to defeat the dark forces of time and ignorance which envelop our future'. Against this injunction, second-order observation as Esposito derives it complexifies Keynes's recursive rational-model further because (i) the observer includes the knowledge that she or he is observed by others as well as observing them, and (ii) the second-order observer is also attentive to the risks and volatility of price movement, thereby including counterconventional combinations in their time-binding calculation (*Future*, 11).

> with a crazy economy, with gambling and a total lack of control.

Supposing that investment is badly (if at all) served by speculative finance would lead to the criticism of the latter as a 'casino capitalism'; a gambling without constraint or external reference that is destructive of the production that should be its true purpose. This is a commonplace criticism of financial markets, often accompanied by the complaint that risk rationality is distinct from calculative-predictive rationality. The former has no clear results or direct and known consequences; nor does it have any rational or social normative core, only the construction of possibilities that countermand the actuality in which they are conceived. Systems-theory constructivism obviates such criticisms of finance in favour of comprehending the ways in which 'the financial economy binds itself and its operations, not to a correspondence with an alleged given world'. On this basis, the risk-rationality of financial markets is not that of production or of 'the real economy' (exogenous referents for those markets) but rather and only that of risk—that is, the possibilities fabricated by the system for its own counterperformative development via emancipation from extant norms. And such risk has two dimensions to it: generally, what are instantiated in the present are the uncertainties of the unknown future, a making-ignorant of the present and its constative determinations; and specifically, per instance of pricing, counterperformative pricing generates profits from 'bucking the trend' of the market as a system of second-order observation.

Such countermanding possibilities cannot be conceived on the basis of the actuality of the present alone, vitiating the very condition for the probabilistic account of price development in the anticipatory model of BSM. Consequently, to reiterate the argument of endogenous counterperformative pricing from another angle, derivative pricing is constitutive of price movement, and instantiates its own 'ignorance':

> [P]rice movements always produce surprises that would not arise if there had been no speculation about the future in financial markets. The future projections to which operators are oriented are correct and incorrect at the same time. If done well, they anticipate the way the future would have come about if there had been no attempt to foresee it. In this sense, they sabotage themselves.[94]

Prices *necessarily* go in unexpected directions because their anticipations (in the future present) are necessarily wrong—and only by virtue of the anticipatory price (in the present future). That is, as well as factors exogenous to the pricing system and trade in the underlying,

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[94] Esposito, *Future*, 128.

pricing as such generates volatility. Implied volatility is for Esposito an effect and measure of the reflexivity of the risk-order itself, with the underlying as a quasi-arbitrary heuristic device to facilitate that measure.[95] The succinct formulation is that implied volatility 'indicates the prevailing opinion on the prevailing opinion'. The elaborate version is that, as a measure, volatility is an observation of the systemic dynamics of second-order observation. Such an observation is not external to second-order observation but is itself an endogenously generated manifestation of second-order observation that estimates its own effects on the pricing mechanism that it is—yet another instance of the recursive revisability of such systems. As such, and because it is itself priced and traded on derivatives markets (enabling gains to be made while the markets for the underlying derivative make losses), implied volatility explicitly demonstrates the reality of the financial risk-order. It is an endogenously constituted measure of the rationality and constructedness of the system in and by which it is manifest. What is important in this result is that volatility is 'not a datum'; rather, 'it refers to the future', to the inactuality that constitutes the uncertainty of pricing *qua* risk order. For Esposito, this means that volatility measures only 'what the changes in the expectations of the operators about these movements are' and affecting the latter as part of its reality.[96]

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[95] Ibid., 139.

Esposito's systems-theoretical account of derivatives pricing surpasses the constraints of the BSM model, positively capturing price volatility as a direct and necessary effect of pricing via the notion of counterperformativity, exposing that derivative pricing instantiates the kind of minimal continuity between time binding and social binding typical of risk-order societies. In short, it shows that risk ordering is intrinsic to derivatives pricing. In these terms, the BSM model is a mistaken because unilateral determination of the integrated sociotemporal constitution of price. A more complete account of derivative pricing requires that it be apprehended as *at once* a political economy: the market endogeneity of derivative pricing is at once a complex form of time management and *as such* a complex form of social organization. It is this injunction that returns the overall argument back to Nitzan and Bichler's contention that capitalization constituted via pricing is a political economy of accumulation; but three further steps need to be taken in order to make the two otherwise divergent theories of pricing congruent.

Firstly, the immanent sociality of pricing for Esposito is restricted to traders as the second-order observers who make up the market, and does not extend to the entire and universalisable social complex that is for Nitzan and Bichler the purview of price as organising term for the 'single quantitative architecture' of capital-power. In view of the latter, the endogeneity of the political economy of market pricing must be extended beyond the confines of its immanent social determination. Secondly, Esposito's entire theorization revolves around the primacy of observers and their systematic intradetermination of price. This sociological determination accords with the Neoclassical paradigm in supposing traders' subjectivity as the condition and term of analysis, as indicated by Esposito's reliance on G.L.S. Shackle's theorization of the uncertainty of economics for the economic agent who relies upon her or his imagination in entrepreneurial endeavors.[97] The argument of counterperfomative pricing is antirealist not just because of this assumed primacy of the sociosubjective dimension, but also owing to the theoretical basis of its constructivism: for Esposito, the volatility of pricing demonstrates that the reality of the derivatives market is indifferent and detached from any referent exogenous to the derivatives markets: (i) volatility does not refer to a reality beyond the system of observation, and (ii) even when it seems to (with, say, the movement of prices putatively in relation to an underlying), that exteriority *qua* real is in fact predicated on the (system of) observation in its ontology, semantics, and rationality. As such, volatility in this account is an index of what Quentin Meillassoux has influentially called 'correlationism', verging here on idealism.[98] By contrast, for Nitzan and Bichler, all market entrepreneurs follow the logic of differential accumulation that is capitalization's dynamic reordering. Determined by that logic, price is 'a calculable measure' that is systemic, ordering, and external to the subjective observation and action which it shapes.[99] Taking up Esposito's words about implied volatility, then, price 'has its own objectivity to which one can refer', one that overdetermines the trader's subjectivity: the objectivity of its market-endogenous constitution. As Esposito proffers in passing, it is necessary to deduce

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[96] Ibid.

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[97] See for example J. L. Ford (ed.), *Time, Expectations and Uncertainty in Economics: Selected Essays of G.L.S. Shackle* (Aldershot: Edward Elgar, 1990).

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[98] Correlationism as Meillassoux defines it for noetic cognition is not to be confused with the various correlations of derivatives pricing structures, not least because the latter are derived on the basis of normalised probability calculations whereas noetic-cognitive correlation is the putatively ineliminable subjective structuring condition of knowledge, as instantiated by second-order observers. For Meillassoux the noncorrelational real, the real beyond thought that it yet comprehends, can only be determined by rational thought to be entirely contingent—that is, without cause or reason—meaning that the real of thought is only the contingency of the fact of thinking, which contingency of the real is therefore its absolute condition (*After Finitude*, tr. R. Brassier [London: Continuum, 2008], Ch.3). Consequently, it is Meillassoux's noncorrelational realism that is schematically analogical to the dyadic contingency of abstraction and revision structuring the underlying of derivative structures even though its content is directly contrary to it. On the basis of the anticipatory pricing model, Meillassoux's 'Principle of Insufficient Reason'—that the unique and supreme necessity for thought of the absolute contingency of the real means that nothing of the real is necessary, including physical laws—can be characterised as rational thought's determination of the real as having the Markov property of memorylessness. But the analogical coherence of the two schema should not belie their substantial divergence: while anticipatory financial models of speculative pricing delimit the contingency of the price of the underlying by probabilistic normalization, for Meillassoux the absolute contingency of reason prevents the establishment of an upper-bound or circumscribed set of possibilities necessary to establish probabilistic calculation (*After Finitude*, Ch.5).

For a relatively nontechnical introduction to financial correlations and their central role in the structuring of the collateralized risk portfolios central to the 2008 financial crisis, despite recognition of their theoretical failure as well as that of delta-hedging in the 'correlation crisis' of May 2005, see P. Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* (Hoboken, NJ: Wiley, 2009), Ch.4.

> a form of rationality that includes the volatility smile and its consequences for markets. According to this rationality, paper markets are not unreal, and their operations are (often) not irrational at all. We should, however, find out what kind of reality and what kind of rationality are at stake.[100]

In terms of the systemic objectivity of pricing, such rationality and reality are those of capital accumulation's finance power, but now determined as an *objective* risk order. The systemic objectivity and logic of capital accumulation then require a noncorrelationist theory of derivatives pricing that accommodates both the endogeneity of market making and the sociosubjective dimension mandating Esposito's constructivism. Such a realist theory of pricing is at once also a theory of its rationality, the latter term incorporating the dimension of both power (from Nitzan and Bichler) and risk (from Esposito). The required theory is therefore a realist ontology of price *qua* rational risk order of capital accumulation. As will be seen, it is this ontology that permits the specific determination of finance power.

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[99] Esposito, *Future*, 140.

[100] Ibid., 151.

Thirdly, Esposito's 'pragmatic' theory or practice of time *qua* freedom upon which the theory of risk is constructed supposes and requires that the present is only actual and the future wholly inactual, the two remaining firmly distinct. In this theory, any derivative's price is the price of 'today's risk', risk in the 'present future', strictly distinct from a 'future present'. Implied volatility is for her 'the projection of the future from the considered present', and risk the anticipation of the inactual future present as a distinct present future.[101] Consequently, even if derivative pricing qua diffférantial temporization is partially comprehended within the constructivist account of derivatives markets *qua* the reflexivity of time binding and the risk order it inaugurates, the differential organization of that pragmatism (and its counterperformative freedom) remains an attenuated if complex and recursive form of presentism. As such, it is inadequate to the diffférantial organization of derivative pricing that is the mechanism for the relation between the actual and the inactual in Esposito's theory of present pricing of risk as 'management':

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[101] Esposito, *Future*, 139.

if 'the future is not the present future or the future present, but the difference between the two',[102] then the pricing of risk by derivatives 'manages' the future *qua* inactuality in the present. The present/pricing is then no longer present to itself, but is deferred from itself qua futurity. What is deferred from the present in pricing risk is the future: the uncertainty and inactuality that the present maintains. Equally, risk is the present manifestation of future uncertainty and, as such, displaces the actuality of the present into an inactuality within the present. Possibility, the freedom occasioned by the distinction in kind between actuality and inactuality in time binding, is then granted by difförantial temporization. But difförantial temporization also immediately constrains possibility, not because of the limitations of the given actuality of the present but because the constitutive imbrication of future and present means that the future present is not wholly distinct from the present. That is, possibility and the freedoms of the present are constrained because the deferral of the present future from itself opens to the future present *in* the present (which intrinsic condition is also why there can be a present future at all). In the complexity of the partial indistinction of present and future that is the temporization of both, possibility cannot be wholly distinguished from actuality; freedom qua possibility is granted by the circumstances of the present. The real of derivative pricing is its actual-inactual temporization, a liberation from the present in priced risk.

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[102] Ibid., 127.

Given the minimal continuity of the integrated sociotemporal binding that is risk order, the three redeterminations of derivatives pricing remarked here are coextensive: the real of différantial pricing is that of the noncorrelational real of endogenous pricing in its systemic and objective logic of differential capitalization. Elaborating the three redeterminations of risk order in reverse leads to the explicit formulation of this comprehensive identity of the real of derivative pricing, which is in fact finance power in its dual dimensions of financial operations and the a priori of capitalization.

7. PRICE PLASTICITY

The price of an asset in capitalization is *only* a financially formulated magnitude of anticipated earnings. The contention here is that derivatives pricing dilates and makes explicitly manifest the process of that formulation and, insofar as the underlying asset is only a contingency upon which that process is occasioned, its primacy for capitalization. While constraints may be imposed on derivatives construction by jurisdictional authorities regulating contract law, such pricing construction is anyway constructed qua legally-binding arrangement. Consequently, regulatory regimes per se are not an external obstacle to the structuring of derivative pricing, but an implement determining its construction. Put otherwise, derivatives construction and therefore pricing is variable without *intrinsic* or necessary determination as regards either the mobilisation of the price differences it constitutes or its time-binding. Limitations imposed on derivative construction are wholly contingent and malleable (via changes in regulation, or the invention of alegal or quasilegal derivatives structures—or both, as with the invention of swaps), structuring pricing by constraining their pathways in a dimension that is endogenously constituted, differentiating, and universalisable thanks to the contingency of its abstraction with respect to the underlying occasions. The variability of derivative pricing is only ever realised in locatable and circumscribed contracts specifying particular pricing conditionality and temporization structures.

Exotic options are an operational index of the indefinite variability of derivatives pricing, yet they are constrained by the requirements of the currently prevailing standard model of capitalization. But this standard determination, while dominant, is *not necessary*. Theoretically, the liberation of business from its industrial determination by derivatives pricing (to adopt Veblen's terminology) is a dynamic power-ordering that is simultaneously more extensive and more intensive than the geospatial and industry-based business variants of differential accumulation to which

Veblen remains bound and from which Nitzan and Bichler draw their analysis. It is more extensive because the 'single quantitative architecture' of price, coupled to the risk-rationality of derivatives pricing—as a claim on earnings that are *explicitly* unknown, inactual, and constituted by a futurity that is in principle unconstrained—means that financial pricing and claims on earnings can extend transhistorically from the present in which the contract is written to any moment in spacetime, including all futurity, indefinitely (if the legal structures are durable enough). And it is more intensive because, to put the preceding point the other way around, derivatives pricing is endogenously constituted, meaning that the in-principle universal extension of price is operationalised (i) across time (at whatever scale), and (ii) in relation to an underlying that is *therefore* fungible, a contingent conditional for the organization of power qua price. Combined as two aspects of the one instantiation of power-ordering, the universal fungibility of the underlying in derivatives pricing has its systemic correlate in the universal fungibility of pecuniary assets in the dynamic reordering of capital-power—which can, for this reason, be determined as a risk order.

The theoretical consequences extend to the conceptual schema of derivatives pricing, in so far as their in-principle indefinite variation requires a significant divergence from Derrida's determination of the logic of différance, the elaboration of which requires a last brief return to phenomenology. Unlike Husserl, for whom there is but one single presence even though the lived present as such is an ideal and never any factual lived presence, for Derrida the present is necessarily different from itself, the living present being no less the simultaneity of the lived present *idealiter* (which is infinitely deferred from being manifest as such) *and realiter*.[103] The infinite différance constituting the ideal present takes place *in* the finitude of the real present. The logic of différance is thereby exempted from the opposition of finitude and infinitude. Furthermore, because the ideal lived presence is no fact of lived presence, its only manifestation is *in fact* the absence of a lived present: death. Transposing the *logic* of différantial temporization to the constitutive structuring of derivatives pricing, Derrida's summary of the relation between the factual lived present and its supposed ideality finds its direct analogue in taking the payoff and (where it happens) the exchange of the underlying at maturity not as the terminal point at the outer limit of the contract (its ‘expiration’ as the terminology for options has it), but rather as one of its intrinsic constitutive and structuring features:

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[103] J. Derrida, *Speech and Phenomena and Other Essays on Husserl's Theory of Signs*, tr. D. B. Allison (Evanston: Northwestern University Press, 1973 [1967]), 99ff. For Derrida, the différantial constitution of the living present in Husserl's phenomenology is instantiated by the deferral of the ideality of that living present (and that of the pure thought Husserl also relies upon) as it is by the non-ideal present which is no less the living present in fact. The living present is different from/to itself (ideal, factual) and is the fact of its deferral. The Ideal living present—what the living present truly is for Husserl—never appears in fact. It is a Kantian ideal, infinitely because constitutively deferred from the presence that it 'is', a present that is then necessarily different from itself.

> only a relation to the expiration [Derrida: ‘my-death’] could make the infinite différance of pricing [presence] appear. In the same blow, compared to the ideality of the positive infinite, this relation to the expiration [my-death] becomes an accident of empirical finitude. The appearance of infinite différance is itself finite. Consequently, différance, which is nothing outside of this relation, becomes the finitude of the derivative [life] as an essential relation with its expiration [oneself and one’s death]. Infinite différance is finite.[104]

That is, the in-principle indefinite variability of differántial pricing, *including its expiration*, is always manifest in the ‘empirical finitude’ of its pricing, which is the theoretical corollary to the volatility smile: maturity/expiration, which is the constitutive deferral of differántial pricing, is but one variable amongst others in pricing. In philosophical convention: the temporization of differántial pricing up to and including its termination is *immanent* to pricing.[105]

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[104] Derrida, *Speech*, 102.

[105] Once constituted, derivatives markets can be conceptualized as a field of immanent differentiation, for which Deleuzian categories and dynamic schemata provide productive theorization especially of the dual deployment

However, the analogy is not a complete one. The logic of différantial pricing diverges significantly from Derrida's deduction of différance from phenomenological consciousness for two reasons:

1. Death and the absolute past are distinct from any living (self-)presence of a consciousness because of the unity and inexchangeability of that consciousness;[106] whereas there is no such constraint on the différantial pricing of derivatives. In general, a derivatives contract can be terminated before maturity/expiration (for example, with American-style options). The purported exchange of the underlying required for the structure of the particular derivatives contract and, historically, to distinguish derivatives trading from gambling, is only a conditional term providing

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of the actual and inactual, the latter being translated in Deleuzian convention to the virtual, which together compose the real—the latter being contrasted for Deleuze to the possible. See B. Lozano, *Of Synthetic Finance* (Abingdon: Routledge, 2015) and Elie Ayache's characterisation of the market a 'pure becoming' (*The Blank Swan* [Chichester: Wiley, 2010], 39). Such accounts however presume and neglect the constituting deferral of the strike price or expiration at maturity as ordering term of the forward contract, ordering it instead as an inactualized virtuality of the market and thus susceptible to the criticisms put to Esposito's systems-theorization and the BSM regime, upon which such theorizations tend to depend. Jakob Arnoldi hybridises Deleuzian and systems-theoretical notions of the virtual as a space of calculative probabilities distinct to the possible in 'Derivatives: Virtual Values and Real Risks', *Theory Culture Society* 21:23 (2004), 23–42.

[106] The condition of the unity of consciousness is not limited eidetic phenomenology. That consciousness has a primary unity is proposed in cognitive neuroscience by Thomas Metzinger, *The Ego Tunnel* (New York: Basic Books, 2009). Ch.2, and for semantic inferentialism by Robert Brandom (*Reason*, Ch.2), for whom it is a condition of philosophy and sapience (see n.133).

the terms for the contract's payoff and determining its market price. The time to expiration is, in other words, but one variable among others in the finite construction and pricing of the derivative and its trading. Consequently, the endogenous différantial pricing of any particular derivative, constructed in its finitude thanks to its contractual boundedness, is intrinsically imbricated with its market pricing, which is its exchangeability in advance of its maturity. In distinction to Derrida's phenomenological commitments, the finitude of the différantial temporization of the derivative contract is constituted in its exchangeability.

2. Since this means that the market is not outside of the endogenous construction of derivative pricing, a derivative's expiration/maturity is one variable in the more general revisability of derivatives market pricing and their concomitant contingeny. This is to reiterate once again that derivatives are *constituted* in the institutions of différantial pricing (derivatives markets); but it also makes explicit that the finite temporization of pricing is necessarily imbricated with market trading. The contingency of revision characteristic of derivatives pricing supervenes on the terms of the contract's expiration, which determine its finitude. Consequently, if the expiration and payoff are but variables of différantial market pricing, the temporization of pricing is not constrained by its finitude *qua* termination of

the derivative at expiration/maturity, but rather by its termination *qua* marketisation. This is the condition and structure of speculative finance, now distinguished from investment by operationally prioritizing market pricing *qua* the contingency of its revision over its termination in relation to the underlying (meaning the provision of liquidity outside of the market upon expiration/maturity). Moreover, because of the priority of the contingency of revision for différantial pricing, the only constraints for market speculation are regulatory, rather than stemming from a putatively 'real economy' external to it. But because such regulations and the institutionalisation of pricing that they permit and impose are themselves as constructed, variable, and subject to the contingency of revision as the pricing mechanisms they regulate, unlike death for the living consciousness the speculatively organized constraints of derivatives pricing are not uniquely determined but somewhat arbitrary.

Combining these two partial results, the speculatively-organised termination of the derivative via its marketisation means that différantial pricing is constitutively indefinite in two regards: firstly, the derivative can be traded at any point up to its expiration; and, secondly, its price varies with the derivatives market, not just that of the market of the underlying. Constituted and instituted in the finite but also variable contractual terms of any particular derivative, the price variability of différantial pricing is therefore intrinsically indefinite. In this it diverges from the logic of différance established in Derrida's deconstruction of phenomenological consciousness, for which infinite différance is finite and the différance of the lived present of consciousness is in 'an essential relation' to its finitude *qua* the unique termination that is its death: not only is infinite différance finite for derivatives, finite différance is also *indefinite*.

The two dimensions of variation for différantial pricing—the price-setting schedule of the finite because bounded contract, and its market price variability and trading—are constitutive of one another: the indefinite price-variability depends upon the variable finitude of the contract (its expiration, the payoff schedule, amongst other conditionals) and the speculatively-organised variations in what a derivatives contract might be are constructed with regard to their indefinite market variability, not the payoff. This integrated dual variability of the derivative contract with its pricing constitutes the operational terms of the derivative's price-endogeneity in its intrinsic contingency of revision, which is here designated as the *plasticity* of the derivatives contract. In practice, and to reverse-engineer the argument, the plasticity of the derivative is the condition for the indefinition of derivative pricing without which there could be no operative market *qua* contingent repricing of derivatives, the bounded pricing structures and schedules of which are fabricated in view of that constitutive and endogenous indefinition. Or, again, market pricing and trading is the operational manifestation of derivatives' intrinsic operational contingency of revision.

That derivatives are constitutively rather than secondarily speculatively organised in their own markets is demonstrated by the 'closing out' of positions. While futures contracts require the buyer to take delivery of the underlying asset at the expiry date, a trader speculating or hedging on the futures market can exit the contract by executing exactly the opposite trade to the initial one, doing so at any time prior to the latter's maturity. The trader then has a long and short position on the one trade, resulting in no net position at maturity. While the position is then 'flat' and the delivery of the underlying need not be made, the trader can still make a gain or loss—or, more likely in the latter case, circumvent anticipated greater losses—in futures prices over the period. The vast majority of futures contracts are closed out, with delivery of the asset being 'relatively rare'.[107]

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[107] Hull, *Options*, §2.1.

Illustration

The strike price for a futures contract in URB maturing in three months is 50lcu per share. A speculator takes a short position for 100 shares, locking in revenue of 5000lcu at maturity (excluding transaction costs).

After two months, the delivery price of URB shares at expiration is anticipated to be 47lcu at maturity. The trader anticipates a gain of 50- 47 = 3lcu per share, or 300lcu on the contract, provided all the shares are immediately bought at 47lcu at maturity.

The speculator guarantees such a purchase by going long on 100 URB shares priced at 47lcu with the same expiration date as the original trade.

The trader then has a 'flat' position regarding the asset, trade in one position cancelling out the trade in the other, yet gains 3lcu per share by closing out the deal.

If the spot price on maturity looks like it will be greater than the delivery price (say 52lcu), the trader with the short position looks to lose 50-52 = -2lcu per share on the futures contract.

Closing out the deal by going long with a strike price of 52lcu gives more certainty to the net loss of 200lcu, rather than taking the risk of an even greater effective loss by the anticipated rising price of URB stock.

That more than one position is taken on the same asset (and by the same trader) inflates the nominal size of the market beyond its actual credit exposure. This explains in part the operational causes for the sizes of the financial markets that underpin Lesson Two in the introductory comments above. In terms of the general theory of capitalization, that Lesson is instructive as a practical demonstration of the liberty derivatives markets have with regard to the parochial statutory limitations imposed on them at the historical inauguration of the CME in Illinois. Closing out makes it quite explicit that the delivery of the underlying is but a jurisdictional requirement to be circumvented—one that is historically fundamental but operationally trivial. It is one among other requirements structuring the early derivatives markets and which, rather than containing them by imposing a relation to the underlying, expanded them by liberating the endogenous plasticity of derivatives pricing.

8. THE INFRAWAGER: THE REAL OF DERIVATIVES PRICING

Closing out operationally demonstrates that the liberation of différantial pricing from its exogenous referent is tantamount to the delivery price of the underlying being identified as a conditional within the derivative pricing process rather than as being rooted in the markets of the underlying. This deracination from exogenous markets is imposed, first, by the endogeneity of différantial pricing, which proscribes the exogenous referent from being anything but a variable of the finite temporization constructed by the derivative contract. And it is also imposed because, second, capitalization per Nitzan and Bichler is organised through price *qua* ownership claims and derivative contracts are only juridicofinancial constructions which build in and make explicit the variability of the price over the duration of the contract. That is, the price of the underlying as *object of capitalization* on derivatives markets is determined not on the basis of prices exogenous to those markets, but on the basis of the plasticity of the construction, temporization, and market pricing. That plasticity is the real of derivative pricing. Consequently, the distinction between derivatives markets and gambling is both operationally *and* constitutively rescinded, as the institutional and regulatory development of the derivatives markets demonstrates. What is less directly evident from that history of institutional practices, however, is that while derivatives markets have in more or less attenuated ways formally observed the distinction from received constructions of gambling for regulatory reasons, they have also inaugurated and massively operationalised an unprecedented mode of the wager.

Derivatives pricing cannot be identified with conventional notions of gambling, in that the standard wager depends on an exogenous referent that is uncertain at the time the wager is made (archetypically, the throw of the dice) from which occasion the wager itself (as an if-then payout conditionality) is distinct, and which it cannot affect without vitiating the very meaning of the term (archetypically, loading the dice), a schema designated here with the term *extrowager*. In the extrowager the gambler is constituted by her or his necessarily limited knowledge of an inactual future occurrence, a subjective manifestation of the inadequacy of finite epistemology to ontology. In these terms, the anticipatory BSM regime attempts to bypass the constraints of the extrowager (the prohibition of gambling), while observing them (the constitutive exogeneity of what is priced to the pricing process itself). The contention here is that, in formulating options pricing as an extrowager, as derivatives typically are, the BSM regime apprehends and domesticates the realist constitution and ontology of the wager inaugurated by derivatives markets. This domestication is reiterated in another format by Esposito's systems-theoretical account of derivatives pricing process as a sociosubjective construction. Furthermore, however prevalent and institutionally dominant such accounts of derivatives pricing may be, the latter is distinct in kind to the extrowager because of the constitutively endogenous operation of differantial pricing and its concomitant indefinite plasticity. To be exact:

—It shares with the extrowager the exogeneity of the underlying as condition of the derivative's pricing process.

—Yet differantial pricing is distinct from the extrowager in that the former is an endogenous operation with an indefinite plasticity until expiration for which the conditional exogenous referent is operationalised as only a contingent abstraction of the pricing process. Derivatives pricing is conditional upon whether the set conditions at expiration will transpire or not, and, if so, what the payoff will be.

—The price of the derivative itself as well as (indirectly) the spot price of the underlying at delivery are themselves then priced in their markets (and its pricing is itself priced in the volatility markets); that is, any instance of derivative pricing is a wager placed not just *in* an indefinite betting process but also *on* it.

—Derivatives markets pricing is thereby akin to odds lengthening or shortening on a bet according to what other bets are placed. However, while the price of odds changes for the extrowager according to what other bets are placed, its changing odds and prices are always in reference to the exogenous circumstances conditioning the payout.

—In contrast, what is unprecedented about derivatives

> pricing is that its plasticity explicitly subordinates that external determinant for pricing to its *own* process, such that the market refers to the changing prices operationalised via that market.
>
> —What is priced by derivatives markets, then, is the pricing process *itself*. Unlike the extrowager, derivatives pricing is an *infrawager*, for which the terms at expiration are not externally determined conditionalities but only parametric constraints.

Displaced to the activities of traders, the processual and referential endogeneity of pricing is what Esposito calls second-order observation. Its determination *qua* infrawager, in contrast, explicates différantial pricing as an impersonal institutional fact, rearticulating its counterperfomativity in terms of the objective dimension of price. It is the real of derivative pricing not as a sociology of derivative pricing but as the ontology of *all* betting as a pricing process. Because the referent of the extrowager is the assumed condition and terminus of the wager, it proscribes identification of the endogenously constituted conditionality of the derivative pricing process as well as the contingency of abstraction with the underlying. This mistake is the consequence of a more or less implicit correlationism, the error of which is in fact exposed and operationally negated by the explicit manifestation of the infrawager in derivative pricing. Put the other way around, the operational and practical exposure of the infrawager by derivatives markets is the historically unprecedented liberation of both the wager as such and of price from their assumed historical and theoretical subordination to exogenous terms that are not, in fact, conditions of pricing.

Commencing instead from the ontology of the infrawager, as the logic of pricing requires, it is, in Elie Ayache's formulation, 'easiest to withdraw' the underlying 'from underneath the contingent payoff and subsequently to claim that contingency is absolute and no longer derivative on that state'.[108] That is, the derivatives contract is not predicated on the underlying but *entirely* on the indefinite plasticity of the infrawager—including the price at expiration, which is only a structuring parameter. Thus the real of the infrawager, manifest and institutionalised as derivatives pricing, consists solely in its twofold contingency: the contingency of abstraction (the universal fungibility of the underlying) and the contingency of revision (the indefinite plasticity of différantial pricing). Establishing that the infrawager is the endogenously-constituted and -referencing real of derivatives pricing provides the basis for the final steps to complete the present argument; namely, to generalise the determination of pricing beyond the specific institutional practices of derivatives markets to price as such (its intensive aspect) which, per Nitzan and Bichler, is the single universal architecture of capitalization (its extensive aspect). The two imperatives for this comprehensive theory of price are, firstly, that it specify the articulation of finance in its practical dimension (institutional operations of capitalization via ownership claims) with financiality (the a priori of capitalization); and consequently, that the theory of price advanced must also provide a specific determination of finance power and thereby the primary characteristics of the state-finance nexus and its cogency (however riven and incoherent it may be in theory). It is Ayache's theorization of pricing that advances the generalisation of pricing required here, thanks to its positive determination of pricing as such as instantiating contingency qua absolute futurity, thereby (to go beyond the terms of Ayache's own argument) specifying the mode of time binding of capitalization not in the dimension of its sociology but of the real of price that is its ontology.

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[108] E. Ayache, 'The Turning', in *Wilmott Magazine*, June 2010, 45, www.ito33.com/sites/default/files/articles/1007_ayache.pdf.

9. ABSOLUTE VOLATILITY

Though Ayache's argument is not directly that of the infrawager, his principal contentions are congruent with it, namely (i) that forward contracts have no price process shadowing a succession of prices outside of the derivative itself. Predicated instead on the contingency of the underlying as its real, (ii) the price process given by the stochastic model and its elaborations are 'eliminated'. Consequently, (iii) the only reality derivatives prices have is that of the long/short position as the contract is re-entered (or not) every day the market is open, and no less (iv) at expiration. Ayache's claims follow from the observation that the real of the derivatives pricing process *in the present* is not the 'path' of différantial pricing, which is the dynamic actualisation of its temporization. Rather (and this is what Ayache adds to the determination of the real of derivative pricing) 'what exists today' for the forward contract (here a metonym for the derivative structure in general) 'are contingent claims, paying 1 or 0. [...] [*B*]*oth belong to the world now* and also to the world "taking place"'.[109] In addition to the contingency of abstraction that is the universal fungibility of the underlying of the forward contract, the derivative is also contingent in that it posits a speculative 'as-yet-unknown' eventuality. That eventuality does not preexist the contract but is fabricated by it; the contract constitutes it in its inactuality and unknowness. The two outcomes are the 'branches' of two different realities only one of which will be actualized at expiration *because of the contract*. It follows that the derivative contract is, in Ayache's terms, always a 'contingent claim'. The contingency identified by Ayache is one that the derivative constitutes and inaugurates and, as such, can be designated as its *thetic contingency*.

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[109] Ayache, 'Turning', 41; emph. added.

What this third contingency of the derivative constitutes is its deracination, not with regard to the underlying (from which the derivative is deracinated by the contingency of abstraction) but rather the deracination of price itself in the pricing process: it posits that 'the world is actually what it is in reality'—the derivative has a particular price in fact—'except that it could have been different'—only one of the contingent inactualities is actualised, the other remains inactual.[110] Thetic contingency is the necessary prerequisite of derivatives pricing, in that 'the contingent claim is only conceived as the written formula that it is (pay \$1 if S is greater than K, 0 otherwise)', and also that the endogenous variability of pricing in the infrawager supposes price not to be a fixed given but, precisely, revis*able*.[111] Inaugurated and instituted by the derivatives contract, the thetic contingency of pricing is endogenous, real, and absolute for it.

This requires a revised determination of différantial pricing. The thetic contingency of différantial pricing means that:

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[110] Ayache, 'Turning', 36.

[111] The quote is from E. Ayache, 'The End of Probability', *Wilmott Magazine*, October 2010, 41, www.ito33.com/sites/default/files/articles/1011_ayache_0.pdf.

—Derivatives are not just a counterperformative time-binding of the present and the future in which the deferring and displacing of the present into the future prevents the actuality of the present from being constituted as clearly distinct from the inactuality of the future.

—What is to be added to that determination of derivative pricing qua temporization, is that the constitutive futurity of the différantially organised present of risk pricing is that of the splitting of the future payoff—that is, the thetic contingency inaugurated by the derivative contract.

—That eventuality is endogenous to the pricing process, absolute yet presently unknown. The only relation to it in any present is speculative.

—The time-binding of derivatives pricing is consequently a constructed relation of the (thereby deracinated) present to the contingency of the *split* future, which will be both actualised and (with the eventuality that does not transpire) inactualisable.

—The logical a priori of the derivatives contract in the present is the absolute futurity of its thetic contingency.

—That is, to vector Esposito's formulation of the risk order across the dimension of the real of pricing: the inactual dimension of the present of pricing (risk) is ineliminable, even in any future present. The present can never be determined as a full actuality, not even in

> the future present; what is real to derivatives pricing is an absolute future that it endogenously constitutes.

The future present is therefore itself susceptible to revision in the way Esposito describes, as integral to a social binding permitting the future revision of decisions made today, but now with regard to the real of the infrawager. The logical a priori of the contract in the present is the absolute futurity of its thetic contingency. Consequently, the deferral of derivatives pricing is not that of a durational extension of the present (that would be the anticipatory formulation) but an irreconcilable and endogenous splitting of the present. That thetic, futural contingency occasioned in the present is the precise sense in which pricing is necessarily counterperformative: *it* is the positing of a future supervening on any continuity of the present, a futurity that is absolute for différantial pricing. In Ayache's words, the thetic contingency of the forward contract is the 'real thread of the future' in the present qua pricing, up to and including its payoff.[112]

As the absolute of derivatives pricing, thetic contingency is the truth of its counterperformativity. Consequently, three preceding determinations of derivative pricing need to be revisited, the third of which is taken up in the next section.

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[112] Ayache, 'Turning', 41.

Anticipatory pricing. Future prices cannot ever be predicted or anticipated, because the delivery price qua conditionality structuring the derivative 'collects as one writing the two branches of the alternative incompatible in actual reality'. That is, the pricing process is inaugurated by *positing* a split futurity that then not only refutes but also vitiates the possibility of anticipation qua extension of the present.[113] Which means that anticipatory models of actual price movement, including but not restricted to BSM, are only retrofitted elaborations, provided at maturity, of how the strike price was supposed to have been reached. The counterpossibilities to the actual price development of the derivative are, *qua* probabilities, only idealized, retrofitted reconstructions of a futurity; while once real in their inactuality, they were *never* actualised. Such counterpossibilities are a consequence of the absolute futurity of différantal pricing: just as the future present of différantial temporization is itself revisable because it too is constituted by the absolute thetic contingency of the real of the infrawager, so the past that determines the present as its actual yet revisable future is itself saturated with the unactualised eventualities of the past, of yet-other-futures for the past that are not the present from which they are apprehended. These past inactualised eventualities are only fictive idealizations in that they have not in fact been actualized and, unlike future inactualities, they remain perennially inactual given that actuality turned out to be the present from which they are surmised. That is, they are only possible, never real. Furthermore, with derivatives pricing,such past inactualities cannot be predicated on an absolute past in counterpoint to its endogenous absolute futurity because, being logically predicated on that futural contingency and historically inaugurated by the contract, the a priori of the pricing process cannot precede it in time. Or, as Ayache puts it, the anticipatory articulation of the price process always and necessarily comes 'after reality, not before'.[114] Inversely, mistakenly presuming that derivative pricing takes place against a stable time background rather than instituting a temporization of contingent futurity, the probabilistic calculation of price development assumes that 'possibility precedes reality and that the different possibilities facing the world become realized as time passes'.[115] As such, retrospective-anticipatory pricing regimes—which take derivatives pricing to be strictly secondary to price movements and actualities elsewhere—repudiate the futural contingency that is the real of derivative pricing.

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[113] Quoting from Ayache, 'Turning', 41.

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[114] Both quotes in this paragraph are from Ayache, 'Turning', 37.

[115] This is not to refute any and all manifestations of probabilistic formulations of pricing of contingent claims. Ayache supports the 'episodic' deployment of probability and stochastic control in the trader's daily market interventions ('Probability', 42).

Volatility. Previously designated as volatility, the endogenous thetic contingency of derivative pricing can now no longer only be rendered by its 'implied' derivation by which, recall, it can only be reconstructed consequent to its preclusion by the constraints of anticipatory pricing models (BSM), or as an effect of the reflexivity of derivative markets as a risk-order (Esposito). Rather, volatility is the absolute of derivative pricing: there is no derivative pricing without the splitting of the real of price into unknown actual and inactualisable futures; without, that is, a futural contingency that, in the endogeneity of the derivative market pricing, is instantiated in the indefinite plasticity of the infrawager. That contingency of revision is however actualised only by virtue of the operations of derivatives markets: the actuality of derivative pricing is, precisely, its price, instantiated nowhere else but in the dedicated market of the particular derivative. Consequently, 'the reality of the whole market worms its way into every attempt that possibility undertakes to precede the real'.[116] The real of derivative pricing is then endogenously constituted and actualized in its plasticity as a marketised futural contingency. While this is a familiar result, reiterating in other terms that derivative pricing is volatile because it is counterperformative, the formulation advanced here makes explicit that the ontology of price qua différantial temporization is necessarily predicated on an absolute futurity. That is, what is realized in every instantiation of derivative pricing is a volatility that is absolute for it.

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[116] Ayache, 'Turning', 49.

The thetic contingency of an ineliminable futurity that splits the present—the absolute futurity inaugurated in différantial pricing—is the real of derivative markets. The innocuous account of the derivatives market as 'the place where contingent claims get prices attached to them'[117]—a put must be met by a call, a short position by a long position—is a prelude to the comprehensive determination of market operationality as the endogenously constituted material occasion—the institution—by which the futural contingency of derivative pricing is actualised and manifest with each reiteration of pricing. As condition of the plasticity of derivatives pricing, the market is the material topology—more exactly, given that in the technical vocabulary of the market, the put option is said to be 'written', it is the *toposcription*—of the absolute volatility that is the actualisation of the futural contingency of derivative pricing. A number of equivalent formulations follow: necessarily instantiated in the derivatives market, the futural contingency of derivatives pricing *requires* its dynamic yet metastable toposcription, meaning that 'only the market preserves contingency in the present';[118] or, as Ayache puts it elsewhere, the market is 'the medium of contingency'.[119] Emphasising the endogeneity of pricing, 'the market is its own source of contingency';[120] emphasising instead the absolute volatility instantiated by that institutional toposcription, market pricing can be characterised as a 'technology of the future'.[121]

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[117] Ayache, 'Probability', 42.

[118] Ayache, 'Turning', 43.

To be clear, and to draw the argument back to the broader political economy of derivatives markets: the 'preservation' of contingency by derivatives markets, its technology, is necessarily contrary to stability. The ontology of these market institutions is predicated on the absolute volatility (thetic contingency) and indefinite plasticity (contingency of revision) of derivatives pricing that together constitute such markets as risk-orders. Locating the instantiation of pricing identifies the market as the sociotechnical condition—the institution—for the contract-exchange that determines price on each occasion. Ayache literalises that condition as the trading pit for options, whereas Esposito notes that derivatives markets are, amongst other markets, now geospatially 'distributed [...] as a ubiquitous form of calculation and reasoning', in accordance with the weakening norms of jurisdictional authority in the geospatially attenuated institutional forms of the risk-order.[122] Furthermore, and to begin the redetermination of the contingency of abstraction that will be taken up more fully in the next section, since derivative pricing is liberated from any intrinsic or necessary relation to the underlying, and given that there is no 'cause' for the contingency of pricing outside of the endogenous pricing process, for Ayache that contingency is instantiated primarily by the existential participation of the derivatives trader in the pit who, in Badiousian fashion, is subjectivised by its eventhood[123]—a singularisation effected, without standing in complete contradiction to Badiou's philosophy despite the theoretical-political incongruity with it, as a personalized embodiment of the second-order observer who is Esposito's systemic agent. But such determinations are again epiphenomenal and inadequate precisely because they are subjectively organised rather than determined by the logic of differential capitalization. Against such correlational determinations, the real of differantial pricing that is the absolute volatility of the infrawager must rather be apprehended in terms of its impersonal, socio-institutional ontology. Taking up that injunction, as the next section does, provides the argument for determining the ontology of price in general to be the real of derivative pricing, a result that in turn permits the operational and a priori dimensions of finance to be coarticulated without subreption.

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[119] Ayache, 'In The Middle of The Event', in R. Mackay (ed.), *The Medium of Contingency* (Falmouth: Urbanomic, 2011), and 'The Medium of Contingency', *Pli* 22, 2011, 62–87. While market pricing is a medium of contingency, following Nitzan and Bichler it is also at once the medium of power. The implied codetermination of contingency and power via price is explicated in §11.1 below. The subordinate point is that, determined as these mediations, finance theory is a variant of media studies. Vogl similarly proposes that finance demonstrates the general characteristic of all media, that they 'communicate themselves in their operation' as well as the communicated 'content', in this case because the control over the contingent future sought by finance is betrayed by the 'time-critical processes' that finance markets are ('Taming Time: Media of Financialization', tr. C. Reid, *Grey Room* 46 [Winter 2012], 82). However, Vogl's argument obviates the primacy of volatility in the pricing of risk and, following Keynes, also predicates the contingencies generated by market pricing on time distinct to the 'control' of price. Ayache's and Esposito's otherwise divergent theses are, rather, that the temporization of market pricing is constituted by the latter's contingencies. That is, the market is a medium of contingency and consequently a medium of time qua futurity. Still opaque, however, is what that futurity is with respect to both the contingency and power it posits, and this is what §11.2 below elaborates.

[120] Ayache, 'Turning', 49.

[121] E. Ayache, 'The Next Question Concerning Technology. Part 1: The Significance of Dynamic Replication', *Wilmott Magazine*, June 2007, 33 [www.ito33.com/sites/default/files/articles/0703_nail.pdf].

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[122] Esposito, *Future*, 69.

[123] Ayache, *Blank Swan*, §4.3.1–2.

10. PRICE IN GENERAL, VALUE, ARKHÉDERIVATIVE

That volatility is the absolute of derivatives pricing does not revoke the delivery price as a constitutive conditionality for that process. There can be no derivatives pricing without the delivery price as a structuring parameter. Moreover, in Ayache's formulation, only at the expiration of the derivative pricing process is 'the contingent claim really derivative on its underlying because its price is then settled and rigorously equal to that function of the underlying called the payoff'.[124] That is, maturity/expiration is the one point at which derivative pricing is convertible to the price of the underlying asset, a moment conventionally called the *valuation* of the contract and thereby of the pricing process. In Ayache's terms, valuation is when the 'underlying' of the derivative transfers from the paper on which the contract is written to the asset, a figurative articulation of the conversion of the endogenous plasticity of the pricing process to its determination by the price of the exogenous referent in its own market, a determination cashed out as the payoff. Valuation is the completion, exhaustion, and conclusion of the pricing process.

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[124] Ayache, 'Turning', 45.

Because valuation is determined by the difference between the delivery price and the strike price at expiration, the former being a static structuring conditional of the pricing process while the latter is also set in the market of the underlying asset, it seems that valuation is an external, structuring boundary condition for derivatives pricing. The institutional distinctions between derivatives markets and those of the underlying assets (when the latter are nonfinancial) confirm the exteriority of valuation to the plasticity of derivatives pricing. Yet price volatility is operationally generated by activity in any market, including those trading assets to which the derivatives refer (§5 above) and, theoretically, determined as it is by the difference between delivery and strike prices, the valuation of a derivative is precisely what is itself priced and varied by derivative markets. As such, valuation is an *internal* boundary condition to the derivative pricing process even as it conditional on the price of the underlying asset in *its* own market. The valuation of the underlying is, as Ayache puts it, 'dictated by the programmatic character of the payoff schedule'.[125]

At best, then, valuation is determined on the one side in relation to the price of the underlying in its own market or, on the other, by an internal boundary condition for derivatives pricing. The two sides are constitutively and institutionally distinct and, as such, the determinations of valuation are in opposition. But they are not incoherent or contradictory; nor can the ambivalence of valuation be settled by a more exacting analysis. In Derridean terms, valuation is a *supplement* to derivatives pricing, a term held to be outside of the derivatives pricing process but structuring it as a conditioning origin, principle, or terminus, yet which in fact is only stipulated as an extrinsic determination by that process (for example, for Husserlian phenomenology, the lived present is a supplement of what is in fact a differentially constituted present). That supplementary condition is what permits différantial pricing to be subordinated to the anticipatory regime of pricing, which is premised on valuation; and what permits the infrawager that is the real of price to be correspondingly determined as an extrowager, in which the real of pricing is its exogenous referent (in the case of derivatives, the price of the underlying asset). Equally, however, if derivative pricing is instead predicated on the infrawager and its différantial logic as its real, as has been established here, then the supplementary condition loses its prerogative over the pricing process and must instead be determined in terms of its real.

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[125] Ibid., 47

To anticipate the next steps of the argument, and without confusing the specific meaning of derivatives valuation with the generality of value as such, what this 'supplementless' determination of valuation means is that (i) value is in every case an exogenous cipher for pricing, and that (ii) price is in every instance predicated on its absolute volatility, including the price of the underlying in its own market. The argument on value follows from that on price, which is itself a general theory deduced from the comprehensive theory of derivative pricing:

—Valuation is the conversion of the derivative at expiration/maturity in its own market to another market in which the underlying is priced. In valuation, the pecuniary magnitude of the derivative contract payoff is exchanged in its *equivalence qua price* for the asset in its own 'primary' market.

—'Equivalence qua price' across markets supposes the commonality of price for both the derivative and the asset as pecuniary magnitudes. And because value

is the conventional term for the conversion point of one market to another via price (as discussed further below), price itself then being determined as a value because of its exogenous referentiality across markets, 'valuation' is the appropriate conventional term to designate this moment in the derivatives pricing process.
—The valuation of the derivative and therefore of the underlying asset is, however, at once priced by the derivatives pricing process itself and, *qua* volatility, modified by it. Furthermore, valuation cannot be recused from derivative pricing without mistakenly limiting derivative pricing to the standard format of the extrowager—an extrojective circumscription that is in any case proscribed by the logic of the différantial constitution of the infrawager, according to which the identity of terms cannot be preestablished.
—That is, if valuation is an exchange predicated on prices, this now means that the putatively exogenous referent of the derivative's valuation—the price of the underlying in its own market—is not in principle distinct from price as it is constituted by différantial pricing. If it were so distinct, derivative pricing would be inequivalent to price in the markets for the underlying, vitiating valuation in particular and derivative markets in general, as well as fracturing the 'single quantitative architecture' of pricing in capitalization.
—For *this* reason, valuation as the conversion point from one pricing process to another is constituted by

> and manifests the two contingencies—thetic (absolute volatility) and revisability (plasticity)—of derivative pricing. As such, and as already noted, valuation is an internal structural conditionality of the derivative pricing process. But 'internal' now indexes only its institutional formats: the exchangeability of derivative pricing with prices outside of derivative markets via valuation means that the infrawager is the structural and ontological condition of price per se; and the absolute volatility of derivative pricing is the absolute of price within *and* outside of derivatives markets.
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> —The price of the underlying is thus *institutionally* external to derivatives markets, but *constituted* in their logic. Or, inversely, derivative pricing exposes and makes institutionally and operationally manifest the general condition of pricing as such. Extending outside of the specific institutions of derivatives markets to the fact of price as such, the différantial ontology of derivative pricing is the real of price per se.

On the basis of that general theory, Ayache's characterisation of the absolute volatility of derivative pricing, that the 'written and material character of the contingent claim repeats that value is in fact unsettled and that it could have been different (i.e., it is a price)' holds even for prices outside of the derivative markets.[126] More broadly, it is intrinsic and necessary to the valuation of derivatives that *all* prices 'could have been different' *because* any price means that another price could have been given thanks to the plasticity and absolute volatility of pricing.

Value

Though this means that price is in general predicated on the real of derivative pricing that is the infrawager and its dyadic contingency, the supplementary determination of valuation persists in the primary sense informing the term 'valuation': that price reflects value (or, at least, it should). As noted above, the value of derivative pricing is its payout, occasioned in its putative exchange for the (price of the) underlying, at which point the derivative pricing process vacates the operating logic of the infrawager and converts into a mercantile exchange; as the terminology for options has it, derivatives and their markets *expire* when they are exchanged for the underlying asset. More generally, value is the exogenous determination of pricing which, in the standard determinations of Neoclassical and Marxian doctrine, also anchors it—the very same conversion of pricing that was operationally imposed by the regulators of the early CME. Formally, the argument against the priority of value over price follows quickly from its différantial logic: what is conventionally supposed as the condition and referent of price is in fact constituted *and* deconstructed by the latter. Price deconstructs value, and that deconstruction is explicitly manifest in derivative pricing. Substantially, the endogenous constitution of price qua infrawager means that the value-referent of price is not established on the basis of circumstances external to the relevant market such as trade, scarcity, demand, use, labour, or any other determinant external to pricing, all of which beg the standard economic question of how these heterogeneous nonpecuniary conditions and specificities can be commonly calibrated via pecuniary magnitudes.[127] As closing out and the universal

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[126] Ayache, 'Turning', 45.

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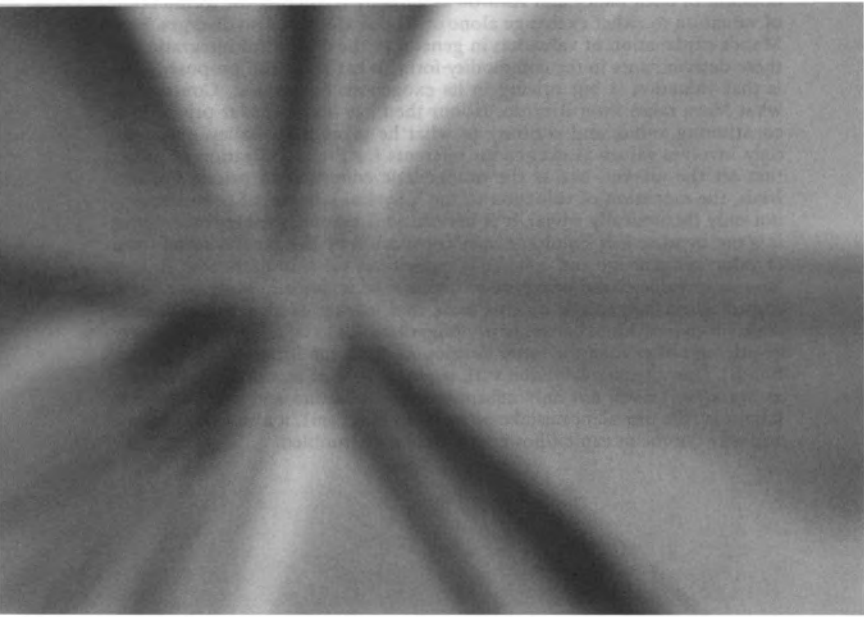
[127] In obviating even the means of means of production as a prerequisite of pricing, this result goes farther than Ian Steedman's conclusion that 'in general, profits and prices cannot be derived from [Marx's] ordinary value schema' but rather only from the 'physical schema' of physical production and labour costs' ('Value, Price and Profit', *New Left Review* I.90, March-April 1975, 78). Marxist criticism of Steedman's argument focus on the formal idealizations of the static model of production Steedman inherits from Piero Sraffa's *Production of Commodities by Means of Commodities* (1960). While Steedman and Saffra both present NeoRicardian critiques of Marxian value-theory, recuperating the division in kind between price (exchange, distribution) and value (production, labour), with Steedman dispensing with valuation as a necessary mediation between labour and price, the claims of the main argument here correspond more to Samuel Bailey's 1825 criticism of David Ricardo's derivation of value on the basis of labour rather than in terms of exchange alone.

For Marxism, all such results can only be errors: Marx's primary theoretical contribution is the synthesis of production/labour and distribution/exchange with his labour theory of value in Capital 1: that theory is not an account of the generation of value by labour alone (Ricardo's thesis) but of labour as an abstract social form constituted by exchange determined in its universal instance by money. Bailey's thesis is that such exchange is the common term of value. As I.I. Rubin remarked in the 1920s, given the dialectical unity of labour as a social form (exchange) and concrete action



fungibility of the underlying make explicit, the operation and dynamic of price in derivatives markets are

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(labour), any separation of its aspects is only a mistaken hypostatization of its comprehensive constitution ('Abstract Labour and Value in Marx's System' tr. K. Gilbert, *Capital and Class* 5 [Summer 1978]). Rubin's resolution however also throws up its own difficulties on how exactly values then change between the input and output of a production process, and how they are converted to prices. The latter is known as 'the transformation problem' and was addressed by Marxist theorists countering Steedman's result by insisting mainly on the intratemporality of value-development and, with regard to price, the dialectical integration of value via the commodity form, constituted on the one hand by labour in its concrete instance (as the yet-to-be-realised form of value, its substance in Hegelian terms) and, on the other, by exchange (as the realized form of value or, per Hegel, its appearance), with money as the (universal) abstract equivalence of value in general (see in particular E. Mandel [ed.], *Ricardo, Marx, Sraffa* [London: Verso, 1984]; G. Carchedi, 'The Logic of Prices as Values', *Economy and Society*, 13.4 [November 1984]; A. Freeman and G. Carchedi [eds.] *Marx and Non-Equilibrium Economics* [Cheltenham: Edward Elgar, 1996]; and A. Freeman, A. Klimam, J. Wells [eds.] *The Value Controversy and the Foundations of Economics* [Cheltenham: Edward Elgar, 2004]).

While the argument of the main text here is congruent with the Marxian criticism of both Bailey and Ricardo as wrongly restricting the formulation of valuation to either exchange alone or labour alone, it also diverges from Marx's explanation of valuation in general as the dialectical integration of these determinants in the commodity-form. What is instead proposed here is that valuation is but pricing in its exogenous conversion. Contrary to what Marx takes from Ricardo, labour then has no particular privilege in constituting value; and contrary to what he takes from Bailey, exchange only involves values as exogenous referents for the mobilization of prices that set the market, not as the ontogenetic condition of prices. On this basis, the extension of valuation to the 'physical schema' of production is not only theoretically trivial, it is necessary: if labour is value-constituting it is not because it is simultaneously constituted by the general social form of value in exchange and concretely constitutes value in particular. Rather, labour is value-constituting only because it is priced. Moreover, with regard to exchange, it is on this basis that market exchange at whatever scale (from individual bartering or obligation) has to be taken as a modality of pricing rather than the latter developing from the former (as per Adam Smith). Constituting valuation with regard to labour as a primary category, as Marx(ism) does, not only misapprehends valuation and therefore what labour is (the prevalent mistake of political Marxism), it also explains how and why dominant capital-power is not thereby troubled.

overtly liberated from these exogenous determinations irrespective of whether they are cast subjectively (in the Neoclassical paradigm) or objectively (in the Marxian paradigm).

In other words, given the contingency of abstraction as a condition of price in relation to value, price in general is not an epiphenomenon or overcoding of values that preexist it, nor an order of marketisation imposed upon them. Rather, in the condition of capitalization, price is the *precondition* of valuation. That is, the condition for the variability, transformation, and equivalence of value—the intrinsic mobility and multiplicity of values synchronically or diachronically—with regard to price is not value, but pricing. As such, price has no intrinsic value. And because value has no basis outside of the pricing process determined as the infrawager constituted in its triadic contingency (thetic contingency together with the contingencies of revision and abstraction), value has no intrinsic value.[128] Value is not then a condition or necessary limitation on pricing and therefore on capitalization, as a real other to them, but only one of the assigned variables of the real of price, a real exposed as such by derivatives market operations. On the contrary, value is but the exogenous determination of price, the conversion of one pricing process to others or to what lies outside of price altogether. As such, and as both Marxism and Neoclassical orthodoxy stipulate, value subtracts the contingency of abstraction from the triadic contingency of price in general, now meaning that value is not only a reduction of pricing to the dyadic (thetic and plastic) contingency characteristic of the infrawager but also that, since price, valuation extends the structure and contingencies of the infrawager outside of price and in other terms.

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[128] The three main ideas of Nietzsche's later philosophy from the period of composing the *Zarathustra* book (1880s) onwards—the will to power, the revaluation of all values, and the eternal return of equivalences (as an idiomatic translation of *ewige Widerkehr des Gleichen*)—can then be identified as variants of the deconstruction of value by price. In rendering the transmutation of valuation in terms of the philosophico-religious traditions of moral value-formation and their modern weakening, Nietzsche correctly identifies the determination of modernity in non-financial terms yet, for that reason, largely misapprehends its constitutive elements.

The formal result above is thereby substantially confirmed: assuming the supplementarity of value as the basis of pricing, price deconstructs value. In the condition of capitalization, value (commonly identified with the qualitiative) is a financial term in principle and in fact (it is quantitative). Derivatives pricing exposes, institutes, and operationalises price as the differential variability of value in general, but without delimitation by an exogenous referent, and thus as a valueless process. Equally, the variability of reference characteristic of value, which is indefinite because value has no intrinsic value, is the condition made explicit and exact as 'abstract pecuniary magnitudes' in a universalisable 'single quantitative architecture' organized by and for capitalization: as price, that is, for which valuation and what is valued (whether or not it is opposed to price, for example as use-value) are only functional occasions for the instantiation of a capital-power.[129]

The Arkhéderivative

That a price 'could have been different' even once it is set and a value given, and that values (are liable to) change are demotic articulations of the general theory of price advanced here: that price is constituted in the triadic contingency of the abstract infrawager. Implicit in the commonplace of price contingency, and now fully exposed, is that, rather than prices arising from exogenously-derived valuation, values are variable by virtue of their price-ontology. Nitzan and Bichler, Esposito, and Ayache each formulate variants of this primary thesis. Nitzan and Bichler note that price as the elementary unit of capital-power cannot be established because both the anticipated earnings and the future normal rate of return for the asset, meaning that the basic discount price formula can not in fact be known. Accordingly, the price of capitalization in the present, which orders industry, is always and necessarily speculative, variable (plastic), and contingent (abstract) and thereby permit differential accumulation—that is, they are administered prices. For Esposito, derivatives pricing is a particularly complex and advanced form of sociotemporal binding that determines the present as revisable (plastic), maintained primarily with regard to the inactual and unknown future (absolute volatlity), a condition typical of the risk-order constituting modernity in general. And for Ayache, referring to the contingency of the definite uncertainty of the absolute volatility of price explicitly posited by derivative pricing (thetic contingency), each price 'successively repeats the whole genesis of price'.[130]

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[129] Confirming from a completely obverse aspect one of the primary theses of communization theory, that because labour is constituted by the value-form, contrary to orthodox Marxian praxes which vectors class struggle via labour organization the only viable exit from capitalism is rather the (theoretically organised) abolition of labour, establishing in its stead 'immediate social relations between individuals' (Endnotes, 'Communisation and Value-Form Theory', *Endnotes* 2, April 2010, endnotes.org.uk/en/endnotes-communisation-and-value-form-theory). In terms of the logic of the main text here, and to preview later developments, such a claim is a perfectly symmetrical abreaction to the strictly endogenous constitution of pricing, and thereby abets finance-power from a putative 'outside'. Communization is consequently a politics entirely compatible with now-prevalent finance-power, reconstructing in other terms the exclusion of anthropological interests from the endogeneity of the infrawager—if, that is, communization is in any way a politics: the evacuation of power-price determinations in the 'immediate social relations between individuals' abolishes the futurity and calculative risk of abstract sociality by which, as argued below, politics is constituted, proposing instead a countermodern ethical relationality. Or, as Endnotes themselves affirm, the 'radical politics' of their conclusions are in fact strictly and wholly 'anti-political'.

Each is however only a partial and circumscribed determination of the general theory of price according to which price as such, and value after it, are constituted by and instantiated as différantial pricing wherever and however spontaneously they happen. Furthermore, the ontology of price, which is the general and realist theory of the 'genesis' of price repeated by each price, is explicitly materialized, institutionalized, and operationalised *qua* derivatives in their markets. But, to return to the organizing caveat in the introductory comments above, if the financial operations of derivatives markets are empirical-institutional *manifestations* of the ontology of price per se, the two dimensions referred to—institutional practices and ontology—cannot be directly identified: for all of their transnational systemic integration, derivatives markets are a parochial set of institutional constructions for capital accumulation via complex ownership claims formulated via specific juridical-financial contracts; on the other hand, the ontology of price as such is the a priori of pricing in *every* instance. Following Derridean convention, wherein the writing that is the logically a priori condition for speech, though it may be historically posterior to speech, is demarcated from the historical manifestation of writing by designating the a priori an 'arkhéwriting', the conditional primacy and priority of the derivative for price as such is here designated the *arkhéderivative*.[131] The term is a theoretically-organized construction articulating and exposing the two dimensions of pricing via one other, integrating them without direct identification.

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[130] Ayache, 'Turning', 42.

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[131] Though it is not named as such, arkhéwriting is at the core of Derrida's *Edmund Husserl's Origin of Geometry: An Introduction* (tr. J. P. Leavey (Lincoln, NE: University of Nebraska Press, 1989 [1962])), §VII, esp.89), in which a modality of writing is identified as the historical and logical condition of science. That derivation is rehearsed in Chapter Six of Speech and Phenomena, where arkhéwriting is explicitly named (85, translated as

That the operations of financial markets are constitutively predicated on the ontology of price is a trivial consequence of identifying the arkhéderivative. The non-trivial corollary is that financiality, the a priori of price in capital power, is also predicated on the arkhéderivative. The arkhéderivative is then the a priori of the *political economy* constituted by the ontology of price. That is, the arkhéderivative is not only manifestly and explicitly operationalised by finance markets for capital accumulation, it is also the ontology of every instantiation of capital-power. As regards the former, it is not just the *fact* of price but also the ontology of price that is made explicit and operationalised by the complexities of the time-binding of derivatives pricing. As regards the latter, the arkhéderivative is the ontological a priori of capitalization, as political

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'protowriting'), becoming a primary thematic in *Of Grammatology* as an explanans of the constitutive role of the expressive/extensive dimension of signification in the otherwise idealised accounts of structural linguistics (tr. G.C. Spivak [Baltimore: Johns Hopkins University Press, 1997 (1967)]), 59–61, from which the following quotes are taken). That arkhéwriting is the a priori 'of all linguistic systems' means for Derrida that it cannot be an object in any language nor 'enrich the scientific [or] positive description of the system itself' as the object of a science. Derrida's retreat to transcendental-empirical or essence-appearances disjunctions at the very point that he surpasses them leads to his influential but therefore restricted characterisation of writing per se as primarily literary (59), distinct from the protoscientific synthesis of the real of writing for which Husserl also provides reasons.

economy in general, *and* in its each time particular instantiation qua price. Financiality is, in other words, the power determination of the arkhéderivaitve qua ontology of price.

The complex institutional-practical operations of financial markets are integrated with the a priori financiality of capitalization by the arkhéderivative in the real of price (what could sarcastically be called its common-wealth) as its respectively operational (power) and constitutive (infrawager) dimensions, and this can be stated without making the category error of directly identifying them. Conjoining these otherwise disparate dimensions of financial pricing, the arkhéderivative is the comprehensive realist ontology of finance. In particular, thanks to their complex forms of time-binding, financial markets make explicitly manifest and operationalise not just price but also the ontology of the instantiation of capitalization in general. The irrevocable lesson of the arkhéderivative is that price is at once institutionally and constitutively financial.

11.1. FINANCE-POWER: POLITICS

The arkhéderivative is the ultimate term in this argument or the ontology of price, serving as a summarising metonym for the various determinations contributing to the general theory of price and permitting, by way of conclusion, the redetermination of finance-power as a risk-order constituted by price contingency. That redetermination is not an arbitrary or parochial issue for theorizing the political economy of capitalization: if the arkhéderivative is the real of finance in its constitutive and operational dimensions, then derivative markets are the truth of market financiality *qua* the dynamic power-ordering of capitalization. Moreover, that dynamism is constituted by the triadic contingency of the arkhéderivative, generally actualized by the universal fungibility of what is priced (contingency of abstraction), the variability of price (contingency of revision), and the futural absolute volatility of pricing (thetic contingency). These are the primary conditions of the risk-order instituted by price; a risk-order determined now not in terms of the sociology of the markets but in terms of the real of price. That risk-order is also and immediately a political economy, because in constituting the financiality of price, the arkhéderivative is no less the ontology of capital-order. As a consequence capital order is necessarily a risk-order.

Distinct from the broad characterisation of modernity as a 'society at risk' (as per Esposito's systems-theoretical determination) social-institutional order in capital power is contingent not because the future is uncertain in the present in general (Esposito) but, more exactly, because the present of capital power—sociotemporal binding—is split by the absolute volatility of pricing into the realisation of incompatible futures.

Turning now to Nitzan and Bichler's account, capital power is dynamic and transformative not only because of the strategically common conflict between capitalists (which again would be a sociological determination of the political economy of capitalization), but because that conflict is itself only possible via pricing because the latter is constituted in the arkhéderivative *qua* the dyadic contingency of the infrawager, manifest in the standard discount price formula of capitalization as the uncertainty of its inactual variables. And because the arkhéderivative is the condition of capital-power, the absolute volatility of pricing theorised by Ayache per force instantiates capital-power. In general, the actualisation of the arkhéderivative's triadic contingency qua price is in every instance capitalization's dynamic and transformative social (re)ordering (including the stability and preservation of extant power configurations, for which the only absolute is their futural contingency and whose stability thereby needs to be actively maintained by repricing). The arkhéderivative is the dynamic metastability of the capital-order.

The triadic contingency instantiated qua price is not just one of pricing with regard to other prices and value but—precisely because price is the ordering schema of capitalization—also the intrinsic contingency of the constitution and organization of capital-power. It is in other words *price* that necessitates politics. The capital-order, which is a risk-order, is constituted as a political economy. Even if it is a commonplace that finance, exemplified by derivatives pricing, is necessarily a mode of capitalization qua social ordering, the ontological corollary established here is that, predicated on the arkhéderivative, social power qua capitalization is transformable, mutable, and contingent as a futural unknown.[132] Such is the contingency of revision conditioning the risk-order of finance-power, for which (i) the financiality of the arkhéderivative 'depriv[es] the very meaning of normativity' from the social order, and (ii) capitalization instead implements the continual and nonterminal revision of social order via price. Consequently, the only basis for the dynamic institution of power in capital-order is capital-power, instantiated by price, the logic of which is organized by differential accumulation.

It follows that differential accumulation is not a norm but a politics, the term now futurally determined as the normless revision of power qua risk (that is, instantiating and capitalising on the futural contingency of price).[133] Such politics is a recusal of

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[132] Roberto Mangabeira Unger proposes that the modern social order is an endlessly plastic and transformable 'artifact' by virtue of acknowledging society to be constructed by human imagination and creativity rather than posited as a given (Z. Cui [ed.], *Politics: The Central Texts* [London: Verso, 1997 (1987)], 3–18 and 172–204). That 'negative capability' of social institutions (contrasted against their extant positive terms) is dedicated to emancipating subjective experience from established scripts but is however often practically constrained and circumscribed by extant elite configurations and 'entrenched' social structures. While the latter point is uncontentious, in the terms of the thesis of the main text here Unger's proposition psychonaturalizes and thereby cloaks the sociopolitical plasticity wrought by capitalization as the prevailing condition of modernity.

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[133] This result countermands the political and theoretical adequacy of neorationalist doctrine to the modernity it claims to advocate for and advance via Left Accelerationism. A short detour into Brandom's philosophy demonstrates why: the consistent and thorough synthesis of judgements in Brandom's 'strong semantic inferentialism' (SSI) consists of three simultaneous activities (*Reason*, 36–38): (i) the consistency of critical responsibilities 'requir[ing] judgers to renounce commitment to contents that are incompatible to other commitments' or their consequences, because each can 'serve as a reason to give up the other'; (ii) completion via ampliative responsibilities, requiring the judger to accept other commitments on the basis of what she or he is already committed to; and (iii) the warrant of justificatory responsibilities, requiring the giving of reasons for one's commitments by recourse to prior commitments. The synthesis of judgements in SSI results in the transcendental original synthetic unity of apperception at the base of Kant's account of the epistemological subject: normative revision integrates (= unity) the endorsements intrinsic to inference-making (= synthesis) by the judgement that these norms inaugurate (= original) by a sapient being (= apperception). Furthermore, these conditions are not just those of judgement but necessarily also of what is judged, which is the content of the concept (= transcendental not formal logic). This latter objective dimension of the unity of apperception constitutes a representational relation to the content of the concept that is therefore intrinsically determined by the constraint of consistency, meaning that in its rational validity of no one object or subject in its unity can maintain incompatible properties (principle of non-contradiction), though two different subjects/objects can exhibit the inconsistency between them (45). The subjective dimension of such necessary exclusions and consequences are its deontic or normative relations (responsibilities and liabilities), and the objective corollary is their 'alethic modal' relations, meaning that a 'single object just is what cannot have incompatible properties (at the same time). That is, it is an essential individuating feature of [...] objects [that they] have the meta property of modally repelling incompatibilities' (48) as a necessary consequence of their having 'objective validity' by inference. Hence, rational inferentialism necessitates a unified and coherently integrated subject and object of judgement that each repudiates incompatibilities.

Against the homology between reason qua SSI and risk-rationality proposed in n.89 above, neither of these two principal conditions of SSI holds for pricing in its thetic contingency and the concomitant future-constituted risk-order, for two reasons: firstly, contrary to the normative performativity of rational inference, pricing is counterperformative and necessarily goes in the 'wrong' direction to any that might be inferred by stipulation of an 'ought'. Secondly, pricing's absolute volatility is precisely and only the positing of a futural contingency qua incompatibilities of what the future will be even once the contingency they construct is settled (the price 'could have been different'). As such, pricing in its absolute volatility instantiates and maintains incompatibilities rather than repelling them. Consequently, pricing and the risk-order do not comply with the deontic constitution of the subject in its orginary synthetic unity of apperception, or to the alethic modality of the object's noninconsistent validity, or to the thus coordinated inferential consequences and deontic adumbration. In formulating the basic unit of judgement not in the predicative form of <If p then q> but in the contingent formulation <If p then q or r or s or ..., where p is insufficient to determine q, r, s....>, the risk-order vitiates reason qua the positive freedom and authority of normative constraints (60).

In Brandom's terms, which have an immediate political overdetermination, it follows that pricing and the risk-order of capitalization are not rational but are conditions of unfreedom (cf. Negarestani, 'Labor'). But such a Brandomian critique of capitalization via pricing is only a doctrinal result, one among several consequences to the incompatibility of the risk-order with the normative synthetic unity posited by philosophical reason. What can also be inferred is:

- that as a discursive social practice with some rules (the logics of differential accumulation and différantial pricing as well as the delimited regulatory requirements for markets), the risk-order is quasirational precisely because it posits an order that maintains incompatibilities;
- that risk-rationality is a nonnormative modality of reason, meaning that the social order of risk is shaped not by rational norms but by inferential processes whose logic surpasses that of the deontic-alethic modalities of unified synthetic judgement;
- given the expansion of inferential pragmatics in the risk-order beyond Brandomian doctrine, the latter is an unnecessary and limiting commitment to philosophical-rational determinations of inference and reason. More assertively, the deontic-alethic modalities of incompatibility-repelling synthetic unity postulated by SSI are undone by the risk-order of capitalization, which socially instituted practice constitutes the very political modernity of which SSI claims to be the philosophy and moral-conceptual authority.

Philosophical adequacy aside, the incompatibility of risk rationality and SSI formulates a schema for the politics of normative reason with regard to the risk-order, botho f these being taken as practices of revision. Affirming SSI, the subjective and objective unity it instantiates as well as its subtending normative constraints mean that SSI necessarily counters the construction of incompatible inferences characteristic of the risk-order of capitalization. But that is to repudiate the primary futurity constituting the risk-order thanks to pricing. This repudiation is evident in Brandom's affirmation of Hegel's configuration of the rational integration of conceptual content by norms which, thanks to the arkhéderivative's contingency of abstraction, is exacerbated in its scope by the universal fungibility of what may be priced (in contrast, then, to the typical but restricted referent of capitalization—production for Marxism or, in its more recent biopolitical overdetermination, 'life', or for Veblen, 'industry').[134] What is indexed here by the

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the process if 'recollection (*Erinnerung*)', which provides a 'genealogical [...] vindication' of inferential commitments 'currently being integrated' (16, and Ch.3)—another variant of synthetic unity of reason now with regard to the sociohistorical fabrication of discourse which, tellingly, is the way that reason 'is the way [reason] moves forward, by looking backward' (23). Inferential reason is then a synthetic traditionalism at a variety of scales and venues—sociohistorical, subjective individual, and objective validity—all of which will come to be integrated with one another. By contrast, asserting the risk-order of capitalization *qua* generation and maintenance of incompatibilities, rationality is not an attribute primarily of sentience but of pricing, reason being here determined with regard to the futural contingency of temporization. That practice prevents retrospective semantic vindication and, concomitantly, the formulation of an original synthetic unity as the organizing term of reason or the quasinorms it posits. In terms of SSI, risk-rationality inaugurates what Meillassoux elsewhere calls the Principle of Insufficient Reason not with regard to the insufficiency of the ontological causal relation as basis for what happens next that concerns Meillassoux (see n.98) but as the constitutive insufficiency of the very establishment and construction of semantic-discursive inference-making itself, vitiating the 'bindingness' of any normative construction.

If, following Brandom, the Enlightenment is the 'development of secular conceptions of legal, political, and moral normativity' predicated on the 'conception of normative positive freedom' as formulated via SSI in its necessary sociohistorical dimension (60)—which is the to-be-vindicated philosophy of political modernity according to neorationalism—that determination of modernity misidentifies it as the coherent generation of retrospectively constituted and integrated semantics rather than the futural positing of incompatibilities. As such, the Enlightenment has little if any salience for apprehending the risk-order of capitalization.

[134] These determinations are compounded via the recent emphasis on the 'precarity' of life-work and experience in neoliberalism: see M. Lazzarato, *The Making of the Indebted Man*, tr. J. D. Jordan (Los Angeles: semiotext(e), 2012) and C. Marazzi, *The Violence of Financial Capitalism*, tr. K. Lebedeva

otherwise paradoxical formulation of an order without norms that is universal in principle, is that the real of capitalization is not constituted materially, normatively, or conventionally, but by stable-enough institutions positing a contingent yet power-hierarchical relation to an indefinite future via price.

If differential accumulation means that price variability is the reorganization of power, the redetermination of capitalization in terms of the arkhéderivative means that power is now not only a power over *what* the future may be—the standard criticism that capitalism segments the future in favour of those with the greatest capital, though since finance-power such a segmentation is in fact all that politics is *qua* the power-organization of the future. Predicated on the arkhéderivative, power is moreover power over the organized uncertainty that price posits in the present (thetic contingency). To elaborate: because the real of price is the endogenously constituted infrawager, the futurity of the arkhéderivative is itself priced as its volatility. As such, the futural thetic contingency of pricing is itself subject to the power instantiated on each occasion of price. Consequently, price qua the magnitude of power of social institutions is the paradox of the magnitude of social power over uncertainty, a measure of the size of a futural contingency *instantiated* by price.

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and J. F. McGimsey (Los Angeles: semiotext(e), 2011). With respect to finance-power, precarity is but an anthropological-industrial incidental determination of generalised price sabotage.

Capitalization is thereby determined as a risk-order of power not only extensively, across the entire 'spectrum of social institutions' or 'societies at risk', but also intensively in each instance of price. Price indexes the magnitude of the absolute volatility of power in the present. It is not then that risk is to be priced by derivatives markets but, constituted in the arkhéderivative, price itself is the magnitude of risk, which is to say the magnitude of absolute volatility that is posited in the present. It is a measure of the futurity of the present, *a quantification of différantial temporization*. Consequently, the political economy of price since finance-power is immediately the politics of futurity itself.

Finance-power instantiated via price is therefore analytically dual: it is the magnitude of power in the holistically organized present of intracapitalist conflict *and* it is the magnitude of the thetic contingency of power. For all of the analytical distinction, the two determinations are however not operationally or ontologically distinct, and for two closely aligned but operationally distinct reasons:

> (1) In general, risk is *in fact* indistinct from all price *qua* power. It is not just that power involves risk, such that the greater the power the greater the risk. Rather, price is at once the magnitude of power *and* the quantification of the futural contingency concomitant with any instance of power, no matter

what the magnitude. Price is both the magnitude of power and the magnitude of futurity *qua* systemic uncertainty—so price itself is 'systemic risk'. Since price is necessarily determined in regard to capital-power, every price is intrinsically an occasion of *political* economy, of what, where, and how much power over futurity is to be had—a systemic conclusion that is effectively dramatised by the size and consequences of the credit default that comprise Lesson Two of the financial crisis.

(2) Sectorially, as the toposcription of the absolute volatility of price, priced risk is the power magnitude of the futural contingency of power's instantiation. Extensively operationalised qua accumulation by derivatives markets, priced risk is how one sector of the entire spectrum of social institutions assigns a power-magnitude to the futural contingency of price. In doing so it gives the futural contingency of power a power-determination in the present and, at once and for that reason, subjects the *systemic* power-organization of risk-pricing to the triadic contingency of price, which is what is dramatized in Lesson One of the financial crisis.

11.2. FINANCE-POWER: AUTOSABOTAGE

While the pricing of risk by derivatives markets operationally demonstrates that they empirically institute finance-power as an infrawager, the single 'abstract pecuniary magnitude' that is price is at once quantified power (capitalization) and quantified futurity (absolute volatility). That duality of price can only be analytically (rather than ontologically or operationally) demarcated: more emphatically, the constitutive ontology of the risk-order is given in the *unicity* of power and futurity via price. Predicated on the arkhéderivative as political economy is—as all politics is—and taking the power-futurity duality of risk-pricing by derivatives markets to be the explicit historical-institutional manifestation of that constitutive condition, this section elaborates in theoretical terms what the political economy of a risk-order constituted by price entails, providing the basis for the more explicitly institutional-sectoral consequences of the power organization of the state-finance nexus that is taken up in the concluding section.

Operationally, derivatives pricing *qua* infrawager means that prices in derivatives markets are conditions for further pricing and also conditional upon them. Because of the universal fungibility of the exogenous reference of derivatives (its contingency of abstraction), and because price is the instantiation of capital-power, the endogenous plasticity of derivatives pricing (its contingency of revision) is then primarily the direct dynamic reorganization of capital-power *on itself* according to the logic of differential accumulation, and only incidentally the reorganization of capital-power outside of the pricing process (qua value). Returning to Means's distinction as it is taken up by Nitzan and Bichler, pricing primarily with regard to other prices is to set administered prices rather than market prices. With derivatives markets, it is not that revenues are fixed against the variable cost of production, as in Means's industry-based account, but that derivatives trading *qua* infrawager sets prices only on the basis of 'back-calculat[ing] the mark-up [the price of the derivative] necessary to realize a rate of return'. That is, derivatives are not priced competitively but rather to maintain a mark-up, doing so in real-time rather than the medium-to-long-haul typical of industrial processes. In terms of the arkhéderivative, the infrawager is the plastic reorganization of administered prices, and the market as a whole is comprised of this price setting of the market. But administered prices are set not only via their immediate markets but also by the organization of the spectrum of social institutions, the general name of which, with respect to what Veblen calls industry, is sabotage. Consequently, sabotage is a primary characteristic and necessary effect of financial markets. There are two distinct aspects to this conclusion:

—From the optic of industry exogenous to derivatives pricing, the plasticity of the latter is pure sabotage because derivative pricing is directly a magnitude of endogenously-constituted capital-power. This is just to reiterate from another angle the criticism of the finance sector's siphoning of capital, productivity, and social reproduction in general.[135]

—However, the industrial determination of derivative pricing is strictly speaking only incidental to the latter *qua* infrawager. The endogenous operationalisation of derivatives pricing is primarily the plastic redetermination of prices and therefore of power *within* the price-terms of those markets. Operationalising the arkhéderivative, derivatives markets *directly* redistribute power *qua* capital accumulation in its own terms, rather than those of what, for it, is only the incidental condition of historical precedents or needs (for example, production or consumption).

If sabotage is the vitiation of industry because business implemented via administered prices diminishes social capacity in favour of the price organization of power via capitalization, the infrawager of derivatives pricing is, in contrast, the *intensive* determination of the operational dynamic of sabotage. It is the sabotage of capital-power by capital-power across time and markets via price plasticity, an autosabotage. To be clear: the intensive autosabotage of capital-power is not operationally distinct from its extensive determination as industrial sabotage; but it is also not reducible to the latter, given the explicitly universalising and abstracting contingencies of the infrawager *qua* real of price. In its most general determination capital-power is not just counterproductive (a 'negative industrial magnitude'); it is also and primarily (as a positive *financial* magnitude) its own intrinsic counterpower: the autosabotage of dynamic price-setting in its own terms which, constituted in the infrawager of the arkhéderivative, is intrinsic to *all* price. Price qua capital-power is then necessarily its own partial countermanding; the very instantiation of capital-power is at once the instantiation of its own counterpower, the sociological corollary of which is the intracapitalist struggle in differential accumulation.[136]

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[135] See Lapavitsas, *Profiting*, 146; Marazzi, *Violence*, 44-46; and Hudson, 'Goldman Sachs'. Nitzan and Bichler complicate the basic assumptions of this claim and received assumptions on the global political economy of the finance sector in 'Imperialism and Financialism: A Story of a Nexus', *Journal of Critical Globalisation Studies* 5 (2012), 42–78, www.criticalglobalisation.com/issue5/42_78_IMPERIALISM_AND_FINANCIALISM_JCGS5.pdf.

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[136] The standard reference for the endogenous fragility of economies relying on financial intermediaries (primarily banks) is Hyman Minsky's *Financial Instability Hypothesis* (*Stabilizing an Unstable Economy*) (New York: McGraw-Hill, 2008 [1986]), Chs. 7–10). Minsky notes that the increasing innovation and elasticity of financial instruments by financial intermediaries encourages short-term lending and leverage, fuelling economic booms and expanding balance sheets for financial intermediaries. Short-term borrowing by commercial banks in these conditions are however overextended against their nonfinancial assets and also susceptible to market volatility. Consequently, and counter to the investment-supporting claims legitimising finance, long-term investment undertaken and facilitated by financial intermediaries is driven by short-term price movements on unregulated

The real of price qua power is, in sum, extensive and intensive differential sabotage. In its intensive determination of financiality, price endogenously instantiates a power gradient, incapacitating in some respect that which it overpowers by outpricing it. That which is outpriced is also a term of capitalization, just a lesser one. However, if prices set the market then the market is the toposcription not only of capital-power *qua* autosabotage but also, at once, of the thetic contingency instantiated on every occasion of price. That is, pricing is not autosabotage only in respect of the incapacitation of what is thereby outpriced, in relation to other prices in the presently and historically comprised capital-order, but also, as elaborated above, in respect of its intrinsic thetic contingency whereby the extant society-wide organization of power is futurally risked to the degree indexed by the magnitude of a particular price. While the two counterpowers of the arkhéderivative—autosabotage and futural contingency—can be

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markets whose instability thereby extends to the entire financial system. For Minsky, the endogenous instability of finance is institutionally formulate rather than located in the fact of price. Minsky's hypothesis has been extensively taken up in theorizations of the 2008 financial crisis. A striking example of this literature discussing the global expansion of the dollarised shadow banking system as condition for both the systemic reach and magnitude of the 2008 financial crisis, paraphrased in the above account of Minsky's hypothesis with regard to the development of financial innovations, is presented in J. Tokunaga and G. Epstein, 'The Endogenous Finance of Global Dollar-Based Financial Fragility in the 2000s: A Minskian Approach', PERI Working Paper Series 340, January 2014, www.peri.umass.edu/fileadmin/pdf/working_papers/working_papers_301-350/WP340.pdf).

analytically demarcated, they are again inextricable and mutually constitutive in the ontological unicity of finance articulated by the arkhéderivative. In that unicity, it follows that price-sabotage risks the market. That is, price is simultaneously the power over present *and* futural disestablishments of power, an autosabotaging futural contingency of capital-power. The several aspects of this unwieldy characterization of finance-power—autosabotage, futural contingency, and capital—are effectively synthesized by the term 'misfortune', but only if it is taken in this precise sense. Instantiated via the misfortune of price, then, capital-power's dynamism necessitates the persistent contingent reorganization and revectoring of capitalization, a reorientation and contingency in time-binding whose direction and gains necessarily cannot be secured.

The determination of the arkhéderivative as a misfortune of power—meaning, to reiterate, an autosabotaging futural contingency of capital-power—is the comprehensive ontology of the market *qua* risk-order. As such, it is a systemic determination of capital-power, providing a diagnostic matrix for its historical development. Taking 'capitalism' as the name for the holistic systemicity of capital-power, the misfortune intrinsic to pricing means that there is no necessary or required direction, orientation, or identity to capitalism; its ordering via price is also the occasion of its contingent reordering. The only sociohistorical constraint for capitalization, given its organization by differential accumulation, is that one capitalist accumulated more capital-power than another, and some sectors against all others. But that is only a constraint of its reason, not a prescription as to who or what will have the greater capacity for capitalization (meaning setting larger prices), nor for where and to what capitalization will be directed. That is, the duality of price-power's misfortune as regards sabotage and futural contingency is the constitutive condition for the sociohistorical contingency inaugurated by and as capitalism, thanks to which price's contingencies of abstraction and revisability are preserved across capital-power's necessary social-systemic operation.[137]

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[137] In terms of Aristotelean categories (*Nichomachean Ethics*, Book VI), finance-power is then a *tekhné*, a process whose ends (teloi) are exogenous to that process and which may therefore never be attained by it (example: a building may never be completed). Aristotle distinguishes *tekhné* from *poiésis*, an artificial process with intrinsic ends (example: live music, which is heard as it is played), and *phúsis*, processes which always and necessarily have intrinsic ends (nature). The exogeneity of purpose to process in tekhné is why in general any technical process can be repurposed, and why in particular whatever is repurposed is a technics (including then nature). For Massimo Amato and Luca Fantacci, the problems of modern finance stem precisely from its operational divergence from its intrinsic purpose, which is investment via completed debt promises within given time frames (*The End of Finance* [Cambridge: Polity Press, 2011]). Securitization, intermediation, and large-scale complexity have also anonymised finance, vitiating what for Amato and Fantacci ought to be the intimate purpose of finance but which condition is here recognized as the consequence of its constitutive technicity. The emancipation of technics from the modern category of energy (which is predicated on work and thereby determines ontogenesis via the intrinsic ends or 'entelechy' common to phúsis or poésis, a logic organising both Marxian and Neoclassical economic doctrine) is proposed in S. Malik, 'Tekhné is Fond of Túkhé, and Túkhé of Tekhné: Energy and Aristotle's Ontology', *Tekhnema* 5 (1999), 124–53; an emancipation that

Constituted *qua* finance-power, capitalism is realised only in more or less local, more or less large power conflicts. It has no necessary operational, social, cultural, or institutional identity, nor (*qua* différantial pricing) any constitutive identity in its logic. Contrary to Marxian doctrine, then, internal contradictions do not necessitate its expansion or its demise.[138] Equally, capitalism cannot extinguish or supersede itself at a putative conversion point (the reassuring myth of singularity).[139] The constitutive misfortune of financiality proscribes any terminal or tendential logic or practice of capitalization, instead advancing only increased magnitudes of capitalization (which itself requires more complex, integrated, *and* differentiated forms of social-order *qua* risk-order). The history and future of capitalization is comprised only of the interminably tactical, dynamic reorganization of price, power, and the 'entire spectrum of social institutions' along both external and internal vectors of finance, the latter having ontological, operational, and political precedence. Constituting the identityless increase

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implicitly countermands the DeleuzoGuattarian transcendental energetics underpinning Nick Land's convergence thesis (see n.139).

[138] That contradictions within the capitalist totality drive the territorial expansion of capitalist countries via colonial and imperial domination is first proposed by Rosa Luxemburg, *The Accumulation of Capital*, tr. A. Schwarzchild (London: Routledge, 2003 [1913]).

[139] This is the characteristic claim of Right Accelerationism. See N. Land, 'Meltdown', in R. Mackay and R. Brassier (eds.), *FangedNoumena* (Falmouth: Urbanomic, 2011 [1994]) and 'Teleoplexy: Notes on Acceleration', *#Accelerate*, 509–20.

in aggregate capital-power, enfuturing the present in the autosabotage of pricing, the misfortune of the arkhéderivative is the historicity of capital-power.

11.3. FINANCE-POWER: THE STATE-FINANCE NEXUS REDUX

Price is the measure of the political economy and the power over misfortune. The operational toposcription of finance-power via the abstraction of the number scheme of price markets means that markets are the basis for the comparison of finance-power in all times and places. Returning then to the contentions of the introductory comments above, the power magnitude and constitution of derivative markets can be directly compared to other organizations of power *in terms of the ontology of finance*—which is to say, by comparison of their respective prices. In particular, taking up Haldane and Alessandri's comments in terms of finance-power, the threat that the finance sector now presents to states is twofold: firstly, if GDP is a proxy for state power in global political economy (for reasons to be presented shortly), then for the most part the transnational derivatives markets outprice state-level GDP, which is to say that, in terms of the power theory of price, these markets overpower states even if the latter have jurisdictional power over them. The political and theoretical question of relative powers then has to be recast as a question of whether statutory authority, stemming from state sovereignty, is endemically more powerful than finance-power, and sufficiently so as to not be overpowered by the latter's quantitative determination. The second identified threat to state sovereignty from finance markets is that all juridical aspects of state power in Westphalian modernity are territorially constrained, including the typical determinations of what that power is tantamount to: the monopoly over violence, guarantor of security, popular autonomy, legislative centrality, bureaucratic control, the ipseity of authority, the paramount status of popular sanction, and so on. Whatever determination of ultimate power is given to state sovereignty, its reach and legitimacy is necessarily territorially limited and constrained, particular (up to and including its global or extraterrestrial extension, as in some science fiction or political theory). As such, it is unable to attain the universal extension permitted by the 'abstract universality of magnitudes' constituting and actualising finance-power in its price-organization.[140]

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[140] In Gilles Deleuze and Félix Guattari's terms, such quantitative abstraction is the primary condition and vector of capitalism's 'deterritorialisation' as a countervector to the system of capture that is the State and its particularising-segmenting codifications (*Anti-Oedipus*, tr. R. Hurley, M. Seem, H. R. Lane [Minneapolis: University of Minnesota Press, 1983 (1972)], Ch.10, esp. 251–54). Capitalism's 'lines of flight' from State territorialization are nonetheless fundamentally constrained and 'reterritorialising' for Deleuze and Guattari insofar as capitalism is axiomatically organized by the commodity form and production for the market. That axiomatic is for them the progenitor of capitalism rather than invented by it, and requires the historical institutionalization of various

That is, the (necessarily universal) geospatial extension of finance-power is in principle if not historically in fact greater than the (intrinsically particular) power of state sovereignty.

In terms of finance-power, the territorial exorbitance of finance-power to state sovereignty does not threaten the latter so long as the capacities of their economies and revenues are greater in magnitude than the resources of financial organizations. However, if 'causality has reversed' between states and financial institutions, as Haldane and Alessandri put it, because regular defaults of monarchical loans in early institutional capitalism are replaced today by

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organized State forms according to its level of development. Revoking the basic Marxian determinations of capitalism's axiom that Deleuze and Guattari adopt, capitalization in the logic of differential accumulation can instead be construed as a wholly formal axiom that is operationally aterritorial and abstractly constituted (via pecuniary magnitudes) and which, in its intrinsically dynamic constitution of intracapitalist conflict via the infrawager, is therefore unbound in its overall axiomatic production—hence, its extensive and intensive universalism. Equally, as discussed in the closing sections below, insofar as pricing relies on enforceable regulations of money and contract (including the 'convertible abstract rights' that secure private property [Deleuze and Guattari, *A Thousand Plateaus*, tr. B. Massumi (Minneapolis: University of Minnesota Press, 1987 [1980]), 454]), the state form is indispensable to capitalism, which means that capitalization is not so much the reterritorialising deterritorialization Deleuze and Guattari propose as it is an each-time territorially inaugurated deterritorialising. 'Territory' in these formulations is only the limitation imposed by sovereign jurisdiction rather than a geospatial factum: any such factum can be subordinated to the reorganization of jurisdictional authority and is thus not at all intrinsically bound to the figure of the nation-state even if that has been its dominant historical configuration. For the specific transformations of Westphalian jurisdictional and financial institutional infrastructures to facilitate transnational capitalization since the 1970s see S. Sassen, *Territory, Authority, Rights* (Princeton: Princeton University Press, 2006).

crises in financial markets requiring state interventions in order to sustain not just that sector but also the entire social order, then in terms of finance-power this reversal is only a historical transformation: the greater power is determined only by which sector has the greater price. That aggregate magnitude is determined for states primarily by their operational capacity and revenues, which is precisely what GDP indexes. Furthermore, given that nonfinancially generated operational capacity and revenues of states from production and consumption are again constrained in the Westphalian settlement by material and territorial factors determined by the inviolable borders sanctioned in that regime, the pecuniary magnitude of nonfinancially generated annual GDP for even the largest states is necessarily constrained in a way that the plasticity of pricing and market-interconnectedness of finance are not. The 'price magnitude' of finance as an operational sector can then in principle be greater than that of any state—or, because finance-power is endogenously constituted, the sectorial price of finance can always be exorbitant to any of its previous levels including that constrained by state-level organization. The current size and transnationalism of financial markets is an institutional-historical figure of the hybrid configuration of finance-power and state sovereignty, the relative sizes of global derivative markets (by credit exposure) and state GDPs indicating the approximate equality of their respective finance-powers at the level of most of the wealthiest states, and the greater power of finance market to the majority of nation-states. Which is to say that it is not that power has 'reversed' between states and the finance-sector over the course of modernity, but that while state sovereignty has been the toposcription of the largest financial powers in that period, that historical condition is now in mutation and no longer a historical given. That is, thanks to the increasing aggregate price of derivatives markets, finance is now relatively more emancipated from the primary political configuration of historical modernity and, with that, the state-finance nexus is reorganised and revectored.

To elaborate this reorganization by way of conclusion: as Nitzan and Bichler remark, the sovereign state is but one of the social institutions in the arrangement of capital-order, albeit the one that has been most dominant in securing the normal rate of return against which all differential accumulation is pegged. But that congruence between sovereignty and finance-power is also countermanded by their typological disparity. If sovereignty is constituted by the indivisible unicity and centrality of its decision as much as by the assumed supremacy of its performative diktats, in contrast finance-power is constituted by the primacy of its thetic futural contingency, the plasticity of the infrawager, and its misfortune. For all of the complexity of the power-misfortune duality of price, its quantitative determination in every instance rescinds qualitative particularity as the term of power, whether that particularity is organized in terms of history, tradition, authority, or the other semantically rich or impoverished meanings typically invoked to warrant sovereignty (up to and including the transcendentality of its theological determination).[141] Minimally, then, finance-power is typologically a counterpower to sovereignty: the primacy and irreducibility of sovereignty *qua* determinant of power is violated by finance-power both in principle (quantity and triadic contingency against the particularity and the insuperability of authority) and socio-institutionally (finance markets outprice states). Finance-power threatens sovereignty not just because its greater financial magnitude and its absolute volatility prevails, but because the splitting of the present by price in the contingency of its irreconcilable futurity overpowers the otherwise assumed and inviolable authority of sovereignty.

That threat is manifest, and state sovereignty is degraded with regard to the arkhéderivative, when states are outpriced by finance markets—as is largely the case today, thanks to neoliberal institutional activism since the early 1970s. Exemplified by the invention of the CME and other derivatives markets, the consolidation and expansion of derivatives markets since the 1970s not only operationally liberates the real of price from nonfinancial determinations such as production and material resources (the putative 'real economy'), it moreover concretizes and manifests the countermanding of any necessity or finality of value, price, or other financial measure, per the ontology of price. Consequently, the aggregate price magnitude of the financial institutions operationalising the arkhéderivative in its own terms are limited only by regulatory requirements and the tactical assessments of a risk-rationality—a liberation unavailable to modern state sovereignty. Thanks to finance-power, sovereignty is no longer the supreme power, but is itself now subject to contingency. More exactly, the very conditions of legislation sanctioning and regulating finance is itself now constituted in terms of the contingency of finance-power.[142]

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[141] C. Schmitt, 'All significant concepts of the modern theory of the state are secularized theological concepts', *Political Theology: Four Chapters on the Concept of Sovereignty*, tr. G. Schwab (Cambridge, MA: MIT Press, 1985), 36.

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[142] The disambiguation of misfortune is politically and analytically crucial here. By an argument similar to Esposito's, Vogl too proposes that thanks to finance capitalism 'danger and chance have returned in an archaic form, as túkhe or fortune' in contrast to the historically preceding welfare societies that sought to 'tame contingency' (*Specter*, 130). Consequently, 'the hazardous whims and caprices (*Launen*) of age-old figures of sovereignty have returned under modern conditions'. The present thesis is precisely the contrary: the arbitrariness of sovereignty is anything but contingent while the contingency of finance-power is highly risk-rationalised and anything but arbitrary. And now the latter dominates the former, further obviating sovereign caprice. Which is also why, for all the vast discrepancies in wealth implemented by neoliberal policy, it ought not to be designated as a neofeudalism (as Hudson or Lazzarato do, for example) nor, for that matter, is it the biopolitics that Vogl mistakenly proposes finance to be in its 'determining [of] the life processes of a society by a single force'.

Ineliminable Statism

What is established here is that, cogent as it may otherwise be, the state-finance nexus is riven in its power ontology. The argument is not primarily that the operational-historical growth of the finance sector deprioritises sovereignty in favour of other modes of power (a Foucauldian variant of the thesis), or that the indebtedness and other financial commitments of the state (whether it be monarchical, or a parliamentary democracy, bureaucratic control, autocracy, etc.) require it to resort to finance markets to maintain itself. Rather, whatever power can be summoned by the state thanks to its sovereignty can be (i) determined as a specific magnitude in any particular instance, and (ii) that magnitude is comprised of the aggregate prices it can command from jurisdictionally-bounded institutions and social organization. The 'command' of prices is not that of a state-controlled economy, but rather the price that the state can raise on the basis of its sovereignty (taxation being the obvious example). While this injunction practically presumes the hierarchy of social institutions and order, the channeling of command via price, qua instance of finance-power, necessarily imposes a dynamic reorganization of social order. In its conservative formulation, this partial conclusion proposes that states are committed to their reorganization in order to sustain their integral role in the general ordering of social institutions by capital-power.

This is, to reiterate, not a reordering *directed* by sovereign command, but a political-economic transformation in which sovereign power has a key, *judicious* role.[143]

And it is this last-mentioned condition that provides the more comprehensive formulation of the reorganising command structure of states in the condition of finance-power: that sovereignty is not the theoretical or operational basis of political *economy* nor exempted from it, but is institutionally and theoretically determined by it. This consequence is partially recognized, in other terms, in Modern Money Theory (MMT), for which state sovereignty is tantamount to the authority to impose and maintain money as legitimate unit of account for creditory relations, generating a demand for those units and also destroying them (by removing them from circulation) via taxation.[144] The immediately relevant argument of MMT is that monetary policy is fiscal policy is social policy, and there is no monetary economy without state debt (which is therefore a public virtue). In terms of the broader argument of power typology advanced here, this would mean that state sovereignty is nothing but a term of political economy, and that, as such, it is not typologically distinct from finance in either its institutional operation or ontology. Yet if the state is a financial institution, it is the only one that fabricates and imposes money on a population that must then use it to pay taxes, and it is for this reason also a distinct and unique financial institution in its sovereign power. Taxation is the state's premonetary but nonetheless financial claim over the power organization of social institutions. In terms of finance-power, taxation is the price of the state—the price of monetisation—for the nonstate sector. Furthermore, as condition of the monetary arrangement of price, the sovereign state is only a subordinated necessity for the chronic reordering of complex modern societies qua risk-orders. Which is only to reiterate through the monetary dimension of finance-power that sovereignty and finance comprise a nexus—modern capitalism—that is at once congruent and also internally disparate, but is in any case constituted as finance-power. As such, the state-finance nexus is a particularly prominent, because systemically ineliminable, example of a general requirement of capital-power: that finance-power maintain institutions in order to advance capitalization, including, for example, sovereign jurisdictions with the authority to sanction and enforce the contracts fabricating derivatives (jurisdictions which in theory need not be nation-states).

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[143] See P. Mirowski, *Never Let a Serious Crisis Go to Waste* (London: Verso, 2013), 56.

[144] See n.54 above, L. R. Wray, *Modern Money Theory* (Basingstoke: Macmillan, 2012), Ch. 2, and, for a discussion of the genealogy of MMT, 'From the State Theory of Money to Modern Money Theory', Levy Economics Institute Working Paper 792, March 2014, www.levyinstitute.org/pubs/wp_792.pdf; also P. Tcherneva, 'Chartalism and the tax-driven approach to money', in P. Arestis & M. Sawyer (eds.), *A Handbook of Alternative Monetary Economics*, (Cheltenham: Edward Elgar, 2006), 69–86.

The Political Risk of Futurity

In general, then, finance-power is bound to capital-order, an organization of power by which greater and lesser magnitudes of capitalization can be socially implemented—and transformed at every instance thanks to the price indexing of that power-ordering: price *qua* misfortune transforms the order of power it measures. Constituted by the arkhéderivative, the dynamism of capital-power ('the most dynamic of all historical orders') is not reducible to nor predicated on the history or sociology of the capital-order but is a *result* of the thetic futural contingency and auto-sabotage of price. Capital-power is in other words a prevailing risk-order dedicated to the future contingency of the present and, at the same time, to its partial incapacitation. Two mutations to primary categories of modernity can then be identified, serving here as terminal remarks:

Statist futurity. In the political economy of sovereignty, statism and even sovereignty itself cannot be opposed to futural contingency. On the contrary, in the near-equality of aggregate price levels of (necessarily local) states with (necessarily crossbordered) derivative markets the state is a particularly privileged organization in capital-ordering, but one that now has a surmountable price: as noted, because derivative markets operate across borders, their monetary levels are not limited by the monetary constraints that particular states have to observe, an operational-historical exorbitance that is theoretically warranted. And because states are now explicitly priced (if not outpriced) sovereignties, they too occasion not just the autosabotage of capitalization (which is the standard criticism of the state by advocates of the so-called 'free market'), but also the thetic futural contingency of pricing. To use Ayache's formulas, the state too is a medium of contingency or a technology of the future.

Dynamic and plastic rather than static (despite the etymology, which provides only a lexical rather than semantic constraint here), the state as a political-economic term deposes the inviolability of sovereignty in its actuality and also its theoretical-ideological justifications. The state may be a term of social sabotage, but in this it is not typologically distinct from any other instance of capital-power (which is why the 'free market' is an untenable doctrine); it is distinct only with regard to its still relatively large size in terms of prices it can set, in being an identifiable actor, and the authority to explicitly transmit its finance-power across all social institutions by law and taxation. As the price of monetisation, taxation itself is at once dually sabotage (the standard libertarian complaint) and, typically, a large power over collective thetic futurity.

Political Reason. Requiring an order yet dynamically transforming it without certainty in its thetic futural contingency, finance-power observes and instantiates a risk rationality to which even sovereign states as prominent modes of power are subordinated. If power in modernity is predominantly organized between states and capitalists, it has been primarily determined across that history according to a risk-rationality. This is a history of sabotage in order to accrue power via price setting. And it is inextricably also politics, the chronic transformation and contestability of power ('it could have been different') predicated on the definitely uncertain future posited each time by price. It is not just that politics is inaugurated with each price qua instantiation of capital-power, apprehended now as a sabotage-contingency duality. Politics itself now means not just *what* the future will be but also the power over the magnitude of futural contingency and who or what owns it across the entire social order, including but not limited to the sovereign state. As such, politics is not predicated on the relation to statedom, although that, also, is not proscribed. Rather, politics is more generally both constituted and determined by risk-rationality, which is to say with a view to the uncertainties generated by the autosabotage of power and the contingencies of abstraction, revision, and thetic futurity of the arkhéderivative that splits the present from itself. Politics in risk-rationality is then occasioned in terms that are not commutative with qualitative determinations of authority and command, and it moreover rescinds any priority conventionally granted to them—and, with that, it also rescinds reason in its sovereignty (if ever there was such) or social normativity, maintaining both only so as to reorganize the necessary misfortune of price.

The Coup de Dés, or the Materialist Divinization of the Hypothesis[1]

Quentin Meillassoux

MATERIALISM BEYOND ATHEISM

Readers of *After Finitude*[2] will no doubt ask why I became interested in Mallarmé's *Coup de dés*, what link my study *The Number and the Siren*[3] could possibly have to the speculative positions that I developed there concerning the necessary contingency of every being. I would simply say the following: The *Coup de dés* is, as far as I know, the greatest poem ever to be dedicated entirely to eternal Chance; and to the role of the human (and specifically of the poet, in Mallarmé) confronted with this dark absolute, the only one recognised by the moderns. What I find striking in this poet is that, in the face of a Chance held to be insuperable, he does not renounce his hope for the *divine*—a divine that takes on an extraordinarily original form which I shall try to unveil in what follows.

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[1] This text is an edited version of a talk given at Miguel Abreu Gallery, New York, 6 May 2012.

[2] Q. Meillassoux, *After Finitude: An Essay on the Necessity of Contingency* (London and New York: Continuum, 2008).

[3] Q. Meillassoux, *The Number and the Siren: A Decipherment of Mallarmé's* Coup de dés, tr. R. Mackay (Falmouth and New York: Urbanomic and Sequence Press, 2012).

Now, Mallarmé's gesture is entirely *materialist*. Thus, as a materialist, it interests me: because (and this is a fundamental point to grasp in order to understand my own trajectory) materialism is not an atheism. For *materialism does not consist in denying gods, but in materializing them*. It is Epicurus, of course, who founds this gesture: for him, the gods exist, but they are not the gods of the mob—the gods of religion and superstition who are feared or praised. The Epicurean gods are atomic beings, immortal in fact, since they are born by chance in the intercosmic spaces where the gains in atoms are always equivalent to the losses, and thus conserve bodies indefinitely. This is why the gods care nothing for our existence, and do not concern us either: they are not bothered by terrestrial affairs, since they remain immortal only on condition that they stay where they are. This is also why they are not essentially different from us: we are identical to the gods, except that we are mortal—a relatively unimportant difference. The materialist philosopher is thus one who knows how to be like a god among men. For to be divine is nothing more than to be filled with life as a god might be, to be for a moment equally happy as man and as god:

which comes down to the joy of satisfying the limited requirements of our nature. The joy of satisfying one's thirst with a little water makes us equal to the divine at the moment it is quenched.

Going beyond the particularities of Epicureanism, we might say that, most profoundly, materialism consists in that thought, now largely forgotten, that unveils to us a divine *norm* for a life entirely avowed to a hazardous absolute. 'Norm' is to be understood here in the sense of the latin *norma*: the carpenter's square. The divine norm of materialism allows the subject 'to be straight', to find his verticality without religion or metaphysics. It does not separate him from gods, but on the contrary gives him access to the true god, one that is material and born of chance. Whence the potent irreligious significance of materialism. Atheism is always impotent against religions: contenting itself with denying religious gods, it remains haunted by their absence, and ceaselessly reimparts that which it refuses—as the term itself indicates: a-theism, that which can only be defined as the negative of the religious god and in relation to him.

Atheism thus always leads back to what it refuses, in the mode of absence and haunting, and unfolds infinitely in its own impotence. Whereas materialism saturates the space of thought with the absolute—the pure meaninglessness of Chance—and with what I call the Ultimate—pure hazardous gods, the most successful creations of a perfectly absurd becoming. Constructing its life and its thought between these two extremes, between the meaninglessness of the absolute and the divine success of contingency, the materialist wages his struggle and prosecutes his critique against religions and metaphysics alike. Against scepticism, he affirms that the absolute is thinkable—for to refuse thought's ability to grasp the absolute is to reserve the absolute for a belief purified of all reason (in this respect, scepticism has always been the loyal ally of faith). Against atheism, it affirms that the gods are real, material, and that they orient our existence without alienating it. Against metaphysics, subject to various forms of the Principle of Sufficient Reason, it denounces the pseudo-necessities of ideology, which justify the powers that be, or powers yet to come, and unveils the real contingency beneath false essences and supposed idealities.

Materialism—if we relate it to the Epicurean gesture, without reducing it to the particular form he gave it in his philosophy—materialism alone, I believe, can hope to deliver us from religious gods. But the paradox is that materialism also delivers us from its own gods, from the material gods that it theorises as ultimate yet perishable points of chance. For what is singular about materialism—a position far more irreligious than the negation of gods—is that it tells us that, certainly, gods exist, but that they are *secondary*.

They are models, perhaps, but not masters. They are 'patterns' that allow us to outline more easily the apparel of our existence—but the 'pattern' matters less than the suit whose cutting-out it allows. Certainly, the gods remain important for Epicurus, but far less important than your way of running your life here and now, by modelling yourself on their reality. Certainly, for Epicurus, the gods exist—but so what? This is a secondary matter for the sage, who occupies himself with men rather than with gods. The gods don't care about us, and we care more about men than about gods. And this is indeed the contrary of idolatry: not to make of god, on the grounds that he exists, the most important thing. To allow gods to exist, but to 'secondarise' them: not to obey them, but to avail ourselves of the knowledge we have of them, so as to cease to preoccupy ourselves with them *any more than that*, and above all to live fully as a human amongst humans. Such is the slogan of every true materialist: god exists, or could really exist, that's a fact—but not the most important one.

It is this materialist gesture that I try, in my own way, to revive today, in my philosophical investigations. I believe that the materialist, on one hand, must radicalise the meaninglessness and the contingency of the absolute; and on the other hand, must think the configuration of the divine that the most radical contingency allows to exist—stripped of any necessity, but subsisting at least as a forever real virtuality of this absurd becoming. I certainly do not believe that gods exist as a remarkable product of chance atomic encounters—but I believe that materialism well and truly consists in thinking the most remarkable emergence of which contingency is capable; that materialism consists in drawing up the most extreme map of the possible, and in living according to the intense effect that this possible exerts upon existence, once it is understood as real possibility and not as mere reverie.

THE METER AND THE CODE

Now, I insist that this revival of the divine gesture of authentic materialism is precisely what Mallarmé already achieved, in his own unique way, in the *Coup de dés*: he produced a poem that I call authentically, and not banally, atheistic, because, through the sole power of Chance, it brings about a configuration that is divine, but nonetheless wholly human. It is a materialist god who rules over these pages, and by the same token a secondary god—one who seeks only to produce an effect on our lives (your life being, all the same, more important than that of Mallarmé's god). In the conclusion of *The Number and the Siren*, I say that the *Coup de dés* is an 'exact atheism'. But I define this exact atheism of Mallarmé's ironically—precisely as the contrary of an atheism; as that which makes of the divine the articulation of the Self and of Chance—and thus as something that departs from atheism, to become a true and vigorous materialism. What I describe therefore is a Mallarméan renewal of the Epicurean gesture.

As I state quite plainly, I am convinced that Mallarmé's poem is coded. But what is totally original in Mallarmé is that he tried to use this question of encryption to resolve the problems of his epoch, which concerned, in particular, the question of *metrics*—that is to say, the question of the writing of poems according to regular forms, rather than in free verse.

Until the *Coup de dés* (written in 1897, in its two different versions), Mallarmé only writes poems in regular forms; that is to say, he adopts a metric linked to fixed forms such as the sonnet, to fixed numbers of syllables, and to rhyme. He continues to do so even though he is confronted, from 1887 onward, with the new form (or refusal of form) that is free verse, and which abandons all traditional meter. But then suddenly, in 1897, everything explodes, and we have a poem even more audacious in form than free verse, namely the *Coup de dés*. The enigma is that there is no mediation between the strict metric of all previous Mallarméan poems, and this stupefying poem of quite unabashed transgression, which no-one really understands (not even the free verse poets) when it is published for the first time in 1897. In order to better grasp the meaning of this abrupt break, I want to show that the *Coup de dés* is in fact not a form (even an exacerbated form) of free verse—that it is not an intensified refusal of metricity—but that it proceeds from another logic entirely; and that the only way to understand this logic is by way of the discovery of a procedure of encryption.

I do not agree with critics such as Ronat and Roubaud that it is a matter of a defence of the old metric (in particular, the alexandrine); rather it concerns a new meter, and a new count. The *Coup de dés* is a eulogy to counting in poetry, and an apologia for the thesis that what essentially distinguishes poetry from prose is that the poet is the one who counts, who 'calculates', albeit in a rhythmic and not solely an arithmetical sense; he for whom every number counts. This granted, the *Coup de dés* fundamentally speaks to the role of number in poetry, and defends meter in a completely unprecedented manner.

THE MASTER AND THE POET-PRINCE

The *Coup de dés*'s shipwrecked Master who throws the dice in the stormy waves is surely poetic Meter, in the process of being drowned by the tumultuous waves that are none other than the segments of text exploding onto the Page of the *Coup de dés*. These fragments have all the characteristics of free verse, exacerbating its refusal of classical form. It is free verse that submerges Meter. In this way, the terrible tension between the two forms is dramatically brought to life, and Mallarmé will try to resolve it from a poetical, not just a critical, point of view: through the writing of a poem rather than through a theoretical intervention.

The Master of the *Coup de dés* holds the two dice in his hand. This theme, as we know, was already present in *Igitur*, the unfinished tale of 1869. The crisis that provoked this poem goes back to the discovery of the Nothingness which Mallarmé writes of in his 1866 correspondence: the discovery that there exists no God capable of guaranteeing the absolute value of the poetic symbol, as was still hoped by the first romantics, perhaps even by Baudelaire himself. He therefore writes this fable, which was never to be published, in which he imagines a young poet-prince, Igitur, inspired by Hamlet, who descends into the tomb of his ancestors, asking himself whether he must perpetuate their destiny. His whole hesitation is condensed in the question of whether or not to throw the two dice he holds in his hand, to try to obtain a double six. These ancestors represent the line of poets whose heir Mallarmé wishes to be; and it is a question of knowing whether it is still worth the effort of producing the twelve of the perfect alexandrine, even when one knows that this alexandrine will no longer be the result of a divine inspiration, but that of meaningless chance. Language no longer being a bond between man and God, but one chance among others, what point is there in throwing the dice? What point is there in continuing to seek the sublime verse, if the divine vocation of the poem, its claim to replace the old religion, is no longer subtended by any transcendence? The romantics refused to perpetuate the old Catholicism: but they claimed that they did so in the name of a more profound understanding of the beyond, not because it is illusory. The drama of Mallarmé himself, transposed into the hesitation of Igitur, is that he no longer believes in the existence of a super-terrestrial reality, but still cannot manage to renounce the idea of a religious and higher vocation of poetry.

The poet thus hesitates between two possible endings that he could give the tale, without managing to decide on one of them—whence the unfinished character of his fable: either Igitur throws the dice and provokes the derisive anger of his ancestors (they make a furious wind whistle in the ears of the hero), because the poet resumes the gesture of his forebears, but does so for opposite motives (chance having become the moderns' sole god); or—the other ending proposed in the manuscript—Igitur keeps the dice in his hand without throwing them, and proceeds to lie down upon the tomb of his ancestors. We already find, in these two endings, the opposition between a kind of

'Sartrian' solution—one boldly assumes the absurdity of the world by throwing the dice—and a solution that puts us in mind of the process of writing according to Blanchot: one writes the exhaustion of writing, a writing that unfolds indefinitely, in a trial of its own impossibility.

Igitur must of course be read in relation to *Hamlet*—it involves a decision at once fatal and impossible, which must separate an absolute before and after, and which, because of its own radicality, seems inaccessible to any resolution. Now, these themes are manifestly taken up once more in the *Coup de dés*, nearly thirty years later. The Mallarmé of 1897 comes back to this thematic from 1869 because he understands that in the *Coup de dés* he will be able to transfer the theme of the death of a verse guaranteed by the divine, to the crisis of free verse. The Master must throw the dice to know whether he will produce once more a universal metrical verse, or whether everything will be lost to the chance of non-metrical verse, the representative of subjective temperaments of different poets, lacking all necessity. The same crisis of nothingness is at play across the distance of decades; in 1897 it directly compromises the future existence of the poetry practiced by Mallarmé.

'NOTHING / of the memorable crisis / WILL HAVE TAKEN PLACE / BUT THE PLACE / EXCEPT / PERHAPS / A CONSTELLATION', writes Mallarmé. The 'memorable crisis' is the crisis of free verse, from which nothing will escape unless meter, classical among all, can escape it victorious. The danger would be that one of the two forms of verse should drown the other. On the contrary, the two forms have to coexist in some original fashion. And yet when we read the *Coup de dés* we cannot see, *a priori*, anything but an exacerbated explosion of free verse. Could there be some way for a metric to be inserted into a poem that apparently breaks so completely with all the old rules?

THE BOOK AND THE MASS

In fact, we find another example of this will to maintain a metric 'on the terrain of free verse' in Mallarmé's *Notes for the Book*. Mallarmé was obsessed his whole life with the writing of an absolute Book, the Great Work which, in a public letter to Verlaine, he called 'Orphic Explanation of the Earth'. This obsession also must be understood in the framework of the religion of art. Mallarmé very seriously tried to write a text that could replace the Bible. We might think he was being ironic here, given the hubristic nature of such a project: but this is, I believe, to misunderstand him—so far was this project from being out of reach, that in fact he wholly succeeded in it, in any case according to his own criteria for success. But only in the *Coup de dés*, as we shall see; I maintain that the *Coup de dés* alone realised the whole project of the Book, but via a wholly new route.

In the *Notes*, Mallarmé describes a ceremony of reading that is quite obviously designed to replace the Mass. This is a most strange ceremony: we see a room, with 'assistants' seated before a scene, and on the scene two pieces of furniture, two racks containing loose-leaf pages which an 'operator', as anonymous as a priest, takes up and joins one to another, according to a combinatory so complex that the reading of the whole Book would take place over a period of five years.

Now, the reader of these *Notes* cannot but be struck by the numerological obsession that runs through them. For the manuscript is essentially composed of numbers, of calculations on numbers, of measurements as to the material and financial aspects of the Book, of various quantities involved in the ceremonial context of its reading. These Numbers, on one hand, have an obvious link to the alexandrine: there must, for example, be twenty-four assistants in the reading room, and the size and the price of the book are also linked to multiples or divisors of twelve. It thus seems clear what Mallarmé is seeking to do with these strange calculations: The poet perceives that the alexandrine is being driven from the poetical text by free verse; free verse seems to demonstrate that the 12 is contingent for poetry. So the 12 takes refuge in the material surroundings of the text and in the context of its reading (size, price, number of volumes, assistants, and so on), and no longer concerns its content. We understand that the poet seeks a way to reinsert the metric—the count—into poetry, by finding new functions for meter

Nevertheless, it is hard to see how this procedure of enumeration is meant to have saved the alexandrine, and restored its necessity. But what is interesting, for our purposes, is to ask whether the *Coup de dés* did not continue this 'counting mania', but make it more effective: through the writing of a poem that, however apparently non-metrical, would contain within itself, in its very composition, numbers that are not immediately visible, but that would constitute the result of the Master's throw. Thus the Master would have admitted that the waves of free verse were destined to visibly engulf poetry—including the *Coup de Dés*; however, in this poem there would have existed a metrical principle—not immediately accessible, but underlying its composition. If this is what Mallarmé did, then the *Coup de dés* could no longer be considered as a radicalisation of free verse, but must be understood as a metamorphosis of metrical verse. The *Coup de dés* would not have pushed one step further the rupture with classical constraints, but would have tried to reinvent them. Mallarmé would then have written what I would willingly call a poem in *essential verse*: a verse neither free nor metrical in the old manner, but capable of uniting radicalised free verse and a reinvigorated metrical verse. This would be a poem we could call 'hyper-metric': in the guise of being 'hyper-free', it would be yet more rule-governed than classical verse, but according to a rule encrypted within the poem itself.

Now, the only cipher that appears, written out, in the *Coup de dés*, is Seven. The final throw of dice that compensates for the failed throw of the Master gives rise to a 'Septentrion', a stellar seven that seems to mark a possible success of the voyage despite the surrounding disaster. What could the Seven symbolize for Mallarmé? Already, in the last Page—the page where the Septentrion emerges—we find a clue to this stellar 7 under whose aegis the meaning of the metrical count governing the whole of the *Coup de dés* is placed. We read—running from the penultimate to the final Page—the second great announcement of the Poem: 'NOTHING / WILL HAVE TAKEN PLACE / BUT THE PLACE / EXCEPT / PERHAPS / A CONSTELLATION'. This Constellation is said to be 'cold with forgetfulness and desuetude' —'not so much', however, it is added—'that it fails to number / on some vacant and higher surface [that is: in the stellar sky, but also on the vacant surface of the page] the successive impact / starrily / of a total count in the making [that is to say, of a total count that is in the process of being produced *at this very moment as we read the poem*] keeping watch / doubting / rolling /shining and meditating / before finally halting /

at some last point by which it is consecrated / Every Thought Emits a Throw of Dice'.

I believe that what is described here is that there is a metrical count that is in the process of being summed, of being totalised, as the reader arrives at the end of the poem, and that will be completed by a 'consecration'. In metrical poetry, the count is obviously always completed at the end of the verse: it is when I read the end of an alexandrine that the summation of the twelve syllables is produced effectively in the verse. Let us suppose, then, that the whole of the *Coup de dés* was written as one single verse, that is to say (since a verse for Mallarmé is always two verses rhymed together) as two adjoined verses, each symbolically of 12 pages. What Mallarmé is describing here is what happens at the end of a poem, in which something is in the process of being summed—and the total count is completed precisely with the word 'consecrated [*sacre*]' which, at the same time, would designate the final crowning of the Septentrion. 'Consecrated' would then be the last word that completes the count (still enigmatic) of that unique Number that cannot be another. The stellar throw of dice is thus a mental throw of dice, and the sky is not the night sky, but the white of the page. The reader believes that the poem is describing to him a stellar night outside of the book, but in fact Mallarmé describes what he himself is doing: he 'enumerates' his 'total count in the making', which is like a glorification of a Meter to come.

THE SIMPLEST OF METERS

If we start out from the hypothesis that 7 is the secret and constellatory Meter of the poem, we still need to find out *what* it counts. To conclusively track down this enigma, we will take a look at the final 'moral' of the Poem: 'Every Thought emits a Throw of Dice'. We can propose the following interpretation: when you think, you must pass by way of language, and thus you must use a certain number of linguistic units. For example, the declaration 'I love you' (in English) has three words, eight letters, five vowels, etc.—it produces a series of implicit numerical counts. But these counts are a matter of pure chance, of a simple dice throw, in regard to the meaning of the phrase. There is no link between 'I love you' and the numbers 3, 8 and 5—no link, that is, apart from a purely chance one. However, what is proper to the poem is precisely to contest this purely chance link between thought and count, by associating the meaning of the verse to the enumeration of the syllables necessary to formulate it. To conquer chance 'word by word', as Mallarmé writes in one of his critical texts—to try to associate meaningfully sense and count, such is the supreme task of poetry—even if the struggle seems lost in advance. But in that case, doesn't this conclusion 'Every thought emits a throw of dice' contain the metrical key that will permit us to know what the final 7 counts?

In other words, won't the secret of this 'moral' of the poem be to indicate to us the linguistic unit we must enumerate in order to obtain the unique meter? Let's now ask whether there exists a linguistic element that, counted *in this phrase*, would give 7 as a result. There is indeed one such, and it is the simplest that could be: *the conclusion of the* Coup de dés—'Toute Pensée émet un Coup de Dés'—*contains 7 words.*

Our hypothesis follows naturally from this: What if Mallarmé had counted the words of his poem? What if his meter was 'lexical' rather than syllabic? In this case we should have to present the matter as follows: the conclusion, 7 words long, would represent in some way the 'musical' key of the poem; it would indicate that the *Coup de dés* is written 'in 7', as a sonata might be written 'in C', the 7 being isolated for itself in the final phrase, clearly separated from the rest of the text. On the other hand, the unique Number, properly speaking, would be the result of the 'total count in the making': it would have the word 'consecrated [sacré]' as its last element, and, being greater than 7 (since from the first word to the word 'consecrated' there are, at a glance, many hundreds of words), it must contain 7 in a sufficiently remarkable fashion that we would hesitate to put it down to chance alone when we discover it.

If 'consecrated' was, for example, the 777th word of the poem, we would indeed have a Number linked in a remarkable way to 7. Another cipher, however, has an immediate significance for the *Coup de dés*: namely 0, since it is the obvious symbol both for nothingness and the void, and for the vortex, the whirlpool that is described as circular and in which the ship and the Master are lost. So we can imagine three other Numbers capable of representing our Meter, formed exclusively from 7 and 0: namely, 700, 707 and 770. If we end up with one of these four counts, we will be able to say that we have not necessarily taken a wrong turn. Any other result, on the other hand, will discredit our hypothesis entirely. But even if we arrive at one of the four numbers, this will not be enough. A simple chance could have given rise to this sum. To be sure that a Meter is genuinely encrypted in the poem, Mallarmé would have had to have given us the means, *within* the poem, to validate this possibility. In other words, the poem would have to speak implicitly of one of these four numbers, as in a 'charade' or a riddle.

As I show in *The Number and the Siren*, we can read the central page of the poem— the page of the 'COMME SI', or 'AS IF'—as the site of this charade. The 'SI', assimilating the Master, decapitated by the waves, to the Saint John (*Sancte Iohannes*) of Mallarmé's *Noces d'Hérodiade* ('COMME SI' = 'LIKE S.I.'), also refers to the seventh note of the simple *solfège* scale in French: '*doremifasola*SI*do*' (in 'a simple insinuation', as the *Coup de dés* tells us, in a line studded with 'si'—'in*si*nuation *si*mple *si*lence pre*ci*pite'). 707 thus describes the central passage of the poem—two 'Comme si' (7) swirling around a central vortex (=0)—and, by making the count of words in full, we can also verify that *the final word 'sacre' is the 707th word of the poem*.

But what can we conclude from this? We are satisfied with having proved that there does indeed exist in the *Coup de dés* an encrypted meter, counting words rather than syllables; but at the same time we remain frustrated, because we don't understand how this is supposed to resolve the problem of modern poetry, nor how the strange Meter is a unique Number that cannot be another.

TREASURE OF THE BLACK DRAGON

To resolve this question, we must start again from the fact that, in the decade between 1885 and 1895, Mallarmé sought to respond to two challenges: that of free verse, which demotes meter to being nothing more than the chance of gratuitous or political invention; and that of Wagner, who usurped from the French poets the project of founding a religion of art. According to Mallarmé, Wagner sought to transpose to the German people what the Greeks did with tragedy: to make them see themselves through mythology, through a reflection of themselves on the stage. Now, for our poet, the Greek stage cannot constitute a new religion after Christianity—because the stage is precisely a *representation*, a fiction. And the moderns cannot go back to a religion of representation. For, in the meantime, we have tasted something else: the Latin Middle Ages. And what did they deploy, of which the Greeks knew nothing? The Mass.

Mallarmé is no longer a believer, certainly; but he always remains interested in the device of the Mass (indeed, Deleuze criticises him for this). The mass is not reducible to a scenic device, because the priest is not an actor: he does not *replay* the Passion upon a stage, but assures the *real* presence of God through his coded gestures—ceremonial (the Eucharist) and sometimes very simple (his withdrawal, facing the audience). The mass brings us something on the order of *presence,* not representation: God is there, and not only his fiction. This Passion descends into the very host, and it even allows for a physical assimilation. There is a real fact here. Mallarmé was persuaded that, if modern poetry was incapable of grasping for itself this capacity of the Mass to really diffuse the divine, to pass from representation to presence—what he calls the 'treasure of the black dragon'—Christianity would never be dethroned. It is this treasure that we must steal in order to put an end to the old religion. He theorises this in the 1895 text 'Catholicism', where he broaches the question of the real assured presence of the Eucharist. Now, 1895 is also the year when he stops work on the *Notes for the Book*. This is surely no chance occurrence: for the 'Mass' of the Book proposes only readings and scenic representations—no real 'diffusion' of the divine. When Mallarmé understands that he has thus taken a wrong turn—that he has fallen into the same impasse as Wagner—he abruptly changes direction, and directs his energies toward the writing of the *Coup de dés*, whose premises appear the same year in one of his critical texts ('The Book as Spiritual Instrument'). But how will the *Coup de dés* resolve this vertiginous aporia: how will it realise a poem capable of bringing about a real presence of the divine, and not a mere representation of the absolute? How, moreover, to envisage such a diffusion of the divine, when poetry is deployed under the reign of Nothingnesss, and no longer under that of the old religious transcendence?

MASTER OF CHANCE

If we admit that there is an encrypted meter in the *Coup de dés*, it must be understood that nothing in this poem, *nor indeed in any of Mallarmé's oeuvre*, allows us to deduce the existence of this meter: you can spend your whole life reading Mallarmé's writings, and you will find no clue to put you on the right path. If I discovered it, I did so simply because I had a stroke of luck, one day, when I had the preposterous idea of counting the words of a sonnet in which this principle had already been put to work in 1894 ('À la nue accablante tue'). But *it is not by chance that this discovery was made by chance*. For Mallarmé had manifestly confided to chance alone—to an accidental enterprise—the care of discovering his meter. There is nothing in his whole oeuvre that allows us to rationally deduce that he had undertaken such a wager—precisely because he wanted it to be Chance, and not the erudition or the intelligence of a reader, that discovered his procedure. Mallarmé thus threw the dice into the aleatory sea of historical reception, a code whose discovery nothing could guarantee.

In Mallarmé's poem, the dice throw is not merely represented: *it is really effectuated*. The poem is performative, because Mallarmé does exactly what he describes the Master as doing. He asks himself, hesitating, whether to throw his stellar Number into the ocean of posterity. Will he play out his destiny as a poet by confiding to his own divinity—Chance, rather than Providence—the care of revealing one day the metrical and stellar calculation by which he hopes to open a new passage for poetry?

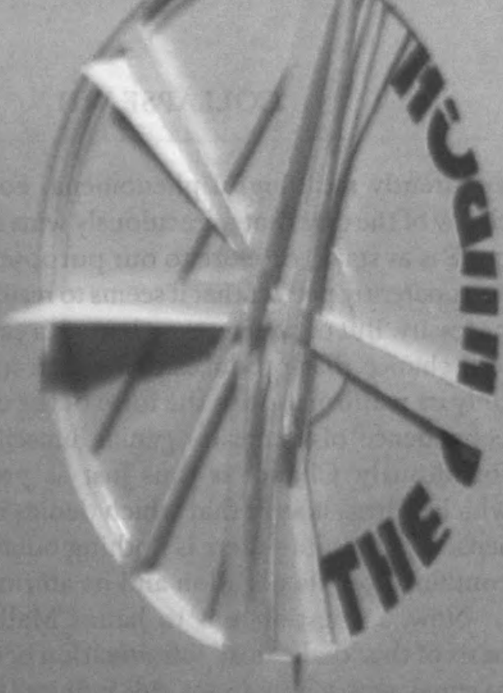
Once we understand that Mallarmé *is* the Master, that he is the real thrower of a Number really hidden in the cloud of our misunderstandings as we read the poem, we understand that we are faced with a true Passion. Christ sacrifices his flesh, but Mallarmé sacrifices meaning (the meaning of his oeuvre). It is a sacrifice yet more spiritual than the christic sacrifice; in a certain way it removes the corporeal immediacy of the latter, in order to express it in a higher form. We can then understand Mallarmé's attachment to a Meter whose essence lies not so much in giving its rhythm to verse as—let us recall—in assuring its cultural dimension. The encrypted Meter allows the silent reader of the *Coup de dés* to evoke once again the presence of a real Poet having assumed the really possible sacrifice of his oeuvre. It is a mental Eucharist that makes of the silent reading of the poem a solitary but universal ceremony—perhaps the only type of ceremony that a modern can perform without making himself ridiculous.

But we still don't understand what is necessary about the Number—what is 'divine' about it, in short. The only divinity accessible to the poet of Nothingness, as we know, is Chance. Now, only Chance is eternal—this is what, literally, the title of the *Coup de dés* tells us: 'A Throw of Dice will never abolish Chance'. In other words, everything is subject to chance, every throw falls into the contingency of the aleatory—except for Chance itself, which no throw of the dice can ever engender or destroy. Thus, The Eternal is Chance—Chance is our only Infinite. Now, in order for the Number to be not only the fact of a contingent throw, that of a simply human and particular poet—in order for it to acquire a necessary dimension—it must *fuse* with Chance rather than simply being the result of Chance: 'If it was the Number / it would be / Chance': that is, if the Number comes, then it will be, not the derisory *result* of Chance, but *nothing less than identical* with Chance—since only Chance 'cannot be another'. But how can a Meter fuse with Chance, and participate in its divinity?

HESITATION AND INFINITIZATION

To understand this final enigma, we must return to *Igitur*, the unfinished tale of 1869. During this period, and under the influence of his friend Villiers de l'Isle Adam, Mallarmé became interested in Hegel. He probably knew Hegel through Edmond Scherer, who in the 1860s wrote a controversial review of the philosopher's work. Now, in this article, Mallarmé could have discovered Hegel's speculative—rather than arithmetical—conception of the infinite. Hegel considered that the divine infinite is infinite in the precise sense that it has nothing outside of it; which explains why the true God is for Hegel a Christian God, that is to say a God who is incarnated in a singular man. For if God was only God, enjoying a transcendence like that of the Jewish or Koranic God, he would precisely not be every thing, since he would not be human. The purely divine God does not have the finite in him, and consequently he is limited by the finite—limited by the contingency, finitude, or imperfection that is external to his nature. In order for God to be authentically infinite, he has to pass into man, become man, become Jesus, thereby incorporating the finite into his own process. But God also must not remain in the state of humanity; in this case he would be but finite, and would lose his divine part. He must therefore return into his infinity enriched by finitude: Jesus must be crucified, must die, and reascend to the Father. As one commentator on Hegel says: in order for the infinite to pass, the finite must pass away. God must die as a man and rejoin himself in his proper infinity, permitting the passage of the human Christ to the eternal Christ of the trinity. The infinite therefore contains eternally the moment of its finitude, as abolished in the crucifixion.

Now, it seems clear that, in *Igitur*, Mallarmé attributes *to chance itself the properties of the divine Hegelian infinite*. In this tale, it is *chance* that nothing escapes, that nothing is external to—no longer God, who is now cast down into nothingness: which is why “Chance” (‘Hazard’—now written with a ‘z’ to recall the Arab etymology: ‘a game of dice’) is explicitly qualified as infinite. Now, chance is always manifested in two basic ways: it can manifest itself firstly in an obvious way, in all the failings of existence, all the inconsequential throws, mediocre verses. And in this sense it is ‘affirmed’ by reality in its everyday mediocrity. But it can also be ‘denied’ by reality, when suddenly there emerge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apparently meaningful phenomena. For example, a throw of the dice that miraculously wins a game where a life is at stake; or more to our purpose here, a verse so apparently perfect that it seems to result from divine necessity. But of course, even in such a case, it is in fact still chance that produces this effect: its negation is only its reaffirmation in the form of the extraordinary 'coincidence' of the creator-genius himself, engendered fortuitously. Chance is thus just as present in that which affirms it as in that which denies it; and in this sense it is infinite—there is nothing outside it, since it contains both its negation and its affirmation.

Now, a question was to haunt Mallarmé on the basis of this 'dialectical' infinitization of Chance: how to equal, with a human act, this infinity? Chance is the figure of the divine within us: to become equal to it would thus be to bring ourselves closer to the divine, eternally meaningless part of ourselves. But through what act, since every act is finite, contingent—that is to say, *produced* by Chance, but not *identical* with it? The act that most closely approximates to the infinite so understood, according to Mallarmé, is *hesitation*. In hesitation you are virtually what you are and what you are not. You are at once he who is on the point of committing an action, and he who nevertheless ceaselessly holds back from it. You are 'between' the two, and you conserve these opposites potentially within you. In one of the endings of *Igitur*, the hero

seems to hesitate, retaining the dice in his hand rather than throwing them. But he ends up renouncing the throw, and lays down forever upon the ashes of his ancestors. The master of hesitation is obviously Hamlet, the model for *Igitur*, and fundamentally, for Mallarmé, the only play, to write and rewrite—he is very radical on this point—because its intrigue is precisely that of the infinite. But here again, in Shakespeare's play, the hero ends up choosing—he kills his father's murderer, and himself dies of being thus finitized.

Let's come back to the *Coup de dés*. If Mallarmé had known the equivalent of a Passion, he would have produced not only a human sacrifice, but a divine one: not only a finite, but an infinite one. Christ is not only a crucified man, he is a crucified man-god. To overcome Christianity, one must produce not only a Passion (the sacrifice of the meaning of the poem to Chance), but a Passion that infinitizes the sacrificer, that is to say one that infinitizes Mallarmé himself. Now, 'THE MASTER / hesitates'— the Master's sole action is his hesitation in throwing the dice. And this hesitation, unlike that of Hamlet or Igitur, is *never* overcome by a determinate resolution. Very simply, we know nothing of the Master, apart from his hesitation, become eternal. Has the throw taken place or not? Is there a Number or not? This is what seems to have been consigned forever to a hypothetical status. And this is why Mallarmé does not write, in conclusion, 'NOTHING WILL HAVE TAKEN

PLACE BUT THE PLACE / EXCEPT A CONSTELLATION', but instead: 'NOTHING WILL HAVE TAKEN PLACE BUT THE PLACE / EXCEPT *PERHAPS* A CONSTELLATION'. The constellation has perhaps taken place, but perhaps not.

On this basis, we can understand whence comes the necessity of the 'unique Number': it cannot be another, *because it is infinite*—that is to say, because *it already contains within itself its other*, its proper non-being, qua *undecidable hypothesis*. It is; but just as much, it is not: it is the eternally hypothetical result of a throw that is infinite because forever hesitant, and thereby capable of equalling the necessity of Chance itself. Mallarmé would himself be infinitized, by making himself the thrower of the Dice who produces *and* does not produce the unique Meter: making himself, for all eternity, the thrower and non-thrower of the two Dice of the unique Meter.

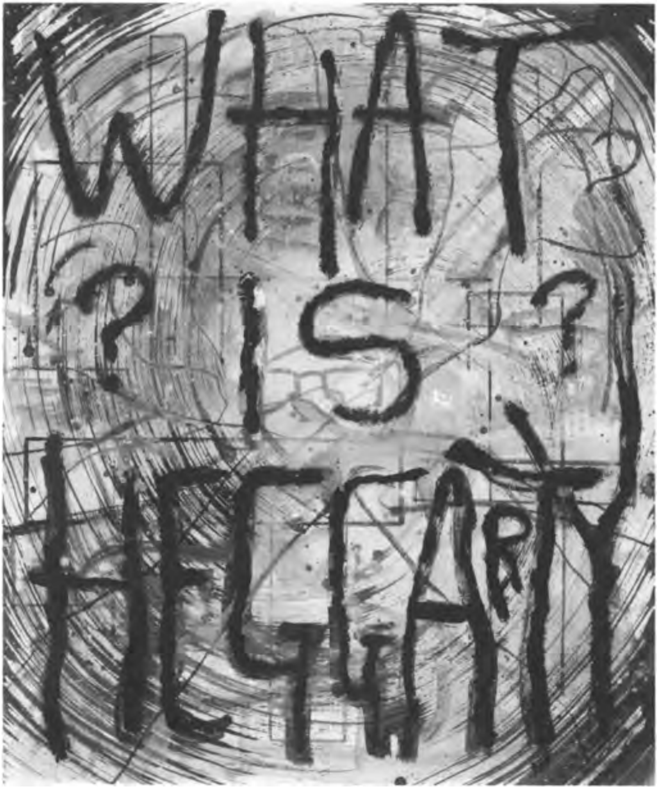
However, this seems to contradict our own conjecture: for, according to what we have said, Mallarmé *did* throw the dice, and produced his Number, 707—a Number too precise not to be contingent, and thus hopelessly finite. But everything would change, were this number charged with an internal hesitation that infinitized it: a hesitation that, at once, made it equal and not equal to 707. How could this happen? Very simply, if we were *almost* certain that the poem was coded, but at the same time not entirely sure of it—if *the count of words was not entirely certain to be equal to 707*.

If there was a 'slippage' in the code, if in the count of words there was a possible hesitation, this would mean that, for all eternity, Mallarmé would have sacrificed the certainty of his gesture, even once his poem was decoded. In doing this, he would have produced a real fact—his gesture of encryption—that would be at the same time a hypothetical fact. Mallarmé, the signatory of the poem, would become, forever—that is to say for the posterity of his readers—infinite: he would have thrown *and* not thrown the dice, he would have drowned himself in chance, infinitized himself in it, like a Hamlet at once real and fictional. A mixture of a real individual and a hypothetical fiction. This would give us a religion of art whose one and only character would be Mallarmé—but not the real, biographical Mallarmé; instead, Mallarmé the signatory of the Poem, and who, as signatory, makes himself equal to Chance.

It is by identifying just such a 'slippage', a 'quavering' in the count, a 'hesitation' that is condensed into one, central, word of the poem—the 'PEUT-ÊTRE [perhaps]' whose count (one or two words?) is uncertain—that I argue, in *The Number and the Siren*, that the *Coup de dés* succeeds in making the number 'divine', and fulfils the conditions of Mallarmé's Book: as the site of the ceremony, of the 'real' or diffusive presence of the divine, and of the advent of a mental song (the poem must be read silently, seen and not read out in public, in order for all its graphical and spatial effects to be deployed). But it also possesses this last remarkable property with which Mallarmé wished to endow the Book: fundamentally it would not have been written 'by' anyone; its author is ultimately anonymous. For the *Coup de dés* escapes its readers, who will never know what the biographical Mallarmé did or did not premeditate—to code, not to code, to hide from himself his own intentions—and Mallarmé will never have known (if he did code the poem) whether or not it was ever decrypted by some lucky chance. No one can grasp both sides of the truth—neither author nor reader—and the Poem thus functions according to a logic that belongs to it alone.

A NEW MATERIALIST GESTURE

In conclusion, you may be worried by this reading—if not Christian then at least christological—of Mallarmé. But to my eyes, this reading, I repeat, is above all materialist. From Epicurus to Mallarmé, the gesture is in truth, I believe, fundamentally the same: the divine exists, but it is not what is essential. For Mallarmé succeeded, in a certain way, in assuring the triumph of modernity: that 'religion of art', that immanent replacement for the old religion that our teachers assured us had failed, or had even engendered political crimes, Mallarmé did bring it to fruition successfully. There is, thanks to the *Coup de dés*, a divinization of the poem, and the birth of a new cult. But this triumph, this cult, this religion, are not at all what we expected—or that which we mocked or condemned. This new cult is simply the silent reading of a book, the remembering of a hypothesis, a play upon the count of words. It is more and better than Christianity, without being any more than that. It is the reinvention of the divine as being nothing grandiose, nothing transcendent; as not being that which matters most in our lives; and at the same time as that which participates in them with an elegant and very beautiful discretion. It is the most effective way in which to repeat such a materialist gesture. To reinvent otherwise than Epicurus and Mallarmé these secondary gods—here, in my opinion, is a task for a philosophy rendered over to its immanentist power.


WHAT
? IS ?
HEGGARTY

Mr Heggarty Goes Down

Sean Ashton

Illustrations by Nigel Cooke

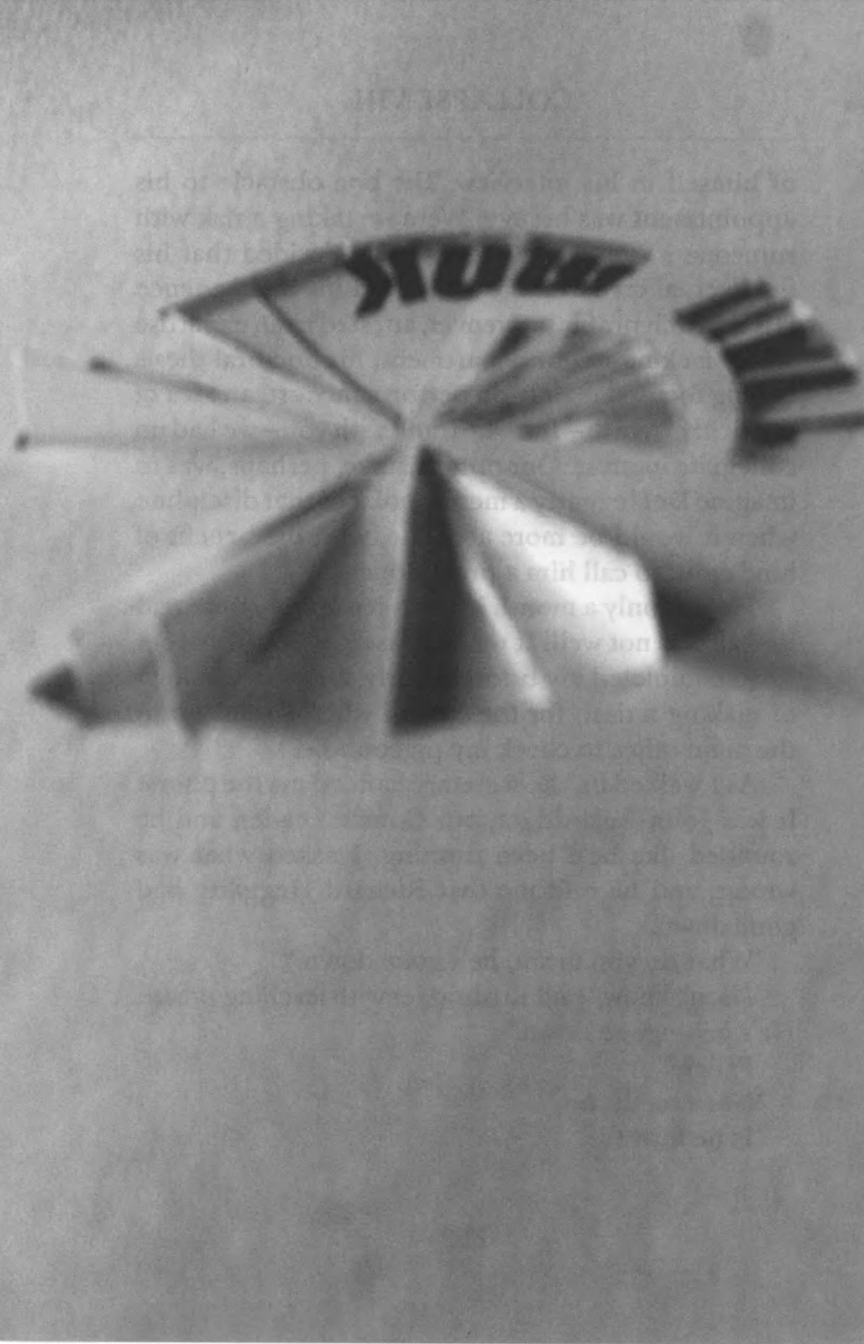
I

You sometimes hear of men who walked out on it all, who upped and left without warning, went forth in their slippers for cigarettes and never came back. Their families say things like *His coffee was still warm* or *He never took his keys* or *Look, there's his jacket*, as if the poignant iteration of these details will be enough to secure the return of their loved one. And sometimes they do—sometimes they do come back, these inconspicuous men who thought to exempt themselves from human affairs. But mostly we learn that they have stepped out of time, as well as place.

Our man had it the other way round. Our man thought to step outside of time, but not place—at least, that is how it seemed to us. Like our notional fugitive, his exile was self-imposed. And yet he never moved. He never went anywhere. On the contrary, he took root. And was all the more distant, all the more unreachable, all the more aloof, for his rootedness. On three separate occasions he seemed to take leave of his body. You might say that a kind of seizure passed through it. On emerging from these interludes, he professed no memory of their effects—even going so far as to suggest it had not been he but some other man who had succumbed.

It was this denial of the incidents, rather than the incidents themselves, that finally led Geoff Alloway to demand his resignation. But there was nothing in his contract that said he *couldn't*—there was nothing that said he *couldn't* lie down in a corridor for nine hours, or walk very slowly through a library over the course of an entire day, or, having tendered his banknote to the cashier in the university canteen, remain there, with his arm outstretched, like a man feeding swans, till security came to remove him. Those were the symptoms, and I give them to you like that, straight up, with no qualification, because that is how they happened: as abrupt and freestanding deviations from the normal course of things.

But let me give you the sufferer. The man in question was Doctor Richard Heggarty, a colleague of mine in the Visual Arts Faculty at East—— University. A new recruit, Doctor Heggarty had given a good account



of himself in his interview. The one obstacle to his appointment was his age: Were we taking a risk with someone so young? We eventually decided that his intellectual credentials outweighed his inexperience. His research profile, moreover, attested to an expertise sorely lacking in our department, his doctoral thesis having focused mainly on performance art, an area of our field in which—I will be frank with you—we had no collegiate interest. Our only mistake, perhaps, was to imagine Dr Heggarty a mere scholar of that discipline, when it would be more accurate, with the benefit of hindsight, to call him a practitioner.

He was only a month into his tenure when we realised all was not well. It was the last Friday of October. I had completed my tutorials early, and was thinking of making a dash for the station when I went up to the main office to check my pigeonhole.

As I walked in, the secretary handed me the phone. It was John Rusbridger, our Course Leader, and he sounded like he'd been running. I asked what was wrong, and he told me that Richard Heggarty had gone down.

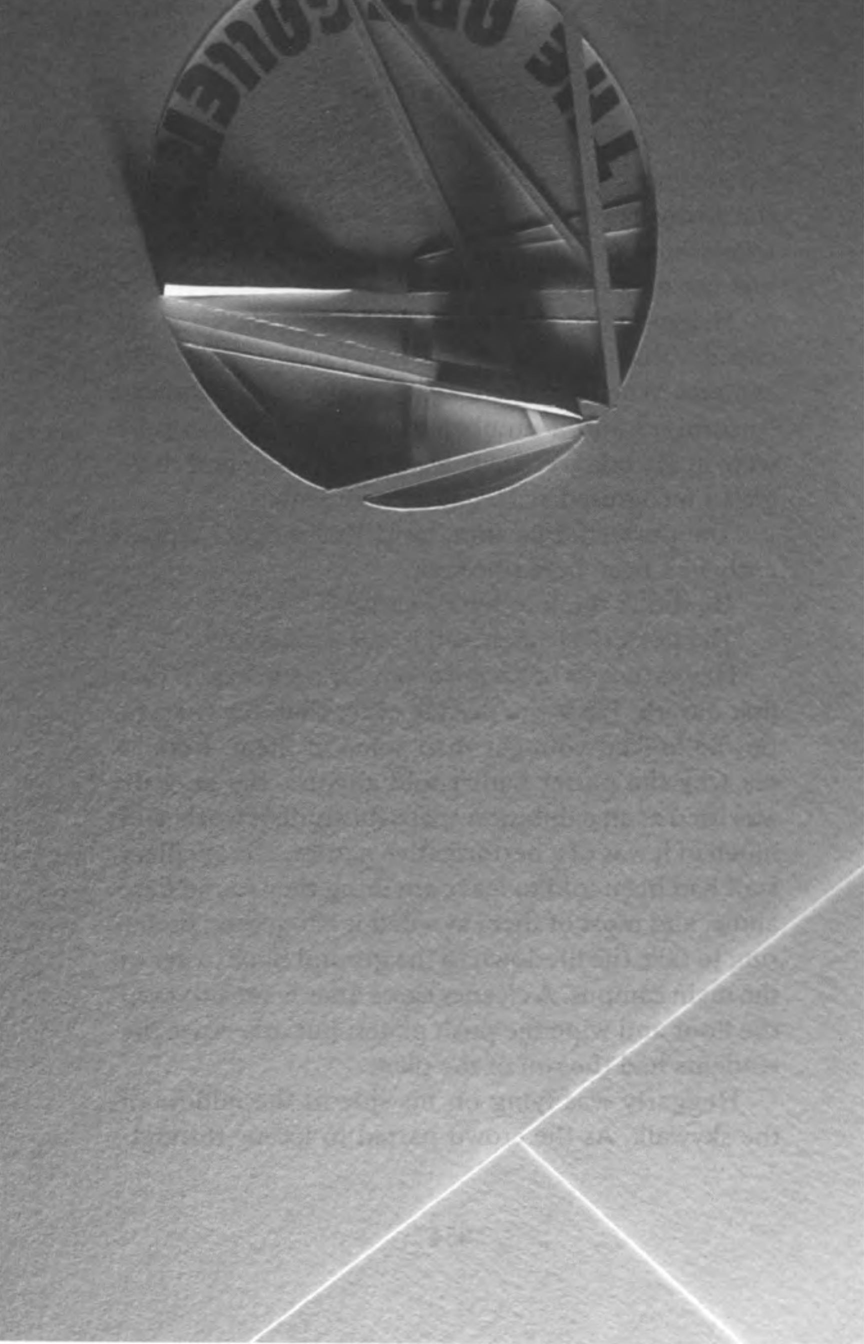
'What do you mean, he's gone down?'

'I don't know,' said Rusbridger with levelling breath. 'He's just—gone down.'

'Fallen?'

'Not exactly, no.'

'Is he hurt?'



'I don't know. He won't talk, he's…'—there was a pause, the swing of a door, footsteps as Rusbridger found somewhere quieter—'he seems fine, but he's… he's just not moving.'

Heggarty had gone down in the skywalk, an aerial corridor that joined the Visual Arts Faculty to the main campus. When I arrived, Den Ganley, Geoff Alloway, Rusbridger and a number of other senior lecturers were in attendance. There was also a porter and three girls I recognised as Heggarty's students.

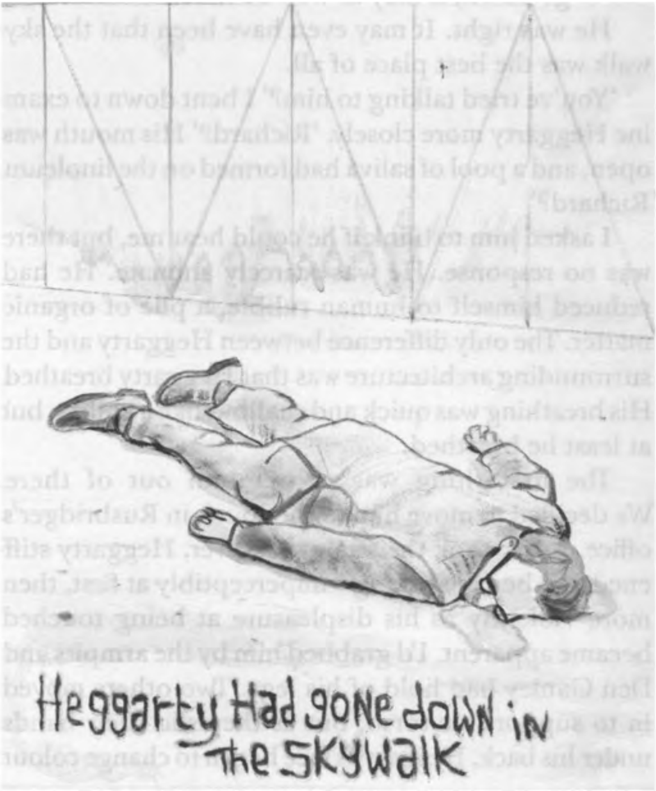
'The porter found him,' said Rusbridger. 'Apparently he's been here since ten.'

'He didn't think to tell us earlier?'

'The porter? He assumed it was a student.'

Heggarty was often mistaken for a student in that first month. He was a decade older than his charges, but he looked younger than some of them. I could see why the porter hadn't told anyone; the skywalk was used as an exhibition space for student work, and much of it was of a performative nature. The ancillary staff had been told to leave anything they found here alone, and most of them avoided it altogether, preferring to take the lift down to the ground floor to get to the main campus. A cleaner came once a week to mop the floor and wipe the push plates, but otherwise the students had the run of the place.

Heggarty was lying on his side in the middle of the skywalk. As the crowd parted to let me through, I saw immediately that nothing was wrong with him. He had placed himself in the recovery position, but there were no visible injuries and he gave no sign of physical or mental distress. It was clear that Heggarty had not fallen; why, then, was he lying on the floor?


Heggarty Had gone down in the SKYWalk

Everyone agreed that he had prostrated himself voluntarily.

'He has chosen to go down,' said Rusbridger. 'But why? And why here?'

'In point of fact, John,' said Den Ganley, 'if a man has to go down, it may as well be here.'

He was right. It may even have been that the skywalk was the best place of all.

'You've tried talking to him?' I bent down to examine Heggarty more closely. 'Richard?' His mouth was open, and a pool of saliva had formed on the linoleum. 'Richard?'

I asked him to blink if he could hear me, but there was no response. He was scarcely animate. He had reduced himself to human rubble, a pile of organic matter. The only difference between Heggarty and the surrounding architecture was that Heggarty breathed. His breathing was quick and shallow, like a child's, but at least he breathed.

The first thing was to get him out of there. We decided to move him to the couch in Rusbridger's office. As we took the strain, however, Heggarty stiffened and began shaking—imperceptibly at first, then more violently as his displeasure at being touched became apparent. I'd grabbed him by the armpits and Den Ganley had hold of his legs. Two others moved in to support his torso, but as they slid their hands under his back, Heggarty's face began to change colour.

'Whoa!' said Rusbridger. 'He's not breathing.'

We set him down; as we did so, Heggarty exhaled and resumed the recovery position. We tried again, but as soon as we moved in, he stopped breathing. This happened several times: whenever we advanced, Heggarty held his breath till we withdrew.

'This is absurd,' said Rusbridger. 'We're getting nowhere. Less than nowhere—we're getting further away.'

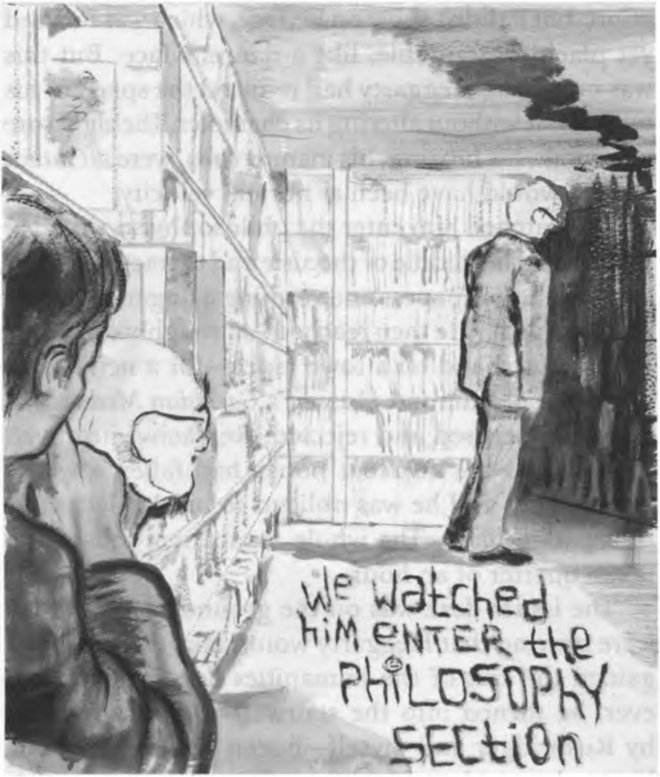
It was true. Moreover, Heggarty's respiratory defence had divided us: those who'd gone for his upper body were scattered to the south entrance, while those who'd gone for his legs were dispersed to the north. We were like two parties of climbers, one hailing the other from either side of an impassable gorge.

'Now what?' said Den Ganley from the opposite end of the skywalk. 'What do we do now?'

The second incident happened in the library. This time, it was me that called Rusbridger. Rusbridger came rather less urgently than I had three weeks earlier, a coffee in one hand and a danish in the other.

'Well,' he said casually, as he arrived on the scene, 'at least we won't have the same problem as last time. At least he's moving.'

And he was. Dr Richard Heggarty was moving. Just. Rusbridger shook his head. 'What's he doing?'


We watched him ENTER the PHILOSOPHY SECTION

'What does it look like, John? He is moving as slowly as possible: as slowly as it is possible to move without coming to a standstill.'

He was moving so slowly that everything else looked speeded up. It should have required immense effort, but it didn't show on his face, which was focused yet placid, inscrutable, like a dancer's face. But this was no dance; Heggarty had reduced the speed of his movement without altering its character. The signature of his gait, his bearing, his mannerisms, were all intact, as they would have been at normal velocity.

We watched him enter the philosophy section. He stopped in the middle of the aisle and extracted a book, turning the endpapers and running a finger down the contents page. He then reached—at roughly the speed of a minute hand on a town clock—for a neighbouring volume, Edmund Husserl's *Cartesian Meditations*, which he perused and rejected. Replacing it proved difficult, for the adjacent books had fallen towards one another and he was obliged to use his left hand to separate them. The whole manoeuvre must have taken quarter of an hour.

The issues desk was on the ground floor, and we were praying that Heggarty would take the lift. As he gained the exit of the humanities department, however, he turned into the stairwell and—chaperoned by Rusbridger and myself—began the long descent. He made two detours, one to the toilet and another to the photocopier. By the time Heggarty got his book stamped, it was five o'clock. A single task had consumed an entire working day.

Heggarty refused to discuss the events in the skywalk and the library; whenever we raised the matter, he claimed to have no recollection of his actions, professing disbelief that we could attribute them to him. If this amazed us, it infuriated Geoff Alloway. If Heggarty would not acknowledge his condition, how could he seek help with it? There were several meetings with the Head of School, all of them unproductive, and it was only Alloway's threat to recommend professional counselling that appeared to dissuade Heggarty from further transgression. For there were no more incidents—not till the last week of the summer term.

I'd gone down to the canteen early one day to beat the lunchtime rush, and was surprised to find a long queue moving very slowly. In fact, it was not moving at all. Everyone had been served; dinners were going cold on their plates, and people were getting angry.

The man at the front of the queue—it was Richard Heggarty—was oblivious to the mounting irritation. Heggarty had frozen mid-transaction, his arm extended toward the cashier. As I approached, I saw that his five pound note had torn as she'd plucked it from his grasp. The cashier had the 'promise to pay the bearer on demand the sum of …' and Heggarty was left holding the Queen. Between the pledge and its guarantor was two feet of space. And this was all that existed for Heggarty, who stared into it, as though into a volcano, until security arrived to take him away. He offered no resistance, borne off like a mannequin, still clutching the torn bank note. That was the last time we saw him.

II

Apart from his indiscretions in the skywalk and the library, and his all-too public swansong in the canteen, Heggarty was a model worker—diligent, conscientious, and popular with the students. It was our reluctance to ascribe a pathological cause to his behaviour that made us turn to his research for answers. The Dean had demanded an official report, and Geoff Alloway wanted me and Rusbridger to write it. Many were the discussions we had, the conjectures and hypotheses we assayed, in completing this task, and I shall limit myself to our most plausible thesis. I say 'plausible', but we can't discount the possibility that this was the conclusion we were meant to reach—the conclusion that Dr Richard Heggarty *wanted* us to reach.

Heggarty had left behind a number of notebooks, boxfiles, folios and sketchbooks, which we studied at length. At his interview we had noted his interest in the radical empiricist philosopher David Hume, and sure enough his papers abounded with references to the work of that great man. Hume, it will be recalled, held that there is no reason to suppose that just because certain effects have always been seen to follow certain causes, they shall go on doing so, of logical necessity. Hume's scepticism of causal necessity fascinated Heggarty. It was John Rusbridger's contention that our colleague had mortified himself by placing his body in the service of this philosophical notion.

The theory was expounded one evening in the pub after work. Rusbridger had examined Heggarty's papers more closely than I, and as he laid the material on the table I saw that he'd singled out several passages for discussion. He selected one, and read from it:

'"If, as Hume says, there is no logical reason to suppose that things must continue as they have always done simply *because* they have always been that way, then I do not know what right we have to assume that the moon will be in its anticipated place tomorrow..." '

Rusbridger paused to evaluate the impact of this proposition. Heggarty seemed to have lumped Hume in with all the other iconoclasts. Like many sceptics, Hume could be something of a logical contortionist—capable of proving the opposite of what we know to be the case—but he was not meretricious, like Zeno with his pert paradoxes, his refutation of motion and so forth; or outlandish, like Berkeley with his glib denial of matter. I suggested to Rusbridger that our inability to say whether a certain cause shall go on producing a certain effect was a shortcoming of *logic*, not of causality. Logic and contingency are mutually exclusive. That's what Hume was getting at.

'The point is,' continued Rusbridger, paraphrasing Heggarty's notes, 'the point is that prior empirical experience does not entitle us to be certain of any future event. You will allow that anything is possible for those who take Hume at his word. You will allow that, for the card-carrying Humean, it is not impossible that I, John Rusbridger, shall rise unaccountably to the ceiling before finishing this pint.' And he held his brew aloft, as though rehearsing the ascent.

'I stake everything I own on the opposite eventuality,' I said, placing my wallet on the table.

Rusbridger declined to meet the wager. 'We must curb our prejudices,' he said, raising a cautionary finger. 'Our purpose is not to challenge the validity of these notions but to examine how our colleague came under their sway. Contemporary proponents of Hume's scepticism of causal necessity hold that hitherto universal laws—gravitation, for instance—may one day cease to operate. Now it follows, does it not, that if universal laws were to change, then that change would have to occur at some point in time and space?'

I pointed out that if the laws were indeed 'universal', then they might be expected to change everywhere simultaneously—at every point in time and space.

'I was coming to that.' Rusbridger reached into his briefcase and took out one of the sketchbooks we'd found among Heggarty's things. 'You have anticipated Heggarty's own feelings on the matter.' He found the relevant passage: ''Everywhere or somewhere?' See—he too wrestled with this conundrum.'

He opened the book and weighted it down with his pint. The pages were covered with thumbnail sketches, each contained in its own box, each depicting a solitary figure in a different position and a different architectural context. The size of the drawings made it hard to identify the setting, but some could be deduced from the stance of the figure, which seemed to imply escalators, train carriages, bus stops, shopping centres. More interesting were the lines surrounding the figure, which appeared to denote movement.

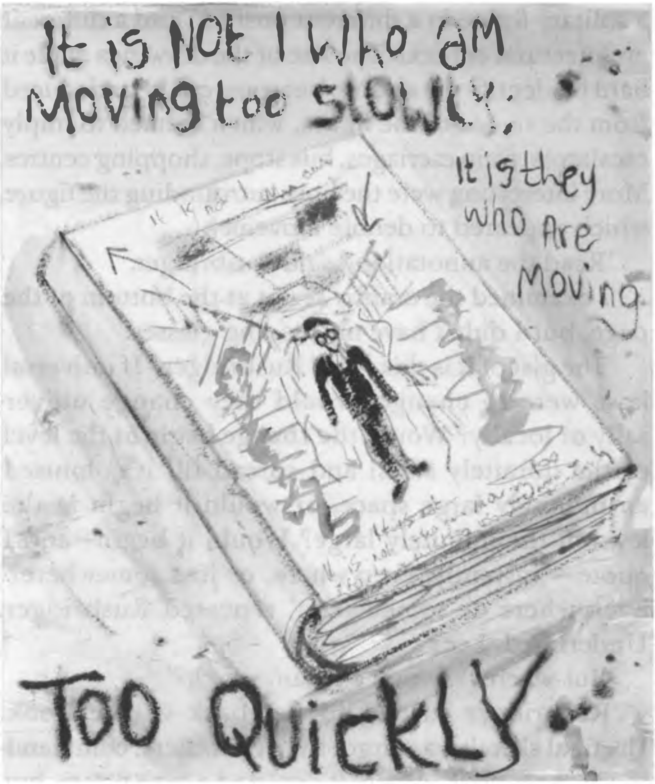
'Read the annotation,' said Rusbridger.

I examined the crabby script at the bottom of the page, but I didn't have my reading glasses.

'The gist of it is this,' said Rusbridger. 'If universal laws were to change, would they change universally or locally? Would the change begin at the level of the infinitely small and spread till it colonised an infinitely large space, or would it begin at the level of the infinitely large? Would it begin—and I quote—"instantly, everywhere, or just somewhere?" Everywhere or somewhere,' repeated Rusbridger. 'Underlined. See?'

'But where?' I said. 'I mean, which?'

Rusbridger turned to the back of the book. The final sketch was larger than the others, commanding a whole page. Again, it depicted a lone figure, but this time the architecture was more discernible—I could make out bookshelves, striplighting, a checkerboard of ceiling tiles receding into the distance. Again, there were lines surrounding the figure, denoting movement: the movement of people, onlookers, their limbs and


It is NOT I who am moving too SLOWLY;
It is they who Are Moving
TOO QUICKLY

faces warped and stretched, as though documented by a camera's long exposure. There was a caption beneath the drawing. I read aloud:

'*It is not I who am moving too slowly; it is they who are moving too quickly.*'

'Heggarty in the library,' said Rusbridger. 'On the previous page he asks where it would happen—the alteration of universal laws. On the next, he gives his answer: not everywhere but somewhere. Not universally, but locally.'

'In the body of a senior lecturer?'

Rusbridger drained his pint. 'Why not? We must think of that body not as the body of a senior lecturer, but as a mere locus in time and space. We must think of it as nothing more than a localised cluster of atoms destined to participate in the disinterested continuation of the cosmos. Another?'

While Rusbridger was at the bar, I pictured our former colleague in his interview, primed, expectant, eager to prove himself. I thought of his CV, his research profile, the sincerity with which he'd outlined the qualities he would bring to the post—all reduced, now, to a 'cluster of atoms', a mere organism: the organism known locally as Dr Richard Heggarty.

It was these words—'the organism known locally as Dr Richard Heggarty'—that Geoff Alloway quoted back to us after reading our report. When we arrived in his office to hear his verdict, he'd already begun destroying the evidence, tearing the pages from the comb-binding and feeding them individually into the shredder.

He sat down at his desk and read from a page singled out for more exacting criticism. '"If universal laws should change locally rather than universally",' he began, '"it stands to reason that they need a locus, a point in space and time in which to inaugurate themselves. Our colleague—our erstwhile Dr Heggarty—was that locus, or so it seemed to him…The incremental nature of his progress through the library, the reduction of his ambulation to minimal velocity, was, to all intent and purpose, from his perspective, the new order of things…"'

As we watched our purple prose disappear into the shredder, we were forced to concede that we'd overdone it, that we'd entered too enthusiastically into the spirit of Heggarty's project, the better to comprehend it. We'd begun our report by stitching together salient passages from Heggarty's notebooks, meaning to paraphrase them later into plainer English. But we'd been seduced by his style and left many intact—too many, we now realised. Only on hearing our words aloud did we see that most of them were Heggarty's.

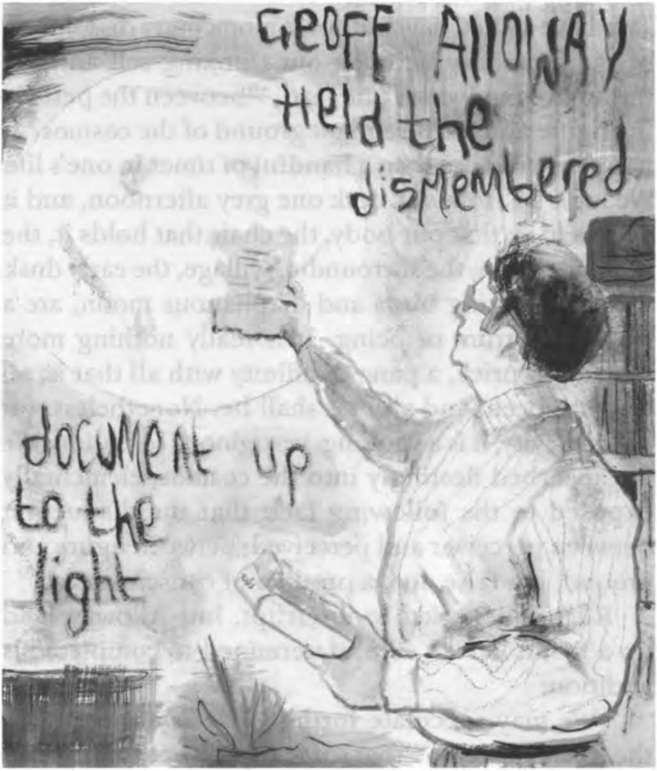
'And what about the incident in the skywalk?' asked Geoff Alloway. 'There's no mention of it.'

We'd consigned it to a long footnote on page sixteen. We directed our line manager to the relevant passage. Geoff Alloway held the dismembered document up to the light, his pupils dilating as they tried to focus on the eight-point text:

‘“We have all felt, have we not, a momentary dissolution of the boundary between our thinking self and the unthinking universe,”’ he read, ‘“between the perceiving figure and the insentient ground of the cosmos? It happens no more than a handful of times in one’s life. We look up from our desk one grey afternoon, and it occurs to us that our body, the chair that holds it, the room we are in, the surrounding village, the early dusk, with its roosting birds and diaphanous moon, are a single spectrum of being. It is really nothing more than a pin-prick, a pang of affinity with all that is, all that has been, and all that shall be. Nonetheless, for all its brevity, it is a vaulting, vertiginous sensation. We are absorbed fleetingly into the cosmos, elementally exposed to the following fact: that the distinction between perceiver and perceived, between figure and ground, is a false one, a product of consciousness.”’

Rusbridger tried to interrupt, but Alloway held up a hand, like an actor determined to complete his audition:

‘“We may speculate further”,’ he continued with theatrical disdain, ‘“that some experience this dissolution of figure and ground more acutely than others; that in certain men and women these interludes are more pronounced, more intense. Perhaps Heggarty was one such man. Perhaps, as he reached the middle of the skywalk, this interlude, this cosmic caesura, extended far beyond its normal duration, and he sought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to extend it further, to prolong it, to maintain the porosity of the boundary between figure and ground for an indefinite period. It was at this point that he went down. One moment, he was separate from the universe, observing it, making his way through it, going from A to B with the characteristic aloofness of the human species; the next, he was barnacled to it. At that moment, the passage from A to B became, not just unlikely, but an impossibility in the mind of Richard Heggarty, since how can one pass through what one is part of…"'

Geoff Alloway removed his spectacles and looked at us gravely: '"Barnacled", gentlemen? *Barnacled*?'

We realised, when we discussed the matter down the pub that evening, that we'd neglected the one issue we'd been expected to address: whether or not Heggarty had faked his condition. Geoff Alloway needed to tick one of two boxes—'mental illness' or 'professional misconduct'—and our report had not allowed him to do that.

We preferred to put the question another way: Did Heggarty really believe his body to be the site of a local alteration of universal laws? Rusbridger said that it didn't matter. What mattered—what mattered to Heggarty—was whether we would recognise such an alteration if it chose an individual as its incipient point, or whether we would dismiss that individual's behaviour—his response to the perceived alteration—as madness.

I reminded Rusbridger of the conviction of Heggarty's words: *It is not I who am moving too slowly; it is they who are moving too quickly.*

'Those words smell of psychosis,' he conceded, 'of the belief that one's own perspective, no matter how different to the prevailing consensus, represents the true order of things. But they smell far too strongly of psychosis to ring true.'

'A simulated psychosis?'

'I'd call it a "rhetorical" psychosis.'

'You're going to have to unpack that for me, John,' I said. 'And fast. It's nearly eleven.'

'I shall do better than that,' said Rusbridger. 'I shall ply it with Glenfiddich and make it walk on its hind legs.'

We both had full pints as the bell went for last orders, but Rusbridger insisted on a pair of single malts.

'I put it to you,' he began when he returned with two doubles, 'that Heggarty has identified Hume's scepticism of causal necessity as a confluence of personal and cosmic psychosis.'

According to Rusbridger, Heggarty had been exploring the idea that personal psychosis was a local manifestation of cosmic psychosis. In other words, personal psychosis was the alteration of universal laws experienced from the perspective of an individual organism. By 'experienced', he did not mean that the organism 'beholds' the alteration as an extrinsic phenomenon, but that it participates in it: that it goes down in the skywalk, moves slowly through the library, stands motionless in the canteen, not through personal volition but through cosmological decree. Hume's scepticism of causal necessity forces us to contemplate the possibility of unaccountable alterations, radical contingencies. The ones mooted by contemporary philosophers were often playfully cataclysmic—the abeyance of gravity, stars that emitted darkness rather than light—but Rusbridger saw no reason why these contingencies shouldn't be more quotidian, more humdrum, why they shouldn't be more behavioural, why they shouldn't implicate Homo sapiens directly. Heggarty's 'mortification' was one such example. A stage-managed example, true: a ruse designed to anchor his research in a somatic sense. And why not? If you can't simulate gravitational abeyance or stellar inversion, why not lower your ambitions and posit your body as the site of a putative cosmic caesura?

Radical empiricism had outgrown its theoretical methods and must now embrace corporeal means—this was John Rusbridger's reading of Heggarty's work.

'It's a call-to-arms,' said my colleague, rapping the table with an open palm. 'A covert one, I'll grant you, but a manifesto of sorts. Look at the programmatic tone, the demagogic exhortations to the reader to "place his body in the service of a new discipline". Evidently, he sees himself as a figurehead. It's there in his prose style. His prose has the manic assertiveness of one who believes he is addressing posterity.'

'A pity we had to let him go then,' I said, 'if Heggarty felt himself to be at the vanguard of something. That might've been useful for us. We could have tucked into his slipstream.'

'You and I?' said Rusbridger. 'Acolytes?'

'Why not? Look at us, John.'

He knew what I meant. What had we done lately? What had we achieved, during the last five years of our tenure? When did we last give a conference paper or submit something to an academic journal? Where was Rusbridger's book, his much vaunted rereading of late modernism, his 'rebuttal of Greenberg and Fried', as he liked to style it? And where was my study of the Hungarian photographer Rudolph Balogh, slated for publication in '04, but now annually deferred? How was that coming along?

'Admit it,' I said. 'Heggarty's activities have galvanised us. Why, your exegetical work has been nothing short of astonishing, John.'

Rusbridger blushed. He had done his best to decrypt Heggarty's papers. But a simple question remained unanswered:

'What is Heggarty?' I asked.

'What do you mean?'

'Like you say, he eschews analytical methods for direct action. Corporeal intervention. What does that make him? A performer? An activist? An artist?'

We both felt the disappointment. To attribute all this to art seemed to condone rather than explain it: by consigning it to an arena of bourgeois transgression, we were shielding it from serious intellectual scrutiny.

'I mean, are we to regard Heggarty's actions as a body of work?'

'Perhaps,' said Rusbridger. 'Though I for one believe the incident in the skywalk was improvised.'

I don't know why, but this amused me. 'A study? A "preliminary sketch", as it were?'

Rusbridger smiled, then looked sternly into his whisky. 'When Heggarty awoke that morning, I do not think he said to himself, "Today I shall go down in the skywalk". I do not believe he foresaw that course of action. More likely, he parlayed an existing sensation—that momentary sense of being subsumed into the cosmos—into something more permanent. The sensation is more common than he imagined; it is even possible that he thought it was unique to him.' Rusbridger swivelled towards me in a gesture of hastily manufactured epiphany: 'It is even possible he misconstrued it as a form of Gnostic "inspiration".'

The lights had come on, chairs were being stacked, the barmaid was standing over our table with a dishcloth. 'Let's not bring the Gnostics into this, John,' I said, handing her my glass. 'Not at this late stage.'

But Rusbridger wasn't done. 'What about the incident in the canteen?' he said, as we got up to leave.

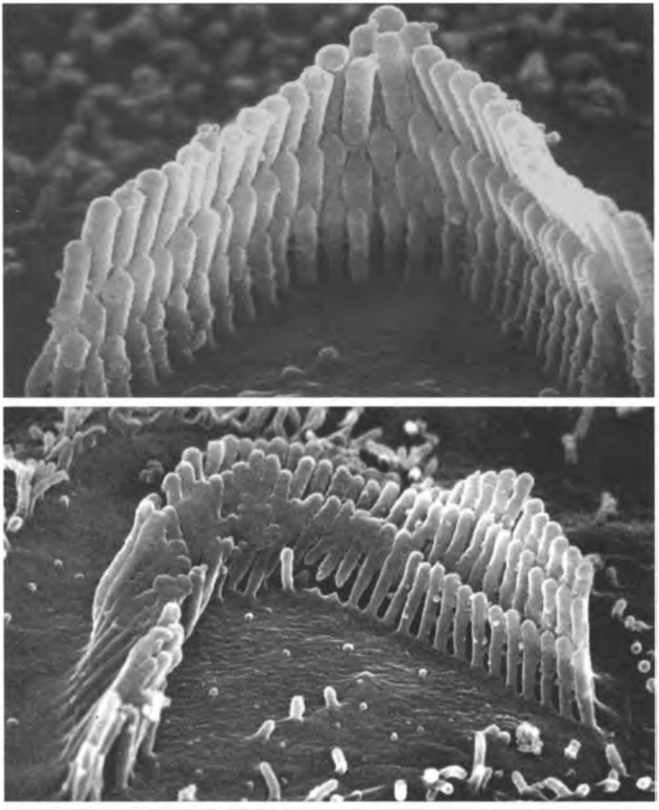
'There's no mention of it anywhere.'

'Maybe he didn't have time to write it up.'

'Perhaps he'll send for us when he does?'

'I think it more likely that he'll publish his findings elsewhere.'

I wish I hadn't said this now. If I hadn't said it, we wouldn't feel compelled to keep an eye on the literature associated with Heggarty's field. And that was the problem, wasn't it: what was his field? To our knowledge, there was no quarterly devoted to bio-philosophical interventionism or onto-cosmological situationism. We think it unlikely that he'll go through the standard publications, the art periodicals and cultural theory journals, but we keep tabs on them anyway: *Critical Inquiry*, *The Grey Room*, *Interregnum*, *The British Journal of Aesthetics*, *Hapax Legomenon*, *Op. Cit.*, *Brontosaurus*, *Texte Zur Kunst*, *The New Kilmarnock Review*…And nothing. Nothing yet.



Healthy, moderately damaged, and severely damaged stereocilia.
Images by Dr. J. O. Pickles, University of Queensland, 2002.

CAUTION

GegenSichKollektiv

DISCLAIMER: WE TAKE ABSOLUTELY NO RESPONSIBILITY FOR POSSIBLE DAMAGE CAUSED TO YOUR HEARING IN THE CASE THAT YOU DECIDE TO REALIZE THE CAUTION EXPERIMENT

HISTORICAL CONTEXT

> *Ancient life was all silence. In the nineteenth century, with the invention of the machine, Noise was born. Today, Noise triumphs and reigns supreme over the sensibility of men.*
>
> RUSSOLO, 1913

> *And when Joshua heard the noise of the people as*
> *they shouted, he said unto Moses, There is a noise of war*
> *in the camp.*
>
> EXODUS 32:17

Noise and danger have walked hand in hand throughout history: from apocalyptic biblical trumpets to the current Long Range Acoustic Device used as a sonic weapon, for example, at the London Olympics in 2012. Outside the 'official' battlefield, in the context of art and music, people have tried many times to take noise to its ultimate conclusion, to its physical limits. Many stories are told, ranging between legend and fact. It is said that at the end of the 70s, Throbbing Gristle (and presumably Monte Cazazza) carried out infrasound and ultrasound experiments in their Hackney studio in order to force an unwanted group of Gypsy neighbours to leave the area.

And the speculations of David Bowie and William S. Burroughs about the Black-noise bomb, the French patent for Dr. Gavreau's infrasonic generator, which anyone can purchase for 40p and presumably use to build a Sound Ray Machine in their basement—an idea that also came to haunt Jimmy Page. A whole generation of noise and 80s industrial musicians dreamt about a warehouse with military spec sound equipment able to reproduce these low frequencies at very high volume thanks to speakers built entirely of metal or stone—A sort of cyberpunk reworking of Artaud's Theatre of Cruelty. Even in the case of the Cybernetic Culture Research Unit (under the command of Sadie Plant and Nick Land), exercising an inhumanism that appealed to the galvanic potencies of rave music, it seems that the dream was to explore the limits of sound in the same collapsed playground in which they were redeveloping nonconceptual negativity. Ray Brassier said of Land:

> If you're accelerating, there are material constraints upon your capacity to accelerate, but there must also be a transcendental speed limit at some point. The ultimate limit is not a limit at all for him, it's death, or cosmic schizophrenia. That's the ultimate horizon. Land unabashedly endorses this remarkable thesis of *Anti-Oedipus*, but strips it of all its palliatives, about how this might generate new forms of creative

> existence, etc. For him it's just: 'at the end of the process is death'.[1]

We wish to try to find a way of obliterating the constraints upon noise's capacity to accelerate negativity to the point of self-abolition.

SETUP

We want to take noise to its ultimate consequences by contemplating the possibility of the existence of an audio support which contains the most damaging audio material to the human hearing apparatus. Henceforth we will call it: CAUTION Object.

The justification for this: to reintroduce risk, chance and extremity back into experimental music.

The questions raised by this game are the following: Is it necessary to have a physical experience of the content of the CAUTION Object (which would result in damage to your body or nervous system)? And if not, then could the conceptual development of this proposal alone—if taken to its ultimate consequences—develop the potential of noise?

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[1] R. Brassier, 'Accelerationism', talk given at *Accelerationism* symposium, Goldsmiths University of London, 14 September 2010. http://backdoorbroadcasting.net/2010/09/accelerationism/. Transcript at http:/moskvax.wordpress.com/2010/09/30/accelerationism-ray-brassier/.

RULES OF THE GAME

We will provide the necessary elements to generate the material conditions to experience what is believed to be the most damaging sonic material for the human ear.

You will have three choices:

(A) To generate the listening experience and take the physical risk.

(B) To explore the conceptual potential of this proposition by considering that the subversive qualities of noise rest at the level of abstract form rather than that of its sonic qualities.

(C) An alternative path, which we will call 'Dialectical Conception of Noise'.

A. SENSATION OBLITERATES CONCEPTION

In case of deciding to listen to the content

A certain amount of scientific/medical research is necessary to certify the functioning of the device (CD, computer, etc.) designed to produce the experience of the content of the CAUTION Object. Some appropriate information is presented below. As far as the physics of the CAUTION Object is concerned, we have two questions:

> (A1) Which audio signal (which may be electronically represented in either digital or analog format) is scientifically verified (by which we also mean that it is materially possible to produce) to be most dangerous to humans—not only for the human hearing system, but also for the subject's health ('condition of an organism or one of its parts in which it performs its vital functions normally or properly')? In other words: Which is the most audio-band frequency most hazardous to the human?
>
> (A2) Depending on the answer to the first question, what protocol and material conditions are necessary in order for this experiment to be carried out? The risk and opportunity at the time of listening to the CAUTION Object involve a direct activation of the listener's performative activity; therefore their decision is subject not only to the level of their commitment to their prior decision (whether or not to listen to the CAUTION Object), but also depends on how the sensory experience determines their subsequent behaviour: to expose themselves to a greater or lesser extent, or to adopt immediate protective

measures, depending on the level of risk they ultimately find they are prepared to face.

‘PHYSICS’ OF THE CAUTION OBJECT

A1. Frequency

For a sinusoidal time course, the number of repetitions per time unit is called the frequency, measured in Hertz = 1/second. The healthy human ear can hear frequencies ranging from 20HZ to 20,000HZ. According to the *Working Paper on Infrasound Weapons* produced by Hungary for the United Nations in 1978, the frequency thought to be most dangerous to humans is between 7 and 8HZ. The infrasound frequency of 7HZ is the median frequency of the brain’s theta rhythms. The current consensus seems to be that 4KHZ is the most sensitive frequency for the cochlea. Noise damage at this frequency causes often irreparable outer hair cell damage, which causes hearing loss. The damage is due to excessive mechanical energy delivered to these very delicate structures. Energy transmission through the middle to inner ear is at its most effective at roughly 4KHZ, depending on the size of the subject. Thus frequencies near 4KHZ are potentially the most damaging.

The delicate structures of our hearing system are well protected inside the skull. For sound transmission, the outer ear canal acts like an open pipe with a length of about 20 to 30 mm. Its quarter-wave resonance is responsible for the high sensitivity of our hearing organ in this frequency range, indicated by the dip of the threshold around 4KHZ. This high sensitivity, however, is also the reason for high susceptibility to noise-induced damage in the region around 4KHZ.[2]

Hair cells that are tuned to frequencies near 4KHZ are particularly vulnerable to noise damage. Therefore, audiograms of patients with noise damage often have characteristic 4KHZ notches.

There are not many experimental studies with humans. In order to estimate expected effects, studies usually evaluate related temporary hearing loss (or temporary threshold shift, TTS) experiments using damage criteria obtained from the parallelism between TTS and permanent hearing loss (or permanent threshold shift, PTS), and assess the results of experiments on animals in an attempt to extrapolate these findings to human hearing.

It is assumed that the lack of available research material studying the effect in humans is accounted for by the fact that the Department Of Defense and related private research organizations carry out most of these experiments, with the results obtained remaining private and restricted from public knowledge.

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[2] G. Mazzola, *The Topos of Music: Geometric Logic of Concepts, Theory, and Performance* (Basel: Birkhäuser. 2003), 1036–7.

Doctor in physics Jürgen Altmann, whom we consulted during this research, has carried out several theoretical studies, but without carrying out any experimental trials on humans. His answers to our questions were most unenlightening, and served only to confirm evident disinformation about the frequency content potentially harmful to humans. Most studies in this area limit themselves to observing the irrefutable damage caused by exposure to audio at very high sound pressures over short periods of time—for example, shock waves from explosive blasts.

A.1.1. Sound Pressure Level and Time of Exposure

Sound intensity is measured as sound pressure level (SPL) on a logarithmic decibel (dB) scale. Normally it is not the 'signal' but rather the sound pressure level in certain frequency bands that produces damage. Noise-induced hearing loss (NIHL) is an increasingly prevalent disorder that results from exposure to high-intensity sound, especially over a long period of time. 'NIHL usually occurs initially at high frequencies (3, 4, or 6 KHz), and then spreads to the low frequencies (0.5, 1, or 2 KHz)'.[3] Aural pain usually occurs on crossing the region of 140dB (200 Pa), but signs of pain need not in themselves indicate permanent damage.

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[3] J.-D. Chen & J.-Y. Tsai, 'Hearing Loss among Workers at an Oil Refinery in Taiwan', *Archives of Environmental Health* 58:1 (2003): 55.

Eardrum rupture occurs in the audio region above 160dB (2 kPa). At levels of about 200dB, lungs begin to rupture, and levels above about 210dB can lead to death.

The research carried out by the group SARA (Scientific Applications and Research Associates) concludes that:

> Infrasound at 110–130dB would cause intestinal pain and severe nausea. Extreme levels of annoyance or distraction would result from minutes of exposure to levels of 90 to 120dB at low frequencies (5 to 200HZ), strong physical trauma and damage to tissues at 140–150dB, and instantaneous blastwave type trauma at above 170dB. At low frequencies resonances in the body would cause hemorrhage and spasms; in the mid-audio range (0.5–2.5 KHZ) resonances in the air cavities of the body would cause nerve irritation, tissue trauma and heating; high audio and ultrasound frequencies (5–30 KHZ) would cause heating up to lethal body temperatures, tissue burns, and dehydration; and at high frequencies or with short pulses, bubbles would form from cavitation and micro-lesions in tissue would evolve.[4]

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[4] SARA report, 10 February 1995.

A.2. Recipe for CAUTION (Material Conditions of the CAUTION Object's Output Device)

Download the audio computer software Supercollider from http://supercollider.sourceforge.net/downloads/. Execute the following Supercollider code in order to generate a 4KHZ tone:

```
{SinOsc.ar (4000)}.play
```

Equipment to amplify signal to 170dB: Obtaining a sound system that reaches 170dB is no easy task. We would like to present just a couple of examples, one low- and one high-tech.

Alan Dante from Lorton, Virginia set a new world record on 31 August 2013, in a dB drag competition[5] with a 180.5dB peak using a single Digital Designs subwoofer. Dante's concrete-filled Volvo contained a Digital Designs 9918Z 18-inch subwoofer receiving 26,000 watts of power from four Stetsom 7KD amplifiers. To power that system, Dante used 15 Powermaster 16-volt batteries and a Flux Capacitor. This is just one indicative example for guidance. It would be difficult with this exact equipment to ensure our goal. We think that 44,000 watts of power (the strength of a big-city radio station) may serve to reach the target.

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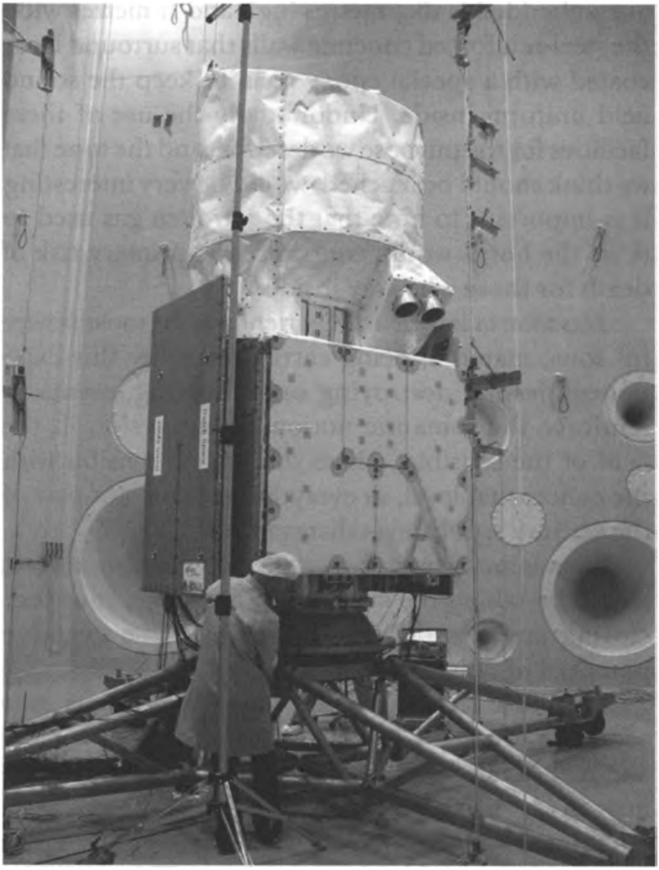
[5] dB drag racing is a competition rewarding the person who can produce the loudest sound inside a vehicle.

Regarding speakers, the 9918Z by Digital Designs can achieve as much as 180.5dB through its 18-inch subwoofer. Four Stetsom KD amplifiers capable of producing a total of 26,000 watts have powered the speaker in a known previous event.

It is worth highlighting that during dB drag racing, the test tone consists of a very short resonating tone between 30HZ and 70HZ, called 'the burp'. This is a much lower signal, and reaching 170dB with a 4KHZ tone may be more difficult, given the lack of previous experiments and tests, but a 4KHZ tone is thorny enough to cause irreversible damage at these incredible amounts of sound pressure.

We also have the example of the Large European Acoustic Facility (LEAF) in the Netherlands, a facility which consists of four different horns with cutoff frequencies of 25HZ, 35HZ, 80HZ and 160HZ plus three high-frequency generators used to realistically simulate the spectral noise pressure levels present in spacecraft launches. These acoustic noise tests are designed to ensure that no damage will occur during the rocket launch, and use nitrogen gas to produce sounds as loud as 154dB. Despite having been announced by the press as 'A Speaker So Loud It Can Kill You', and despite the European Space Agency having claimed that 'no human could survive', the fact is that the frequencies that being used at LEAF are again far from being a 4KHZ tone. The wall in which the horns



Aeolus Structural Model in the Large European Acoustic Facility (LEAF) [Image: ESA–Anneke Le'Floch].

are embedded is 16.4 metres high and 11 metres wide, the steel-reinforced concrete walls that surround it are coated with a special epoxy resin to keep the sound field uniform inside. Undoubtedly the use of these facilities for the purpose we describe, and the tone that we think should be reached, would be very interesting. It is important to note that the nitrogen gas used to drive the horns would constitute the primary risk of death for those who stay inside.

Sensation in isolation: Experiencing the most powerful sonic material, being carried away by this experience, despite destroying one's hearing, seems to reinforce the romantic notion of immersion in the field of the sensible, where there is no tension with the conceptual level, as everything that is not part of the sensory spectrum is disregarded.

What is more, in each case, the experiencing subject would be taking the last turn of the game, thus foreclosing any possibility of socializing the negative potential of noise.

Therefore this would be noise in its most conservative form: an escapism not only from society and reality but from life itself (if you take this experiment to its ultimate consequences), without giving anything in return, without yielding anything apart from one's own subjective experience. This would be an individualised form of self-abolition.

B. CONCEPTION OBLITERATES SENSATION

In the Case of Deciding Not to Listen to the Content

How could the subjective physical experience of the CAUTION Object impede our access to the supposedly subversive attributes of noise as an abstract form?

The usual presentation of a subjective process of interpretation (in this case the interpretation of the CAUTION Object) implies access through experience. This experience would inevitably be mediated by our senses, which would also determine our perception of the aesthetic context. This subjective perception of the aesthetic context subordinates the production and reception of noise to criteria of taste and to individual (physical and cultural) determinations. Gadamer described the ontological character of the work of art as an experience of reality, being, and truth, in contrast to the abstraction of aesthetics' consciousness and its subjectivist character. Thus, we have to figure out how to extract the 'real' from the physical experience of the CAUTION Object, and how to deal with all of the aesthetic constructions triggered by our cultural baggage, intellectual abilities, aesthetic education, social class, gender, race, etc.... Aesthetic consciousness tends to undermine the game's cognitive claims so that it is only understandable from the point of view of the players' own subjectivity.

The Kantian tradition in the study of aesthetic experience focuses attention on the plane of the subject by emphasising individuals' subjective experiences. It is according to this proposition that Kant establishes the autonomy of art, his well known form of disinterested contemplation of beauty, and the more vexed assumption that beauty has nothing to do with truth. Far from aspiring to return to this question, what we want to recover here is the idea that emerges from Gadamer's work: the idea that the freedom of subjectivity activates itself in the game. The players are not playing a game; it is the game itself that plays them. But the 'freedom' of the game does not mean an absence of rules; to play is to found an order. Therefore the players subsume their voluntary freedom to the rules of the game. If the game is successful, it will generate an act from which a different type of freedom might emerge: a compulsive freedom that is indifferent to ourselves as individuals. Understanding this act as a superimposition of rule-conforming behaviour onto pattern-governed behaviour,[6] our actions as players within the game are laced with the conditioning pattern that results from the game itself and its rules. A pattern-governed behaviour operates in line with our cultural and biological determinations. To assume and conform to the rules of the game is a precondition for our acting according to the rules. The optimum execution of the game pursuant to the rules depends on this agreement—an agreement which seems to evoke an action that goes against the impulsiveness of subjectivity: one must relinquish the autonomy of subjectivity in favour of being able to perform the game according to its rules.

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[6] R. Brassier, 'Unfree Improvisation/Compulsive Freedom' (2013). http://www.mattin.org/essays/unfree_improvisation-compulsive_freedom.html.

How does the certain objective nature of a rule-based game activate the freedom of a subjectivity within the context of this game? Passing through the pattern and the rules of the game entails an acknowledgement of our lack of freedom in the facultative activity—what is understood by Brassier as *the gateway to compulsive freedom*;[7] recognizing the unfreedom of voluntary activity, being aware of how objectivity generates subjectivity. *The subject as agent of the act is the point of involution at which objectivity determines its own determination.*[8]

Gadamer appeals to a kind of rationality free from ends which is characteristic of human games: children giving themselves rules to play by. We are interested in this perspective because it connects with Brassier's idea of compulsive freedom. For Gadamer the game is ultimately the self-representation of the movement of the game. We believe that the game metaphor in his work *Truth and Method*[9] does not imply the annulment of human freedom, but rather represents a vindication of man's place in all understanding and puts us on the horizon of the genuine idea of responsibility.

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[7] Ibid.

[8] Ibid.

George Berkeley stated that our knowledge of physical objects begins in experience, and that physical objects cannot exist apart from our experiences of them. This submission is closely connected with correlationist thought, the assumption of the impossibility of a mind-independent reality. The confusing association between ideas and experiences is derived from the act of identifying the 'act' of thinking with the 'object' of thinking.

In this game such confusion is averted, since we will have two distinct paths to choose from: conception or sensation.

Noise's subversive potential lies at the level of abstract form; and not in any alleged radicality attributed to its sonic content (volume, frequency, pitch, etc.).[10] But why do we want to try to develop noise conceptually? Because we think that the promise of noise in its sensorial expression has lost its subversive qualities—as we have seen, even the extreme exercise proposed above would represent a cul-de-sac.

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[9] H.-G. Gadamer, *Truth and Method* (London: Sheen and Ward, 1989).

[10] R. Brassier and Mattin, *Metal Machine Theory 3: An E-Mail Conversation*, http://www.mattin.org/essays/METAL_MACHINE_THEORY_3.html.

We aim to propose the use of reason as an engine for developing noise beyond subjective experience. Because we think noise has the potential to exacerbate the rift between knowing and feeling by splitting experience, forcing conception against sensation.

Brassier again shows us a series of dead ends in subjective experience:

> The task can be achieved by exposing the entirely contingent, conventional character of the phenomenological self-image promulgated through the myth of subjective interiority; by denouncing the hallucinatory character of privileged access [the lynchpin of all foundationalist demands]; and by inveighing against the illusory authority of the first-person perspective; myths which, whether taken separately or in combination, serve to shore up the subjectivist ideology through which liberal democratic capitalism convinces a stupefied population of consumers that they are sovereign individuals, naturally endowed with freedom of choice, and that the interests of subjective freedom coincide with the interests of a free market economy.[11]

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[11] R. Brassier, *Alien Theory: The Decline of Materialism in the Name of Matter* (PhD Thesis, University Of Warwick, 2001). http://wrap.warwick.ac.uk/4034/.

Taking this into account, what might the conceptual path in the production of noise be? The question, we believe, is not a straightforward one.

The work of some of contemporary noise artists may serve as an example. Jliat (James Whitehead), Jarrod Fowler, Mattin, and Taku Unami, for example, have shown works where conception obliterates sensation. This can be very interesting, but also (like bad conceptual art) runs the risk of evacuating sensation and reifying conception, since it does not preserve the *tension* between conception and the sensory. If we look at some of these works, we can see how a cryptic use of language, or the context of the piece's presentation, can operate as a shortcut to highlight the cognition of the work—a very dangerous manoeuvre that reifies conception. In fact, conception is the only material presented in the suggested framework, which means that it operates in a context where abstract ideas must be adapted to the rigorous parameters that govern disciplines within the formal sciences. In the field of arts the problem is different: in art, the abstract entities are rarely based on axioms and rarely follow logical thinking; even in the naive assumption that some artwork is produced under such epistemic vehemence, as Deleuze and Guattari stated, art's plane of composition is not equal to science's plane of reference.

There is a transition here from noise conceived as 'unwanted sound' to noise conceived as something endowed with aesthetic attributes (which the subject receiving the experience may or may not enjoy), because of its transgression of initial conception or initial definition. The power of noise lies in its capacity to generate conceptual shifts in the listener's perspective. As noise is always redefined, we need a material with which the concept associated with noise will be able to operate—a sensory component that forces you to consciously think about the real in the experience of what you are feeling.

Walter Marchetti said that if you think about music, this is already music; but in that case, reifying the process of conceptualization means that there is no tension with the material. Here, the disturbance in the conceptual process is completely alien to the physical danger proposed on the 'A' path. Obviously, if you only think about this game, this poses no risk for you. You are safe with your knowledge wherever you are reading about this. There is no risk, no problem. You can think of this text as a substitute activity for experiencing the CAUTION Object, but it does not share the dangerous attributes of listening to the most damaging sonic material for the human ear.

C. DIALECTIC CONCEPTION OF NOISE

> Subjectivity disappears once the play of chance is accelerated, once the formation and the obsolescence

> of combinations is so fast that all fixed conglomerates vanish in favour of an incessant chaotic and anonymous process.[12]

Noise, by means of combining conceptualization and sensory sonic material, defies your epistemic categories if it places you in an unprecedented situation where you are defenceless. In order to do this we dialectically need both parts: Sensation (perception/experience) and conception. In this process, a tension is generated which it is essential to conserve.

Looking at historical examples, we find that in the early 60s Robert Ashley started to use unwanted audio feedback for musical purposes. Soon after that, The Beatles recorded the song 'I Feel Fine', starting with a feedback note produced by McCartney's bass which was picked up on Lennon's semi-acoustic guitar. This voluntary process related to an aesthetic purpose is a commodified sound which is entirely contrary to the idea of noise as unwanted sound. In this case there is no danger because there is no material or sensory threat to the listener.

Throughout the career of the seminal band Whitehouse (also English) we can think in depth about the conceptual possibility of experimenting with noise as an unwanted and threatening event. In the path of composers such as Ashley, Whitehouse tried to challenge listeners' perceptions as to what music was really capable of, or how one could be completely uncompromising through the making of noise, and thus to explore power relations, violence and abjection. However, today the methods used by Whitehouse are already part of the canon of noise.

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[12] G. Lipovetsky, 'Power of Repetition', in R. Mackay and A. Avanessian (eds), *#Accelerate: The Accelerationist Reader* (Falmouth/Berlin: Urbanomic/Merve, 2014), 228.

Both the example of Whitehouse and the previously mentioned experiments in totalitarianism of Throbbing Gristle, or even, looking further back, the 'noise of modern life' called upon by Russolo and Marinetti at the time of Futurism, should be addressed rigorously. We must take note of how these ideas of future, speed, risk, technology, youth, and violence were accompanied with an aesthetic, performative and ideological affiliation which flirted (or flirts) with fascism, in part because of a fascination with a fetishized, naive and erratic idea of nihilism and the extremes of human existence.

In order to unfold the future, the commitment of noise must be to head toward a discontinuity with the past and the present, a discontinuity characteristic of the constructive statutes of the future. We can only update the definition of the risk involved in noise by way of a historical analysis that clarifies which contingencies generate the possibility of risk, and under what conditions this will help us to clear the way for a epistemic construction of risk and its role in noise.

There is no room for melancholia over futures past, which inevitably cancels the future and involves the repetition of stupid mistakes.

How to assume the possibility of risk? If you know that experiencing a given work unequivocally implies pain and destruction, then there is no chance or possibility of experiencing the risk in an uncompromising way. So in order for this dialectical conception of noise to function, the contingency and the proximity of damage must be encountered as a set of unwelcome circumstances.

As Wikipedia states:

> Risk is the potential of losing something of value, weighed against the potential to gain something of value. Values (such as physical health, social status, emotional wellbeing or financial wealth) can be gained or lost when taking risk resulting from a given action, activity and/or inaction, foreseen or unforeseen. Risk can also be defined as the intentional interaction with uncertainty. Risk perception is the subjective judgment people make about the severity of a risk, and may vary from person to person. Any human endeavor carries some risk, but some are much riskier than others.

How we can connect the concept of risk with the concept of noise? We can think of situations where you are not sure whether you are being damaged by sound or not. How can we generate situations where unwelcome circumstances can appear?

In the first two cases discussed above there are no unwelcome circumstances: an end is sought, but we would hardly choose to accept the uncompromising physical damage. It would be a case of masochism—in which case it would involve the expectation of a desired event. Only if it is to some extent unwanted or unpredictable is it noise.

We thus face the necessity of generating epistemic uncertainty. A computational device designed to generate a unknown random possibility of non/activation. The CAUTION Object could carry out this assignment. You would have to place your trust and commitment in the randomness intrinsically generated by the system which will decide in lieu of the whole audience whether or not the CAUTION Object is played.

With this last option, CAUTION entails the contingency of games of chance. The tension to which we appeal in the 'Dialectic Conception of Noise' is the same tension between knowledge and contingency.

We are aware of the complexity entailed by invoking a device that generates a random chance. In UNIX-like operating systems, /dev/random is a special file that serves as a blocking pseudorandom number generator. This is performed by an algorithm for generating a sequence of numbers whose properties approximate the properties of sequences of random numbers. The solution would be based on associating even or odd with the performance or non-performance of the CAUTION Object.

But why would an audience subject themselves to this experiment?

What we propose here is to restore the risk in noise through the objectification of experience in the cognitive sense. It is completely absurd and anachronistic to continue to assume that noise as a musical genre is the bearer of qualities such as chaos, when, each time we hear an album or attend a concert, we receive exactly what we expect from it. Noise must involve a self-generative event.

Because of the magnitude of the exercise, it very likely needs to be implemented collectively. As a matter of fact we think it must be done collectively.

The question that is being posed with this experiment is the following: Given that today aesthetic production is no more than the valorization (in capitalist terms) of any form of activity that was previously dismissed, with a concomitant acceleration of forms of individualization, what kind of noise could challenge this valorization? Inevitably, it must be something that questions the notion of aesthetics altogether.

If aesthetic experience has to do with the sensible, this type of experiment has to do with the possibility of the destruction of sensibility: Something barbaric, something unprecedented, something that might not happen, but where, even if the sound is not produced, the collective experience is linked with risk, and not only cognition.

In this sense one shares a sense of fragility, of not knowing, of having no control. Something might happen from which there is no return.

We think that what is required is a noise where individual subjectivity is subsumed under the rules of a game wherein certain danger may be possible.

This could be a collective form of self-abolition in the sense that we leave behind our own desires, tastes, and forms of consumption in order to share a possible destructive experience; negativity in the most material sense.

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Peirce's Tychism: Absolute Contingency for our Transmodern World

Fernando Zalamea

Charles S. Peirce (1839–1914) proposed a complex pragmatic architectonics, with multiple information channels and nested control layers, constructed in order to understand the world *simultaneously* in its most abstract generality and its most concrete specificity. Subtended by five basic structural girders—the pragmatic(ist) maxim, the cenopythagorean categories, universal semeiotics, a dialectics of determination and indetermination, a triadic classification of sciences—Peirce's system is particularly well attuned to an evolving comprehension of the World. The architecture of the system, with its pervasive reflections and overlapping frames, recalls the gothic cathedral evoked by *À la Recherche du Temps Perdu*, but transcends even the work of man, striving to capture a general design in Nature, a reality independent of communities of inquirers. Peirce's architectonics provides an extensive arsenal of *intersecting* instruments for the partial understanding of a complex reality in which are merged—on a *frontier* crossed over by constantly iterated and deiterated information—the richness of the external cosmos and the multiplicity of semiotic systems internal to cultural communities. It should therefore come as no surprise that Peirce's architectonics supposes a *continuum* which weaves together cosmos and humanity, which makes possible the systematic study of the bordering processes characteristic of any semeiosis, and which makes it possible to contrast the *back-and-forth* miscegenation of the whole edifice. On the other hand, many forms of invention, according to Peirce's celebrated theory of abduction, occur via *breaks* in continuity, via some type of uncontrolled modal lapse where *chance* enters into the picture. Peirce's *creative tension* between sedimentation and wavering—where *contingency* often dictates the divergent paths to be followed—propels all human endeavours, and, in particular, seems to command our present, Transmodern condition.

1. TYCHISM OR ABSOLUTE CHANCE: THE FOUNDING CONTRADICTION

At the beginning of the 1890s, Peirce introduced the concept of tychism:

> In an article published in *The Monist* for January, 1891, I endeavored to show what ideas ought to form the warp of a system of philosophy, and particularly emphasized that of absolute chance. In the number of April, 1892, I argued further in favor of that way of thinking, which it will be convenient to christen *tychism* (from *tyché*, chance). A serious student of philosophy will be in no haste to accept or reject this doctrine; but he will see in it one of the chief attitudes which speculative thought may take, feeling that it is not for an individual, nor for an age, to pronounce upon a fundamental question of philosophy. That is a task for a whole era to work out.[1]

Opening up a formidable task that it would fall to a whole era to work out (witness the present volume of COLLAPSE) Peirce introduced a pillar of his late (1890–1910) philosophical system with a *fundamental*

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[1] 'The Law of Mind' [1892; CP 6.102]. References of the form [*xyzt*; CP *a.bcd*] signal a year of Peirce's writing (*xyzt*), a volume (*a*) and a paragraph (*bcd*), referring to C.S. Peirce, *Collected Papers* (CP), 8 vols., eds. Hartshorne, Weiss & Burks (Bristol: Thoemmes Press, 1998; new reprint of Harvard University Press's original edition, 1931–1958; electronic edition: Intelex Corporation, 1992).

contradiction in terms: *absolute chance*. Isn't chance everything *but* absolute? How can chance—contingent, fleeting, discontinuous—be thought as an 'absolute'? Doesn't this stand in contradiction to Peirce's very own system—a relative architectonics always open to evolution, and which never accepts an absolute *status quo*? We do indeed have *in fact* a contradiction, but one that sparkles with creativity. As with Florensky's antinomy between the visible and the invisible,[2] or Thom's aporia of the continuous and the discrete,[3] we are in the presence of a *founding antinomy* of thought. In *attempting* to posit a form of chance as initial, archetypical, 'absolute', Peirce enters into the first of his three cenopythagorean categories[4]—*firstness*—oriented towards the immediate and the spontaneous, the free and the fresh. *Free chance* may be thought as a first, but never instantiated (thus becoming already a second) nor normatively established (becoming a third). Nevertheless, the usual contexts of *contingency* (forms of secondness) *may* be embodied as *projections* of a free concept (first). This could seem just a vague ideal, were it not for contemporary mathematical Category Theory, wherein free objects, algebras as projections of free objects, and initial, archetypical topoi, have been completely formalized.[5]

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[2] P. Florensky, *Beyond Vision: Essays on the Perception of Art* (London: Reaktion, 2006).

[3] R. Thom, 'L'aporia fondatrice delle matematiche', in *Enciclopedia Einaudi* (Torino: Einaudi, 1982), vol. XV, 1133–46.

[4] For good presentations of the categories, see 'A Guess at the Riddle' [1887-88; CP 1.356–7] or 'Lectures on Pragmatism' [1903; CP 1.322].

In relation to the three categories, Peirce classifies three ubiquitous, universal forms of evolution:

> Three modes of evolution have thus been brought before us: evolution by fortuitous variation, evolution by mechanical necessity, and evolution by creative love. We may term them *tychastic* evolution, or *tychasm, anancastic* evolution, or *anancasm,* and *agapastic* evolution, or *agapasm.* The doctrines which represent these as severally of principal importance we may term *tychasticism, anancasticism,* and *agapasticism.* On the other hand the mere propositions that absolute chance, mechanical necessity, and the law of love are severally operative in the cosmos may receive the names of *tychism, anancism,* and *agapism.*[6]

Tychism—that is, the operative condition of absolute chance (1.1) in the cosmos, commands an embodied *tychastic* evolution (1.2), which, in turn, can be elevated into a doctrine of *tychasticism* (1.3). The *molten*, founding antinomy (1.1) thus gives rise to separated, *well defined* fortuitous variations (1.2), and to a pervading doctrine

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[5] For an understanding of Peirce along these lines, see F. Zalamea, 'A Category-Theoretic Reading of Peirce's System: Pragmaticism, Continuity and The Existential Graphs', in: M. Moore (ed.), *New Essays on Peirce's Mathematical Philosophy* (Chicago: Open Court, 2010), 203–33.

[6] 'Evolutionary Love' [1893; 6.302].

(1.3) in which contingency *has to be* taken into consideration. The result completely *opens up* Peirce's philosophical system, allowing (and *supporting*) creative contradictions, introducing dynamical dialectic tensions, and begetting a web of systemic, hierarchical interactions.

2. TYCHISM AND SYNECHISM: THE DIALECTICS

Peirce's indetermination/determination adjunction shows how some considerations as to continuity must be set within a hierarchy of levels and meta-levels. Over the meta-level of a meta-generic *continuum* (a 'continuum of higher generality')[7] can schematically be drawn the *lower* (*i.e.* locally multi-layered) back-and-forth between *tychism* and *synechism* which pervades Peirce's architectonics:

> Permit me further to say that I object to having my metaphysical system as a whole called Tychism. For although tychism does enter into it, it only enters as subsidiary to that which is really, as I regard it, the characteristic of my doctrine, namely, that I chiefly insist upon continuity, or Thirdness, and, in order to secure to thirdness its really commanding function, I find it indispensable fully [to] recognize that it is a third, and that Firstness, or chance, and Secondness,

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[7] 'The Logic of Events' [1898; v 6.191].

> or Brute reaction, are other elements, without the independence of which Thirdness would not have anything upon which to operate. Accordingly, I like to call my theory Synechism, because it rests on the study of continuity. I would not object to Tritism.[8]

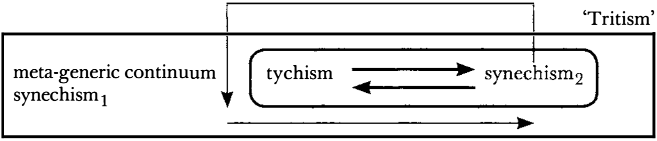

Figure 1. Tychism-synechism adjunction drawn over a generic continuum

The introduction of elements of 'pure chance'—the characteristic indetermination of tychism—can thus be seen as a contextual *ingredient* within a much more general process, wherein the primacy of the *continuum* is never contested. Indeed, the *continuum* happens to be the truly generic concept on which the 'design' of Peirce's architectonics can be sketched, since it is the only one that allows multiple intra-level internal reflections in the edifice. This explains Peirce's (otherwise cryptic) motto:

> Tychism is only a part and corollary of the general principle of Synechism.[9]

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[8] Ibid. [1898; CP 6.202].

[9] 'Letter to William James' [1897; CP 8.252].

In fact, Peirce's *continuum* combines the three categories: through a modal and plastic character, it includes a spectrum of *pure potentiality* (firstness); through breaks and cuts, the scale of numbers acts and reacts (secondness); through generic gluings and connections, the rule of continuity holds (thirdness).[10] Tychism—with all its related concepts, 'absolute' chance, free chance, pure potentiality—stands, in firstness, as a counterpart to thirdness. Contingency *liberates* the hard and fast ruling of the *continuum*. Creativity and its abductive variants construct a *back-and-forth dialectics* with sedimentation and its normative variants. We are in the presence of some sort of *chemical* reaction between polarities, as Novalis had well fathomed;[11] a mathematical chemistry of opposites that Reza Negarestani has brilliantly situated at the basis of an architecture of decay.[12]

Saturation and decay are pendulous movements that pervade not only Peirce's architectonics, but also our Transmodern world. Diverse forces of saturation bring us nearer to continuity, bridging new frontiers and enriching Peirce's *summum bonum* (the continuous growth of potentiality). On the other hand, many shifts in the direction of decay are related to *contingent* situations in which chance produces new, unexpected combinatorial perspectives. Both growth (third) and decay (first) are fundamental, when seeking an active-reactive balance (second). Decay, Negarestani says, 'is an irresolute process of building that potentiates architectures', a 'subtractive' force, 'concurrently intensively negative and extensively positive'.[13] Writing independently of Peirce, the Iranian philosopher turns out to be very close to the American: it is indeed the subtractive, intensively negative Tychism that potentiates Peirce's extensively positive Synechism.

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[10] See F. Zalamea, 'Peirce's Logic of Continuity: Existential Graphs and Non-Cantorian Continuum', *The Review of Modern Logic* 9 (2003): 115–62.

[11] Novalis, *Notes for a Romantic Encyclopaedia* (Das Allgemeine Brouillon) (Albany: State University of New York Press, 2007).

[12] R. Negarestani, 'Undercover Softness: an Introduction to the Architecture and Politics of Decay', COLLAPSE VI (2010): 379–430.

3. TYCHISTIC SYNECHISM: A TRANSMODERN CONJUNCTION

After Modernism and Postmodernism, *Transmodernism* has been advocated as a more faithful neologism for our plastic and transient age. Introduced by the Spanish philosopher Rosa María Rodríguez Magda,[14] the term 'Transmodernism'—both diachronic and methodological—seeks to reintegrate many awkward postmodern differentials, to balance some supposed breaks with more *in-depth sutures*, to counter relativism with a *topological logic* wherein certain *universal relatives* provide invariants beyond the flux of transformations.

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[13] Ibid., 386.

[14] See R. M. Rodríguez Magda, *La sonrisa de Saturno* (Barcelona: Anthropos, 1989), and R. M. Rodríguez Magda, *Transmodernidad* (Barcelona: Anthropos, 2004).

A rich counterpoint emerges between Postmodernism and Transmodernism: break, locality, differentiation, contradiction, ambiguity, the impossibility of universals, 'all is equally worthwhile', Death—'Postmodern dissonances' if you will—are now contrasted with revision, local/global dialectics, oscillation between differentiation/integration, partial gluing of relative coherences, a fabric of vagueness/exactness, relative universals, 'some are more worthwhile than others', Renaissances—a sort of Transmodern harmonics. *Both* the dissonances and the harmonics are fundamental for our epoch, but one should not forget the necessary swings of the pendulum.

In many ways, Peirce's architectonics already included most of the salient features of Transmodernism, a situation that perhaps explains the unusual relevance of Peirce's thought at the beginning of a new millennium. In fact, Peirce's system is essentially topological, open to all sorts of continuous transformations (pragmatic maxim, triadic semiotic, classifications of sciences, synechism, etc.), and in particular, the system is able to represent a 'bimodal'[15] net of *both* differentials and invariants, thus providing a full understanding of the *TRANS-* prefix. At its very core, Transmodernism is open (*i*) to a *conjunction* of opposites, in this case Tychism and Synechism, and further (*ii*) to a

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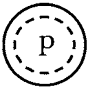
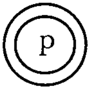
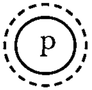
[15] The term, due to Jean Petitot, refers to the simultaneous static and dynamic status of many concepts and objects, particularly in the Modern and Transmodern world.

distributive—differential and integral—analysis of the development of the contradictory conjunction at play. *Contingency* enters into the panorama as a dynamical factor which multiplies the 'growing of potentiality', thus complying with a full instantiation of Peirce's esthetical *summum bonum*.

Amazingly enough, Peirce was able to embody his (*i*) *tychistic synechism* in a fully-fledged logical calculus, thanks to his Gamma existential graphs. The 'broken cut' is defined as the *topos* of *contingency* (possibility of negation), generalizing standard negation (Alpha). Then, applying to the broken cut to the general writing/erasure rules proper to the existential graphs, Peirce proves the fundamental laws of *normal* modality:[16]

	deduces		deduces	
$\neg\Diamond\neg p$ $\Box p$ *necessity* (*negation of contingency*)		$\neg\neg p$ p *actuality*		$\Diamond\neg\neg p$ $\Diamond p$ *possibility* (*contingency of negation*)
	[by insertion in an odd area, the Gamma broken cut is 'filled' into a complete Alpha cut]		[by erasure in an even area, an Alpha cut is 'half erased' into a Gamma broken cut]	

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[16] 'Some Topics of Logic Bearing on Questions Now Vexed' (Lowell Lectures) [1903; CP 4.516].

The extremely simple and plastic transformations of the cuts prefigure *exactly* Thom's dialectics between the continuous (Alpha's complete cut) and the discrete (Gamma's broken cut). Moreover, Peirce's topological logic shows—in a precise, theorematic way—how contingency, an instantiation of Tychism, may be encompassed within a wider *TRANS*formational calculus of *topoi*, an instantiation of Synechism.

The topological logic of modulation goes even deeper if we look at the multiple (*ii*) *distributive gradations* of the iteration/deiteration existential graphs rule (moving information *back-and-forth* through cuts). We must observe, first and foremost, that if one allows arbitrary insertions of the necessity cut (a double cut formed by a broken cut inside an Alpha cut) for graphs marked on the page—a fact which corresponds to modal *necessitation*: α provable forces $\Box\alpha$ provable—then a Gamma system cannot also accept arbitrary iteration/deiteration through broken cuts, since then one can prove that Alpha and Gamma cuts are equivalent.[17] Thus emerges in Gamma an important *obstruction* to arbitrary iteration/deiteration, and a series of *partial resolutions* of that obstruction is precisely what gives rise to intermediate modal systems. Specifically, the following representations of intermediate systems

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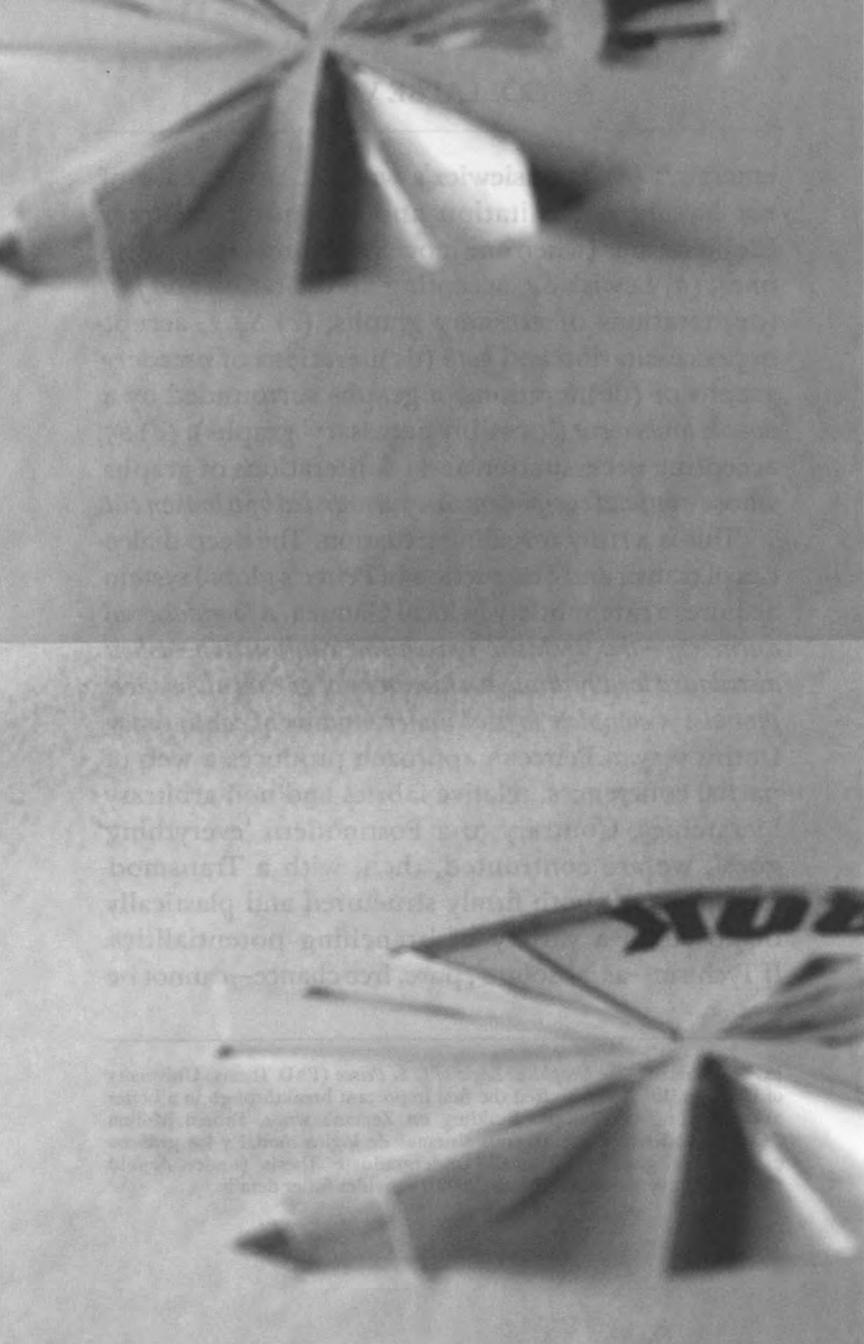
[17] We thank here many personal communications (2010) of Arnold Oostra.



emerge:[18] (*a*) Lukasiewicz's weak *L*, in the case of *not* having necessitation and accepting *arbitrary* (de)iterations (when one movement forces the inverse one); (*b*) Lewis's *S4*, accepting necessitation and *just* (de)iterations of *necessary* graphs; (*c*) *S4.2*, accepting necessitation and *both* (de)iterations of *necessary* graphs or (de)iterations of graphs surrounded by a *double broken cut* ('possibly necessary' graphs); (*d*) *S5*, accepting necessitation and (de)iterations of graphs whose *minimal components are surrounded by a broken cut*.

This is a truly revealing situation. The deep dialectics of transit and obstruction in Peirce's global system acquires a rare subtlety in local Gamma. *A foundational antinomy—the 'tychistic synechism' conjunction—when distributed locally through a hierarchy of partial allowances, provides a complete logical understanding of contingency*. In this way, a Peircean approach produces a web of partial coherences, relative fabrics and non-arbitrary hierarchies. Contrary to a Postmodern 'everything goes', we are confronted, then, with a Transmodern appraisal, both firmly structured and plastically disposed to a variety of branching potentialities. If Tychism—as 'absolute', pure, free chance—cannot be

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[18] Jay Zeman, *The Graphical Logic of C.S. Peirce* (PhD Thesis, University of Chicago, 1963) constituted the first important breakthrough in a better understanding of Gamma. Building on Zeman's work, Fabián Molina ('Correspondencia entre algunos sistemas de lógica modal y los gráficos existenciales gama de Peirce' [Undergraduate Thesis (under Arnold Oostra), Universidad del Tolima, 2003]) provides fuller details.

constrained, on its own, by any governing structure,[19] all of its subsequent instantiations (ordinary chance, contingency, breaks, variations) nevertheless enter into a *grand* architectonics. Our contemporary disorientation might be better understood if we took into *serious* consideration Peirce's system, with all its natural, dialectical, adjusting instruments, which help us to circumnavigate the Relative and to handle the furious winds of Contradiction.

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[19] Nevertheless, Peirce himself tried to 'axiomatize' Firstness, that intrinsically elusive category. He introduced a *swa* as 'something which is without reference to anything else', and provided some 'axioms' for swas: the excluded middle does not hold for swas, no swa exists, any swa is independent of its possible representations, a swa is not a whole constituted by parts, etc. See C. S. Peirce, *Categorie* (ed. Fabbrichesi) (Bari: Laterza, 1992), 130–35.

Quantum Mechanics as Generalised Theory of Probabilities

Michel Bitbol

PROLOGUE

The thesis I will defend here comprises two propositions: Firstly, quantum mechanics is not a physical theory that happens to make use of probability calculus; it is *itself* a generalised form of probability calculus, doubled by a procedure of evaluation that is probabilistic by way of its controlled usage of symmetries. Secondly, quantum mechanics does not have merely a predictive function like other physical theories; it *consists* in a formalisation of the conditions of possibility of any prediction bearing upon phenomena whose circumstances of detection are also conditions of *production*.

PROBABILITIES, SIGNS, AND SECONDARY QUALITIES

Before developing and justifying the above propositions, I should like to return briefly to the prehistory of probability calculus, between the sixteenth and seventeenth century. This return will help us in overcoming certain prejudices about probability that are the product of an intermediate era (roughly, the eighteenth and nineteenth centuries), and in approaching quantum mechanics with an open mind. I mean in particular the prejudice that consists in conceiving probability merely as the expression of a certain subjective ignorance of underlying processes, processes which play out in and of themselves, according to determinist laws.

So what conditions permitted the collective elaboration, from the seventeenth century onward,[1] of probability calculus? Ian Hacking has furnished an extensive list of such conditions,[2] but he insists upon one in particular. This crucial condition is the development, in the sixteenth century, of sciences of *signs* or of *secondary qualities*.

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[1] One precursor is Jerome Cardan, in the mid sixteenth century. But his work remained isolated, with no real influence, and his main treatise on games of chance was only printed for the first time in 1663, in the era of Pascal and Huyghens.

[2] I. Hacking, *The Emergence of Probability* (Cambridge: Cambridge University Press, 1975).

The distinction between primary qualities and secondary qualities—in other words, between properties that show themselves such as they are intrinsically, and properties imputed to material bodies on the basis of impressions or signs that result from their interactions with the sense organs—is usually attributed to Locke. It can ultimately be traced to Galileo, Descartes and Robert Boyle. But in fact we already find the trace of it earlier, in Jerome Fracastor, a doctor in the first half of the sixteenth century.

From the moment when the distinction was recognised, an opposition could develop between the sciences of first causes and exact proofs (such as astronomy, geometry, and mechanics), and the other sciences (such as medicine and chemistry) which were reduced to *prognostics* acting on the basis of signs, phenomena, or sensible secondary qualities. It is in the field of so-called 'inferior' sciences, these sciences of secondary qualities, that the notion would crystallise of an opinion supported by signs, which in part gave rise to the concept of probability. The clues as to the outbreak of an epidemic, or the symptoms of an illness, which are secondary in relation to the supposed primary causes of the epidemic or the illness, were, for example, called 'signs of probability' by Fracastor in his book *On Contagion*.[3]

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[3] Ibid., 28.

This close association between the birth of the concept of probability and the elaboration of the concept of secondary qualities bears an implicit lesson for the understanding of the privileged link between quantum mechanics and probability. For, as Heisenberg wrote, quantum physics confronts a situation where *even* spatio-kinematic variables of the position and quantity of movement, which were considered at the time of Descartes and Locke as direct and 'primary', must be taken as indirect manifestations, relative to an instrumental context—in short, as secondary.[4] To the universalization of the notion of secondary quality, or of the relativity of phenomena in regard to a context, responds, in quantum mechanics, the universalization of the pertinent domain of probability.

One can guess, however, from this short summary, the reason why the concept of probability remained embryonic and marginal in the natural science of the first half of the seventeenth century; a reason which also explains, albeit belatedly, the contemporary reticence to take entirely seriously a physical theory built on a probabilistic armature, such as quantum mechanics. This reason is that, from the beginning, probabilities were considered as a predictive lesser evil in a situation where one finds oneself momentarily incapable of offering a descriptive account based upon well-founded principles and truths (truths concerning efficient causes if one is Aristotelian, figures and movements if one is Cartesian). It is no surprise, under these conditions, that all the efforts of the players in the first scientific revolution were focused on elucidating causal links or describing a real universe of primary qualities by way of geometry, rather than seeking to systematise the estimation of the uncertain in the shifting circumscription of secondary qualities.

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[4] W. Heisenberg, *Philosophical Problems of Quantum Physics* (Woodbridge, Connecticut: Oxbow Press, 1979), 38.

THE UNCERTAIN AND THE MIDDLE OF THINGS

As Catherine Chevalley quite rightly emphasises,[5] the estimation of the uncertain only began to constitute an entirely separate theme of investigation in the work of an anticartesian thinker, Pascal, for whom 'the end of things and their beginning are hopelessly hidden from [man] in an impenetrable secret'.[6] If man must content himself, according to Pascal, with 'perceiving some appearances from the middle of things, in an eternal despair of knowing either their beginning or their end',[7] he cannot denigrate the appearances in favour of an ungraspable backworld governed by principles. Man must learn to inhabit his milieu; he must know how to focus his attention upon the play of his experimental manipulations and the phenomena that result from them; he must admit the inconsistency of cutting up the world into separate and intrinsically-existing objects, since phenomena are so tied one to another that it is impossible to know how to grasp one without grasping all; he must understand, also, that no cognition can free itself from the nexus of interrelations, but can only situate itself within it, remaining cognizant of the perspective from which it derives. Finally, man must consent to make the effort to domesticate the uncertainty that is his lot, by mathematizing directly the relations between antecedents and expectations, and between expectations and observations.

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[5] C. Chevalley, *Pascal, contingence et probabilités* (Paris: PUF, 1995).

[6] B. Pascal, *Pensées*, fragment 199, in *Oeuvres complètes* (Paris: Seuil, 1963), 526.

[7] Ibid.

Of course, probability calculus was able to develop after Pascal by freeing itself of what some would call an epistemological pessimism motivated by the vertigo of the impenetrability of the Divine plan. The tone, in Laplace's 1814 *Philosophical Essay on Probabilities*, is almost antipodal to the latter, since Laplace here affirms the omnipotence of a Principle of Sufficient Reason incarnated by a God whose work is transparent. According to Laplace, 'the curve described by a simple molecule of air or of vapour is governed in a manner just as certain as that of planetary orbits: the only difference between them is that which our ignorance places there.'[8] And it is only in this interval between the in-principle determination of all things and our perhaps provisional ignorance with regard to them, that probability has any place: 'probability', Laplace continues, 'is relative in part to our ignorance, and in part to our cognitions'.[9]

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[8] P. S. de Laplace, *Essai philosophique sur les probabilités* (Paris: Courcier, 1814), 4.

Such a conception perfectly fulfilled its office in the framework of classical physics, and particularly in classical statistical mechanics (leaving to one side the more recent problematic of sensitivity to initial conditions). But, faced with the recurrent question of the essential or nonessential character of probabilities in quantum physics, and the difficulties it presents to the thesis of probability-ignorance, it was worthwhile our returning before Laplace, and recalling that the calculus of probabilities made one of its first appearances upon an entirely other philosophical terrain. It emerged in Pascal, as we saw, on the basis of a recognition of anthropological limits, of an epistemology close to operationalism, of a generalised holism, and of a gnoseological perspectivism. One cannot but be struck in observing that *all* these traits are present in the most current interpretations of quantum mechanics, and that there is no acceptable interpretation that does not include at least one of them. The most frequently encountered trait, including in the most reliable 'hidden variable' interpretation, is *holism*.

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[9] Ibid.

INDETERMINISM AND CONTEXTUALITY

These two historical remarks—one on the association of the concept of probability with the concept of secondary qualities, the other on the conception of probability calculus as an instrument for the predictive mastery of our situation of entanglement in the network of natural relations—will now help us to undo two interpretative knots of quantum physics, both of which relate to *indeterminism*.

The first concerns the notion, very widespread since Heisenberg's foundational works of 1927–30, of an uncontrollable *perturbation* that the agent of measurement is supposed to exert upon the microscopic measured object. It is interesting to note that this 'perturbation' was assigned a twofold role by those who conceived of it.

On one hand, as Bohr emphasises at the end of the 1920s, the uncontrollable perturbation constitutes the reason for the *indivisibility* of quantum phenomena—that is to say, the impossibility of separating in the phenomena that which belongs to the object and that which belongs to the measuring agent. Perturbation would explain, in other words (borrowed this time from Heisenberg), that quantum physics leads to a generalisation of the model of secondary qualities—with their obligatory reference to the context within which they manifest themselves—to the detriment of that of primary intrinsic qualities.

But on the other hand, according to the 1927 article where Heisenberg presents his so-called ‘uncertainty’ relations for the first time, the perturbation is also that which takes account of the *indeterminism* of quantum physics. The incompressible and uncontrollable perturbation by the agent of measurement is what prevents complete knowledge of the two groups of variables that compose the initial state of a particle. Consequently, concludes Heisenberg, the principle of causality, which links in a constraining fashion an initial state and a final state, is inapplicable in quantum physics.

The model of ‘perturbation’ thus allows us to bring to light a close relation between contextuality and indeterminism, since perturbation has as a consequence the contextuality of phenomena as well as an indeterminism in regard to them. A relation which is, perhaps, historically translated in the confluence of the concepts of secondary quality and probability at the time of their birth. Unfortunately, the image of the perturbation of the object by the measuring agent also has a major inconvenience which did not escape Bohr or Heisenberg, and which Karl Popper later emphasised: Basically, this image begins by bringing into play a universe of objects endowed with primary spatial and kinematic qualities, and then invoking their mutual alteration so as to subsequently justify the putting aside of the concept of primary quality and the generalisation of that of secondary quality.[10] In this image, then, one puts forward the representation of a universe of figures and movements, with the unique aim of demonstrating its inanity, or (what comes down to the same thing, for a verificationist epistemology) its in-principle inaccessibility.

The image of 'perturbation' thus represents a metastable moment in the reflection on quantum mechanics. It invites us to surpass it, in two opposite directions: Either we take wholly seriously the *premises*, and we try to construct an empirically-adequate theory of the inaccessible spatio-kinematic processes that are postulated—this is the strategy of the authors of certain hidden variable theories. Or, on the contrary, we take wholly seriously the holistic *consequences* of the image of perturbation, namely the indivisibility of the quantum phenomena, its unsurpassable *relativity* to an experimental context, and we develop a conception of physical theory that no longer appeals to an imagined representation of the supposedly constitutive moments of the phenomena—this is the strategy that Bohr adopted from 1935 onward, not without certain shortcomings.

It is reassuring for those who, like myself, have chosen to push the second strategy to its ultimate consequences, to observe that it is possible to establish a *direct* formal link between indeterminism and contextuality, without need of an intermediary furnished by the image of perturbation. In 1935, Grete Harmann published a small book in which she hinted at such a link.[11] This young German philosopher remarked that the possible causes of a quantum phenomena *cannot be used to foresee it*, because they are only ever defined afterwards, *relatively* to the very circumstances of the production of this phenomena when measured. Later, at the beginning of the 1950s, Paulette Destouches-Février proved in a much more rigorous way a theorem according to which every predictive theory bearing upon phenomena defined relative to experimental contexts certain of which are mutually incompatible, is 'essentially indeterminist'.[12]

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[10] On this point, see M. Bitbol, *Mécanique quantique, une introduction philosophique* (Paris: Flammarion, 1996), Chapter 3.

DETERMINIST IDEALS, INDETERMINIST PROJECTIONS

Let us remark now that, through what has been said above, a second interpretative knot concerning the relation between quantum physics and indeterminism has been implicitly undone. It was often asked in the 1930s whether quantum mechanics, with its probabilistic, or even 'statistical' (as Einstein had it) character might one day be rendered obsolete by a determinist theory of the individual underlying processes. The response of the last forty years research to this question is somewhat sibylline, but all the more instructive philosophically.

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[11] G. Hermann, *Les fondements philosophiques de la mécanique quantique*, tr. A. Schnell and L. Soler (Paris: Vrin, 1996), 90.

[12] P. Destouches-Février, *La structure des théories physiques* (Paris:PUF, 1951), 260–80. This theorem is perfectly compatible with the existence of hidden variable (or rather, hidden process) theories, since it bears only upon the link between effective or possible phenomena, and not the link between processes in principle inaccessible to experimentation (see paragraph 5).

The first lesson to be drawn from this research is that *it is not impossible* to formulate theories which dictate the intrinsic properties of individual objects via determinist laws, but which also reproduce exactly the predictions of quantum mechanics.[13] These so-called hidden variable theories simply find themselves subject to certain constraints, principal among which are non-locality[14] (that is to say, the instantaneous mutual influence of the properties of arbitrarily distant objects) and contextualism[15] (that is to say, the influence of the measuring device on the postulated properties). These two conditions, however, do raise problems. The nonlocal concept of instantaneous interactions at a distance[16] introduces a formal conflict

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[13] D. Bohm & B. Hiley, *The Undivided Universe* (London: Routledge, 1993).

[14] J. Bell, *Speakable and Unspeakable in Quantum Mechanics* (Cambridge: Cambridge University Press, 1987).

[15] S. Kochen and E. Specker, 'The problem of hidden variables in quantum mechanics', *Journal of Mathematical Mechanics* 17 (1967), 59–87.

[16] At this stage we must avoid confusions of vocabulary and ideas between standard quantum mechanics and hidden-variable theories,

(albeit one without practical consequences) with the axioms of relativity theory.[17] As for contextualism, it

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which may lead one to believe wrongly that standard quantum mechanics encounters the same problems as hidden-variable theories with regard to nonlocality. Standard quantum mechanics leads us to *foresee correlations* between distant experimental events; but, in itself, it furnishes *nothing that could be taken for an explanation* of these correlations. In particular, it does not imply in itself any idea of *nonlocal* interactions. All one can remark is the *nonfactorisability* of the components of a global state vector which furnishes (correlated) probabilities of the results of two distant events. But the current interpretation of the state vector poses the temptation to a semantic overdetermination of nonfactorisability. For in this interpretation, a state vector represents the 'state' of a 'system', and not merely a generalised instrument of the probability calculus of experimental phenomena. Whence the nonfactorisability of the state vector was understood as the *nonseparability* of the states of the subsystems that composed the system; and this nonseparability was sometimes confused with the nonlocality that implies instantaneous influence. The difficulties and confusions here come from the mixing up of an operationalist and predictive orientation with implicitly ontological and descriptive elements (the concepts of 'system' and 'state').

Hidden-variable theories have at least the advantage that they seek to furnish an *explicitly* ontological interpretation of quantum mechanics, bringing in the intrinsic properties of objects. On this basis, they can claim to *explain* correlations. The correlations are explained either in applying the concept of causes common to the postulated intrinsic properties (local hidden variable theories), or by invoking instantaneous interactions at a distance between these properties (nonlocal hidden variable theories). The explanation via common causes having been excluded by Bell's theorem, it remains to partisans of hidden variable theories to confront the consequences of the explanation via instantaneous interactions at a distance.

Let us just indicate that an attempt to generalise explanation via causes common to *contextual phenomena* rather than to properties, without soliciting any structure other than that of standard quantum mechanics, and consequently without falling victim to Bell's theorem, can be found in M. Bitbol, *Mécanique quantique, une introduction philosophique* (Paris: Flammarion, 1996), 189–91.

[17] But, it will be asked, are there not *also* difficulties in adapting standard quantum theories to relativistic theories, in spite of the advances realised by Dirac and the creators of quantum field theory? Doubtless. However, in the light of the remarks made in the preceding note, one might think that these difficulties are *not of the same nature* as those met with by hidden

has as a consequence that measurements do not at all allow us to accede, point by point, to continuous and determinist processes which, according to the theory, would take place in and of themselves in nature *if one had not modified them by seeking to bring them to light*. In other words, the theory itself implies that the 'independent' determinist processes that it describes are inaccessible to experience.

The conclusion to draw from this is certainly not that we must cast anathema on hidden variable theories, but simply that it is indispensable to revise their ambitions downward. We have seen that one of the principal objectives of their advocates was to reopen the question of determinism, against those who affirmed overhastily that this question had already been settled (in a negative sense) by quantum mechanics. Standard quantum mechanics may well have been 'essentially indeterminist' in structure, but if one could reproduce its results in an *other* theory comprising determinist processes, the determinist option would regain all of its credibility. It is true that the *ontological* question of

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variable theories. Hidden variable theories confront relativistic theories *on their own terrain*—that of the *description* of spatiotemporal events that can be treated *as if they occurred of themselves*. On the contrary, standard quantum theories operate on a completely different plane: that of the prediction of phenomena whose production is conditional to the presence of appropriate contexts that are sometimes mutually incompatible. The problem of the putting into concordance of standard quantum theories and relativistic physics thus very probably pertains to the difficulty in defining an appropriate terrain upon which the two theoretical universes can encounter each other, rather than to a direct conflict.

knowing whether the ultimate laws of nature are or are not determinist is *undecidable*, because determinist appearances can result from a statistical regularity, and, inversely, indeterminist appearances can be a translation of deterministic chaotic phenomena.[18] But at least one could still hope for determinism to rediscover its traditional status as a guiding thread for research. Yet we have been disabused of even this hope. For in hidden variable theories, the determinist stance does indeed seem to have been lost, even at the level of its epistemological fecundity. The determinist stance was only fruitful because it compelled researchers to conceive of networks of univocal bonds underlying phenomena, to design the type of experiment that would allow these bonds to be brought to light, and to thus define often unprecedented classes of phenomena. Unfortunately, this process is blocked from the outset by the in-principle inaccessibility of the bonds that underlie phenomena in contextualist hidden variable theories capable of reproducing quantum predictions. Once the reciprocal current of information between the determinist project and the definition of new domains of experimentation dries up, the attempt to pursue this project formally becomes nothing more than a jeu d'esprit whose principal (if not sole) interest is its serving as an intellectual stimulant for specialists in the foundations of modern physics.

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[18] On this subject, see Jacques Harthong's 'fifth conflict of transcendental ideas', cited by A. Dahan-Dalmedico in A. Dahan-Dalmedico, J.L. Chabert and K. Chemla (eds.), *Chaos et déterminisme* (Paris:Seuil, 1992), 405; and J. Harthong, *Probabilités et statistiques* (Paris: Diderot, 1996).

This situation does not justify, for all that, the inverse excess—namely, indeterminist dogmatism. All one is within one's rights to observe is that henceforth, in the physical sciences, the advantage of epistemological fruitfulness will belong to the stance that consists in maximally developing predictive capacity to the detriment of descriptive ambition, the calculus of probabilities rather than determinist models of evolution.

It is true that many thinkers do not stop there; they tend to extrapolate the epistemological observation of the fecundity of the indeterminist option into an ontological affirmation of the intrinsically stochastic character of the laws governing the world. But their position is easily acceptable on the methodological plane, without it being necessary to follow them in the metaphysical aspects of their conclusions. As James Logue has shown in his *Projective Probability*,[19] every coherent system of probabilistic evaluation can be interpreted in realist fashion—that is to say, it can be understood as expressing propositions whose truth status is independent of the means of testing them. And this interpretation in turn might lead the authors of a probabilistic evaluation to project it onto the world. We should not be surprised, in these circumstances, that quantum physics' coherent system of probabilistic evaluations, without the counterbalance of a fruitful determinist programme, could have been conceived by researchers as eminent as Popper (and even Heisenberg, in his own way) as translating, in part or as a whole, a 'real' or 'existent' characteristic of the world.[20] Popper, for example, holds that the world is made of capacities, of potentialities or of natural propensities, which manifest themselves experimentally through particular statistical distributions of phenomena, and which are reflected in quantum theory in the form of a probabilistic algorithm.

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[19] J. Logue, *Projective probability* (Oxford: Oxford University Press, 1995).

Incontestably, the partisans of an ontological indeterminism thereby deliver themselves, just as much as the defenders of hidden variable theories, to what Kant would have denounced as an attempt to extend the application of our concepts beyond the limits of experience[21]—the sole advantage accruing to the partisans of ontological indeterminism being that they limit themselves to directly hypostasizing the quantum formalism's mode of operation, rather than seeking to develop a new one. But ought we to reproach them for this? Since every coherent system of probabilistic evaluation can be read in a realist mode, since nothing prevents the interpretation of the quantum algorithm of probability calculus as translating an order of natural propensities, why would we prohibit them from *adhering* unhesitatingly to such interpretations? Why would we refuse their *belief*, without ulterior motive, that quantum theory describes a reality made of pure potentialities?

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[20] K. Popper, *A Universe of Propensities* (Bristol: Thoemmes, 1992).

[21] This accusation is addressed to someone who takes Popper's declarations on propensity more literally than Popper himself. For Popper recognised that the m*etaphysical* question of determinism remains undecidable before, just as after, quantum mechanics. He considered simply that only the abandonment of dogmatic determinism could open the way to nonconventional theories of change that may prove more fruitful than the causal and spatiokinematic theories inherited from the first scientific revolution of the seventeenth century. One of these alternative theories is no other than the theory of propensions. See K. Popper, *The Open Universe* (London: Routledge, 1988), chapter 4.

The type of response we shall try to give to this question is of an epistemological rather than metaphysical order. We shall not ask if reality *is* or *is not* made of potentialities that have the structure of the probabilistic algorithm of quantum theory, but only whether or not we lose anything on the plane of understanding if we interpret this algorithm in realist fashion.

Let us say right away—and this is the meaning of James Logue's statement of equivalence—that neither the practitioner of probabilistic evaluation nor the quantum physicist lose anything whatsoever to such a way of seeing things. They may even gain something that is at the heart of every profession of realist faith—namely, the seriousness with which they consider their theoretical entities, and the motivation for research.[22] On the other hand, the philosopher really does have something to lose in allowing himself to be fascinated by the sole relation between theory and world. For this stance does not at all incite him to reflect upon what the theory owes to the *situation* of man in the world, and in particular what it owes to the very practice of experimental investigation. Unlike the scientist in his everyday work, the philosopher cannot content himself with *occupying* the Pascalian situation of the man in the milieu that he explores; he must *think* this situation, and charge himself with enunciating its consequences. The scientific researcher, moreover, also has an interest in adopting the reflexive stance from time to time, when she arrives at periods of reorientation in her work. And everyone knows that she finds herself almost inevitably led to do so when science is going through revolutionary times.

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[22] See M. Bitbol, *Schrödinger's Philosophy of Quantum Mechanics* (Dordrecht: Kluwer, 1996), paragraphs 5–9.

A GENERALISED THEORY OF PROBABILITY

It is this type of reorientation that we shall now proceed to undertake. We are going to suspend judgment on the subject of a hypothetical partial isomorphism between quantum mechanics and the real in which we experiment, and interest ourselves selectively in what the structure of this theory owes to the form of experimental activity itself.

Let us begin by rapidly recounting, to this end, the architecture of standard quantum mechanics:

1. The formal kernel of this theory consists in a vector space defined on the set of complex numbers, and endowed with a scalar product; in other words, *Hilbert space*.
2. Upon this space are defined specific operators, called 'observables', which furnish, through their 'eigenvalues' the list of possible results of an operation of measurement.
3. A vector in Hilbert space, called a *state vector*, is associated with each *preparation* (that is to say, with that which, in an experiment, fixes the initial conditions for measurement).
4. By applying *Born's Rule* to this state vector, we obtain a function assigning *probabilities* to the results of any measurement whatsoever that is made subsequent to this preparation.
5. As variable spatiotemporal intervals and diverse physical circumstances can separate the end of the functioning of the preparation and the operation of measurement, we take account of them by way of an *evolution equation* of the state vectors: Schrödinger's equation in the non-relativistic case, Dirac's in the relativist case.

Here I would like to insist upon the major difference between the probability functions in the classical theory of probabilities and those that are obtained on the basis of the state vectors of quantum mechanics by applying Born's Rule. Classical probability functions associate a number between 0 and 1 with each 'event' in the broad sense, defined by Kolmogorov[23] as a subset of elementary events. The set of these subset-events comprises the empty set and the exhaustive set, and it is endowed with a Boolean algebra structure by the operations of union and intersection. In other words, classical probability functions are defined upon a Boolean algebra. On the contrary, taking account of the properties of Hilbert space, quantum probability functions are not defined upon a Boolean algebra; they are defined upon different and richer structures called 'orthoalgebras'.[24] I will avoid detailing the axioms of orthoalgebra, and content myself with indicating that the concept of orthoalgebra is not unrelated to Boolean algebra. One might even consider that orthoalgebras constitute a generalisation of Boolean algebras, and that, correlatively, quantum probability functions generalise classical probability functions. For an orthoalgebra contains Boolean algebras as its substructures; and, on the other hand, the restriction of a quantum probability function to these Boolean substructures is equivalent to a classical probability function.

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[23] A. Kolmogorov, *Foundations of the Theory of Probability* (New York: Chelsea, 1950).

[24] R.I.G. Hughes, *The Structure and Interpretation of Quantum Mechanics* (Cambridge, MA: Harvard University Press, 1989), 220.

This structural disparity between classical and quantum probability functions justifies our refusing to content ourselves with the observation that quantum mechanics 'uses' probability theory. *Quantum mechanics itself consists, in part, in a new and broadened form of probability theory.*

A METACONTEXTUAL PREDICTIVE FORMALISM

It would, however, be a shame to limit ourselves to this superficial and formalist exposition of the situation. We can easily enough understand the reasons for the emergence of a new sort of theory of probability by showing that it is a practically inevitable response to the characteristics of the class of experimental phenomena that quantum mechanics deals with. Principal among these characteristics, as already pointed out in our reflections on the concept of secondary qualities, is *contextuality*; in other words, the inseparability of the phenomena and the experimental context of its manifestation. It is this that imposes a great many of the structural characteristics of quantum theory.

But to really bring to light the very strong link between contextuality and quantum mechanics, we must firstly analyse what makes the contextuality of quantum phenomena uncircumventable, and differentiate it from other, more benign and easily surmountable forms of the relation of determinations to a context.

In all sciences, as in many ordinary situations, we can say that to each experimental or sensory situation there corresponds a whole gamut of possible phenomena or determinations. For example, to a context represented by the cones of the retina there corresponds a scale of colours, to a context represented by a ruler corresponds a scale of lengths, to a context represented by a thermometer corresponds a scale of temperatures, and so on. But as long as the contexts can be conjoined, or as long as the determinations are indifferent to the order of intervention of contexts, nothing prevents our fusing the scales of possibilities into one sole scale relative to one sole global context, and then passing over this context in silence and treating the elements of the scale as if they translated so many intrinsic determinations. The presupposition that nothing prevents us from retracting the context is automatic when one makes use of the propositions of ordinary language: for the latter allow us to attribute many determinations to the same object as if they belonged to it. It is important to note that this presupposition and this mode of functioning of language are associated with a classical, boolean logic and a classical, kolmogorovian, theory of probabilities.

But the appearance of obstacles to the conjunction of contexts, or the observing of a lack of independence of phenomena vis-à-vis the order of utilisation of contexts, as is the case in microscopic physics when one tries to measure canonically conjugated variables, renders traditional methods useless. The strategy of not taking account of the experimental context fails, and it becomes imperative to make explicit the contextuality of determinations.

In this situation that confronts quantum physics, boolean logic and kolmogorovian probability, at first glance, only survive fragmented into many sublogics and many probabilistic structures, each of them associated with a particular context. To *each* experimental context is associated a scale of possible determinations and a scale of attributive propositions which belong to a classical, boolean, sublogic; and to each determination chosen from the set of possible determinations corresponding to *a* given context, can be attached a real number that obeys Kolmogorov's axioms of probability. But these sublogics and these probabilistic substructures cannot be *fused together*, for they depend on distinct contexts that cannot, in general, be conjoined. Under such conditions, we seek to *articulate* them with each other, respectively in the framework of a metalogic and a metacontextual probabilistic formalism. What is remarkable is that when one constructs such a metalogic, in taking account *only* of the impossibility of conjoining the diverse scales of possibles, one arrives at structures isomorphic with the celebrated nondistributive 'quantum logic' of Birkhoff and von Neumann.[25] And what is more, when one tries to construct a metacontextual probabilistic formalism, in constraining oneself *only* to respect Kolmogorov's axioms separately for *each* scale of possibilities, and utilising *one unique* generative symbol of subfunctions of probabilities for each preparation, one arrives at a class of structures whose vector formalism in Hilbert spaces of quantum mechanics is hardly a peculiar case. The form of the evolution equation of quantum mechanics is itself derivable from the general conditions bearing upon the temporal stability of the status of the tool of probabilistic evaluation of the state vector.[26]

In its function as a theory-framework, quantum mechanics is consequently nothing less than *a metacontextual form of probability theory.* It brings together the conditions of possibility of a *unified* system of probabilistic prediction bearing upon phenomena inseparable from sometimes incompatible contexts.

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[25] P. Heelan, 'Complementarity, Context-Dependence, and Quantum Logic', *Found. Phys.* 1 (1970), 95–110.

[26] Bitbol, *Mécanique quantique, une introduction philosophique*; M. Bitbol, 'Some steps towards a transcendental deduction of quantum mechanics', *Philosophia naturalis* 35 (1998), 253-80. The essential theorems that allow us to arrive at these conclusions are due to J.L. Destouches, P. Destouches-Février, G. Fano, A.M. Gleason, et J. Bub. See P. Destouches-Février, *La structure des théories physiques* (Paris: PUF, 1951), and R.I.G. Hughes, *The Structure and Interpretation of Quantum Mechanics* (on the subject of the theorems of Fano, Gleason and Bub).

It only remains to complete this theory-framework with various symmetries[27] in order to draw from it various particular varieties of quantum theory.

DECOHERENCE AND PROBABILITIES

We have seen that, short of confronting the grave epistemological difficulties of nonlocal hidden variable theories, quantum probabilities cannot be taken as the expression of an *ignorance* on the subject of processes or events that happen *of themselves* within nature. The quantum calculus of probabilities bears upon phenomena whose occurrence is suspended by the intervention of an appropriate context. The problem is that, qua physical theory, quantum mechanics has a vocation to universality. The metacontextual probability calculus which is its principal constitutive element must therefore be able to be applied without restriction and on every scale. But, in our familiar environment, isn't the classical (Kolmogorovian) theory of probabilities perfectly utilisable? And doesn't this classical theory, unlike its quantum equivalent, function such that nothing prohibits us from considering it as expressing a partial ignorance as to intrinsic properties and autonomous events? Thus is posed a problem of *compatibility*, between quantum probability calculus (valid in principle on every scale) and the classical calculus of probabilities (valid in practice on our scale).

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[27] 'Quantum mechanics is not itself a dynamical theory. It is an empty stage. You have to add the actors [...] the missing element that has to be added to quantum mechanics is a principle, or several principles, of symmetry.' S. Weinberg, in R.P. Feynman & S. Weinberg, *Elementary Particles and the Laws of Physics* (Cambridge: Cambridge University Press, 1987), 87.

The principal objective of theories of decoherence is to test this compatibility. For they allow us to prove that, when applied to complex processes involving an object, a measuring apparatus, and a vast environment, quantum probability calculus is reduced, *up to a very weak approximation*, to the classical calculus of probabilities. This is manifest in the quasi-disappearance of the terms of *interference* typical of quantum probability calculus, and isomorphic to those of a wave process, in favour of a quasi-validity of the classical rule of the additivity of probabilities of a disjunction.

However, rare are those physicists who are content with this purely *probabilistic and predictive* formulation of theories of decoherence. Some among them have even cherished the hope of utilising decoherence as a means of explaining the *emergence* of a classical world, on the basis of a quantum world supposedly 'described' by a universal state vector.[28] The major obstacle they find themselves up against is that, in order to be able to derive, on the basis of a purely quantum calculation, the classical laws and behaviours that prevail at the human scale, they have not been able to avoid introducing hypotheses that already contain anthropomorphic elements.[29]

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[28] M. Gell-Mann, *The Quark and the Jaguar. Adventures in the Simple and the Complex* (New York: Abacus, 1995).

These discomfitures encourage us to demand no more from decoherence theories than a retrospective assurance of a mutual consistency that is *in practice* sufficient between quantum probability calculus and the presupposition, at once fundamental and elementary, that subtends its experimental test. This presupposition consists in admitting that macroscopic events (like the deviation of the pointer of an apparatus) themselves arise in the laboratory, that their trace is for all time available for any researcher who desires to repeat the observation, and that the utilisation of probability calculus *with regard to them,* consequently, only expresses a partial ignorance as to what they are.

QUANTUM FIELD THEORY, PATH INTEGRALS, AND METACONTEXTUAL PREDICTIVE FORMALISM

The reflections above, it is true, hold something surprising for certain contemporary physicists. For, in manipulating a concept of field sometimes insufficiently distinguished from its classical equivalent, and in taking literally the processes that are figured imagistically in Feynman diagrams, a non-negligible number among them ended up behaving as though the conceptual problems that quantum mechanics raised at its birth were but a bad memory. If physics 'describes' the evolution of fundamental fields, and/or if it manages to 'describe', equally, the dynamics of particles (considered as a state of excitation of a field) by way of the procedure of Feynman path integrals, why still preoccupy oneself with that old Bohrian notion of the inseparability of the phenomena and its experimental conditions of manifestation? Why bring to the fore a notion as opaque for the theoretical physicist as that of 'measurement'?[30] Why insist obstinately upon the *predictive* rather than *descriptive* status of quantum theories? Isn't it possible that many of the philosophical perplexities of the creators of quantum mechanics were linked to the use of a formalism (that of vectors in Hilbert space) which, in the most advanced theories, has been rendered obsolete by the formalism of path integrals?

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[29] Bitbol, *Mécanique quantique, une introduction philosophique,* 410-18. For a close critique of the ontological claims of theories of decoherence, see B. d'Espagnat, 'Towards a Separable Empirical Reality', *Foundations of Physics* 20 (1990), 1147–72. R. Omnès's response can be found in R. Omnès, *The Interpretation of Quantum Mechanics* (Princeton, NJ: Princeton University Press, 1994).

The response to these questions is that, in truth, *none* of the epistemological constraints exerted by the standard quantum mechanics of 1926 have been relaxed by contemporary varieties of quantum theory, and that new constraints of a similar order have even been added to them. Whatever representations they may give rise to, current quantum theories *always* operate as generalised, metacontextual instruments of probabilistic prediction. And this stems from the fact that they are *always* confronted with phenomena inseparable from their context of manifestation. So as to shore up this response, it will be sufficient to evoke rapidly the renovation of philosophical reflections invited by quantum field theory, and then to redefine the relations between the formalism of state vectors in Hilbert space and that of Feynman path integrals.

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[30] Let us remark in passing that, if it is true that the concept of 'measurement' cannot claim any particular status within the field of validity of physical theories (since it is not distinct in principle from other physical processes), it belongs to the conceptual resources of a background that is *logically prior* to any *experimental, testable* theoretical elaboration. It thus has an uncircumventable *metatheoretical* function.

The central trait of quantum theories, which is that they consist in a metacontextual structure of probabilistic prediction, is rediscovered, not only intact but amplified, in quantum field theory. At the end of a reflection on the formalisms of Fock spaces, Paul Teller concludes: 'states [in Fock space] simply characterise propensities for what will be manifested with what probability under various activating conditions. Among the items for which there can be propensities for manifestation is the occurrence of various numbers of quanta...'[31] In other words, far from having rendered superfluous contextual notions such as those of propensive state,

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[31] P. Teller, *An Interpretive Introduction to Quantum Field Theory* (Princeton, NJ: Princeton University Press, 1995), 105.

'observable', and conditions of 'activation', quantum field theories have generalised their application. The concept of quantum field is derived from the classical concept of the field by putting local observables into correspondence with local functions, and through the introduction of relations of commutation (or anticommutation) for certain couples of observables. As to state vectors in Fock space, they allow not only the calculation of the probability that this or that 'property' of a particle will manifest itself in a given experimental context, but the probability that a certain *number* of particles will be detected under the appropriate instrumental conditions. This number itself is treated as an *observable*, the set of whose possible values *under appropriate conditions of detection* is identified with the set of whole natural numbers. To the contextualisation of the *predicate* of objects typical of standard quantum mechanics, then, quantum field theory adds the contextualisation of the notion of the denumerable *bearers* of predicates.

That one must from now on hold the very concept of 'particles', and not only that of 'properties of a particle', to be relative to a context of manifestation, is rendered particularly evident by the relativistic phenomenon of so-called 'Rindler particles'. This phenomenon is observed when accelerating a detector in the 'void'.[32]

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[32] The formal translation of the concept of the 'quantum void' is a state vector in Fock space identical to those of vectors belonging to the observable 'Number' that is associated with the eigenvalue *Zero*.

The *accelerated* detector responds, in this environment where no detector *at rest* would detect the least particle, as if it were plunged into a thermic bath of particles.[33] It is thus quite clear that one cannot treat particles as objects that 'are' there or 'are not' there, independently of the conditions of their detection. One has only the right to speak of *phenomena of detection* that imply, indissociably, a milieu (say 'the quantum void'), a detector, and the dynamic state of this detector. Quantum field theories now appear as particular elaborations of the metacontextual probabilistic framework of quantum mechanics—elaborations adapted to a broadened class of contextual phenomena, belonging to a relativistic domain, and pertaining to the formal concept of 'bearer', beyond that of 'property'.[34]

Now we come to Feynman path integral formalisms, which have often supplanted standard formalisms in the modern practice of quantum field theories.[35]

This state vector associates a null probability with the detection of a number of particles larger than zero by a detector at rest.

[33] Teller, *An Interpretive Introduction*, 110.

[34] The link between the intervention of *relativistic* processes and the mobilisation of the concept of 'bearer' alongside that of 'property' is made immediately comprehensible by a clarifying remark of B. d'Espagnat: From the fact that the energy-mass equivalence established by the Theory of Special Relativity, d'Espagnat remarks (in *Le réel voilé* [Paris: Fayard, 1994]), it can always happen that a 'property of objects' (kinetic energy) is transformed into 'objects' (one or several particles).

[35] In *superstring* theory, the linear pathways are replaced by *tubes*, and the summation effectuated by an integral bears upon these tubes of spacetime whose section is an annular 'string'.

Although the functioning of path integrals is illustrated by linear diagrams evoking spatiotemporal trajectories of particles, their role is only to permit the calculation of the *probability* of a final experimental event (at a certain point) under condition of the occurrence of an initial experimental event (at another point). Here, the dependence of the phenomena whose probability is calculated on an instrumental context is only implicit, but it plays a no less capital role in the very principle of the calculation to be carried out. For what does one concretely do when one evaluates a path integral? One sums 'probability amplitudes', then one takes the square of the modulus of the sum thus obtained, to obtain the *probability* one seeks.[36] Now, the distinction between probability amplitudes and probabilities corresponds pretty much to that between virtual experiments and actual experiments. Read in the framework of standard formalism, probability amplitude is nothing other than the scalar product of the state vector and of a vector belonging to an observable corresponding to an experiment that *would have* taken place (but which did not) in the interval that separates the two actual experiments.[37] On the contrary, probability is calculated for the result of an experiment that will *actually* take place, or which already has done. The path integral formalism, just like that of Hilbert space vectors, manifests the metacontextual predictive structure of quantum theories. It consists in evaluating the probability of a contextual phenomenon by summing the terms corresponding to *virtual intermediary contexts* distinct from those in which the phenomenon is effectively manifest.

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[36] R.P. Feynman & A.R. Hibbs, *Quantum Mechanics and Path Integrals* (New York: McGraw Hill, 1965); R.P. Feynman, *QED: The Strange Theory of Light and Matter* (Princeton, NJ: Princeton University Press, 1988).

[37] Generally, these experiments consist in making (virtual or actual) measurements of the *spatial position*.

Let us add to this two other circumstances that suggest close relations between the functioning of quantum theories utilising a vector formalism in Hilbert space, and those making use of path integrals: Firstly, Feynman has demonstrated the equivalence between the formalism of standard quantum mechanics, which puts a Hamiltonian operator in place in Schrodinger's equation, and the path integral formalism, which uses the corresponding Lagrangian function.[38] What is more, just as certain principles of symmetry determine the Hamiltonian form of Schrodinger's equation, it is the principles of symmetry that allow us to fix the density of the Lagrangian of each interaction, and thus to determine the path integral.[39] The use of such principles of symmetry has as its most concrete consequence the modulation of path integrals (and consequently also that of the probabilistic evaluations that result from them), annulling the amplitude of certain of the diagrams that intervene in the summation.[40]

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[38] Feynman & Hibbs, *Quantum Mechanics and Path Integrals*, chapter 4.

[39] G. Cohen-Tannoudji and M. Spiro, *La matière-espace-temps* (Paris: Gallimard, 1990), 185.

EPILOGUE

All of this leads us to conclude with two propositions that are valid independently of the variety of quantum theory or formalism utilised: Every quantum theory combines an invariable element—a metacontextual form of probability theory—and a variable element—a set of symmetries. The association of these two elements makes it a system of probabilistic evaluation suitable for a class of experimental situations whose extension depends upon the symmetries brought into play. As soon as one accepts that there is nothing more to be understood in quantum mechanics, a whole world of non-physical applications of the theory opens up, in game theory,[41] perception theory, or linguistics.[42] Conversely, the very success of these exotic applications testifies that quantum mechanics is indeed in its essence a metacontextual form of probability theory.

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[40] S. Weinberg, *The Quantum Theory of Fields I* (Cambridge: Cambridge University Press, 1995), 428

[41] A. Lambert-Mogiliansky & V. Danilov, 'Expected Utility Theory under Non-classical Uncertainty', *Theory and Decision* 68 (2009), 25–47.

[42] P. Bruza, K. Kitto, D. Nelson, & C. McEvoy, 'Is there something quantum-like about the human mental lexicon?', *Journal of Mathematical Psychology* 53 (2009), 362–77.

A Formal Deduction of the Market

Elie Ayache

PROBABILITY

Kolmogorov's probability formalism[1] is pure mathematics and knows nothing of experiment, trial, event, or realization. It is an abstract measure theory in which a function, called measure or *probability*, maps a field of sets into the set of positive numbers and verifies certain axioms of additivity. The passage to the limit in countable sums of measurable sets and the notion of sets of measure zero are its main characteristics. Random variables are mappings between the sample space (the set of elementary events) and the real set, and are said to be measurable as soon as the pre-images of the mapping are measurable.

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[1] A. N. Kolmogorov, *Foundations of the Theory of Probability* (New York: Chelsea Publishing Company, 1950).

The words 'event', 'random' and 'probability' are part of a semantic apparatus that has been superimposed on the formalism. When used as labels at the formal level, these words do little more than hint at one possible interpretation of the formalism. Realization, trials, and thus statistics, are just one possible interpretation of the probability formalism—and there may be others. In Kolmogorov's own words, 'Every axiomatic (abstract) theory admits, as is well known, of an unlimited number of concrete interpretations beside those from which it was derived.'[2]

In asking what the meaning of probability may possibly be, I will consequently embrace, in the following, a different angle than the one from which probability is intuitively understood as the 'degree' (whatever that means) to which a certain event is known to, or expected to, happen. I will inquire what other interpretations can be given of the probability formalism, even if such interpretations prove to be so radically new as to rob probability of its usual intuitive meaning and to make it almost inaccurate to continue to speak of the 'probability' formalism.

You may ask what the point could be in giving alternative meanings to the probability formalism that may disconnect it altogether from the original intuition of probability and from the physical reality that probability was meant to represent. My quick answer is that derivative pricing and trading, or for short, the derivatives market, or for even shorter, the *market*, are in my view a consequence of an interpretation of the formalism that is utterly foreign to statistics and to the corresponding intuition of probability. The formalism in its finest form (i.e. Brownian motion) has produced a new reality—the market—that has nothing to do with statistics or with the idea that outcomes are *realized* at each trial and generate *statistical* populations.

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[2] Ibid.

The probability formalism is peculiar in that reality itself is a part of its concrete interpretation. If the dialectical opponent of form is to be called *matter*, then we may say that reality is a part of the matter of probability theory. Is this a hint that materialism is different, and perhaps more general, than realism; and that metaphysical insights as to what we mean by reality and by matter are to be gained from the question of probability and its formalism—more deeply so than from other formalisms in which the pair form/matter is at play? And would it then surprise us that a philosopher such as Davidson should lean on the example (and even the precedent) of the probability formalism to suggest what an axiomatic theory of truth might look like?[3]

Interpretation is usually supposed to connect a formalism with the real world, with reality or with concrete models. For instance, certain primitive terms are involved in a list of axioms in Hilbert's formalization of geometry or in Mach's formalization of mechanics, and we later interpret them as straight lines and circles, or as solids and mass. Similarly, formal probability can subsequently be interpreted as objectively inherent in the chance set-up that produces random outcomes (dice, roulette)—what Popper calls the generating condition[4]—or as mentally contained in the mind of the subject. In that sense, the interpretation of the formalism bestows reality on probability. However, we also say of a probable event that it will either be *realized* or not; and we commonly believe that an event of probability equal to 1 is *realized*. We can observe, therefore, that reality enters into the semantics of probability theory at a more basic level than the question of the reality of the probability: before we ask, along with the realist or the antirealist, whether the probability of a certain event is real or not (in the sense of belonging to the ontology of the world and residing either in the object or in the subject), there is first the sense of reality according to which we say that the event in question will either happen or not. The very notion of *event*, which is more elementary than probability in the formalism, calls for the notion of *fact*, and therefore that of *reality*.

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[3] D. Davidson, *Truth and Predication* (Cambridge, MA: Harvard University Press, 2005).

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[4] K. Popper, *Realism and the Aim of Science* (New York: Routledge, 1983).

We shall see that even this first level is open to interpretation, and therefore to variation, and that an event of probability 1 may not need to be linked with the idea of realization. The intuitive meaning of the word 'event' as a 'happening' may have to be revised. Even reality, in the sense of actual occurrence or realization, may not have to be part of the 'realization' of the formalism (now understood at the higher level of its interpretation). Perhaps reality will gain a wider meaning from its peculiar double entry in the semantics of the probability formalism.

As a matter of fact, in addition to the two levels or meanings of reality (reality as in realization and reality as in realism), we will finally consider a third one: a new brand of reality that is, this time, literally triggered by the formalism. The reality of the market is something we shall *deduce* from the formalism—not the market as a preexistent reality that was waiting for an interpretation to later make its terms correspond with those of the formalism but, astonishing as it may sound, the market as something that will literally *come into being* following a certain interpretation of the formalism. It is as if the market were an accident, something we could construct from the formalism but that was not meant to be.[5] This final brand of reality is reality in the sense of genesis and inception.

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[5] G. Simondon, *Du Mode d'existence des objets techniques* (Paris: Éditions Aubier, 1958).

Everybody knows that Kolmogorov developed his formalism based on statistical heuristics. He had in mind repeatable experiments, and he thought of the probability of a certain outcome as the frequency of its appearance in finite sequences of successive trials. The notion of independent random variables was precisely introduced to suggest repetition. As for countable additivity—and one can argue, measure theory as a whole—it was ultimately adopted to demonstrate the strong law of large numbers,[6] which ultimately gave probability the *precise* objective meaning of a limiting frequency. (As for subjective probability, it required only coherence from the theory, not the full extent of the law of large numbers.)

Measure theory is of the essence as soon as infinitary events are considered, and we need to exclude sets of measure zero. However, what probability theory specifically brings, over and above measure theory, is the notion of independence and repetition, or the notion of independent trials. Ultimately the purpose is to demonstrate the strong law of large numbers, which is believed to be the distinguishing feature of probability theory. (In the case of von Mises, probability is even defined after the law of large numbers.)[7] No matter that infinite sequences of trials may not empirically exist; the meaning of probability—and meanings are real, albeit not empirically verified—is that the frequency will precisely converge to that number in the infinite long run, in an appropriately repeated experiment.

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[6] The strong law of large numbers is a theorem that was proven by Émile Borel in 1909. It states that the frequency of appearance of a certain event A in a series of independent trials converges to the probability p of that event almost surely, or in other words, with probability equal to 1.

To be more exact, the strong law of large numbers is a mathematical proof in Kolmogorov's formalism, and is therefore unquestionable; however, in order for it to connect with reality, and for probability to acquire its objective and precise meaning, it is necessary (1) to interpret the formal sequence of independent identically distributed (iid) random variables that appear in the strong law as repeated trials of the *same* experiment (indeed, there is no such thing, in the formalism, as a material die that one would grasp, lift and throw over and over again, so one has to force this image through an external interpretation); and (2) to interpret the probability equal to 1 as triggering the realization of a certain event (Cournot's principle).[8] Now, *sameness* (the sameness of a repeated experiment) and *realization* (the realization of an event) are two terms that are foreign to the formalism; so it is only through an *interpretation* that the formal proof of the strong law of large numbers could endow real probability with this meaning.

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[7] R. von Mises, *Probability, Statistics and Truth* (New York: Dover, 1981).

[8] Cournot's principle is the principle according to which an event whose probability is very close to 1 will happen. Surprising as it may sound, this principle is not part of probability theory. Kolmogorov adds it separately to the axioms of the theory in a paragraph entitled 'Relation to Experimental Data'. Indeed, it is an *interpretation* of the formalism of probability theory, or a bridge between the formalism and reality, to specify as a *meaning* of a probability close to 1 that the event to which this probability is assigned by the theory will empirically happen.

Now, note that the random variable which converges almost surely[9] to the mean of the iid variables is, in the case of the law of large numbers that interests us, the average of the infinite sequence of random variables that take value 1 or 0, depending on whether the outcome whose frequency we are measuring appears or not in the corresponding trial. The event that will be realized with probability 1 is not, therefore, a *specific* infinite sequence in which the frequency of the outcome of interest can be checked, but the whole set of all sequences in which the frequency of the given outcome is equal to the mean. In other words, the event that is realized almost surely in Kolmogorov does not distinguish between permutations of occurrences. Additionally, measure theory is here to exclude exceptional events in which the given frequency is not verified—for instance, sequences in which the desired outcome never appears.

The very idea of randomness seems to prevent us from identifying (term by term) the actual sequence of outcomes that is supposed to realize the frequency. Even if one were to argue from the realization of the whole set of sequences to the realization of a specific one, its membership in the set is here to remind us that the sequence could have been otherwise, provided the overall frequency of the outcomes is preserved. We should be reminded that von Mises, who adopted the alternative approach to Kolmogorov, in that he defined probability *in terms of* the realized frequency in the actual infinite sequence, took special care to reintroduce randomness in what could otherwise have looked like an actualized sequence in which all is finished and done and the frequency is checked ex-post. The *axiom of randomness* which he introduced for this purpose provides that the infinite sequence in which the limiting frequency exists (and is defined as the probability) preserves the limiting frequency through sub-selections.

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[9] 'Almost surely' means with probability equal to 1 (see footnote 6 above).

To be more exact, given the infinite sequence in which the frequency is assumed to converge, the axiom of randomness requires that you may have no way of selecting an infinite sub-sequence (looking only at outcomes previous to the place you are currently sub-selecting) in which the limiting frequency would be different. Von Mises called *collectives* the sequences of outcomes which exhibited this remarkable property. One might wonder if such collectives could ever exist—formally, of course, for they certainly do not empirically exist.

The existence of collectives was proven mathematically, albeit non-constructively. Not only do they exist, they are dense in the set of all infinite sequences. The drawback, however, is that a collective is not identifiable term by term. One cannot construct a collective by definition, for otherwise one would know how to construct a sub-sequence that violates the frequency. In the words of von Mises: 'In the case of the collective, we must be satisfied with its abstract "logical" existence. The proof of this "existence" is that it is possible to operate with the concept of a collective without contradictions arising'.[10]

As a result, even though it looks as if von Mises is considering sequences of outcomes in an ex-post fashion, the axiom of randomness really prevents one from imagining that the 'next' outcome is ever given. As a matter of fact, the axiom of randomness reinstates the ex-ante stance in which a random generator is at play at each step, really guaranteeing that we cannot see and foresee the next outcome. Being an empiricist, von Mises did not want to believe in the existence of such a random generator or in the reality of ex-ante probability, and wanted only to consider the observable outcomes. However, we saw that the axiom of randomness, which he definitely needed, precisely reintroduced the undesirable tension between ex-ante and ex-post.

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[10] von Mises, *Probability, Statistics and Truth*, 88.

The only way to reproduce the ex-ante stance unambiguously is to adopt an approach like Kolmogorov's. His approach may even be better than ex-ante, as it is not clear that anything (an event) ever happens at all that would justify our even speaking of ex-ante, let alone of ex-post. Indeed, not only is the outcome never actually drawn in Kolmogorov's formalism, but one could argue that the infinite sequence of iid random variables involved in the strong law of large numbers are not even chronologically indexed. Each random variable in the sequence remains a variable (i.e. a complete mapping) and is never 'thrown' in a single outcome. And the statement of the law is, as we have seen, only a probabilistic statement concerning the overall random variable which is the average of the individual ones. One can always imagine that the whole sequence is 'realized' in one throw, as a single sample, if at all. Chronological sampling is only an image, which is forced on us by the image of the material die and the corresponding interpretation. Only if we interpret the individual random variables in the sequence as throws of the same die (and thus as repeated throws) does this impose the image that the die is thrown, collected and thrown again in an identifiable sequence.

This is not to mention that realization ultimately is an interpretation too. In a paragraph titled 'Relation to experimental data' and separate from the axioms, Kolmogorov specifically indicates that one can be practically certain that the event with very high probability would occur.[11] If the meaning of the probability being close to 1 is that the corresponding event shall occur, this gives us no idea what the meaning of a probability p that is less than 1 might be. The only statement linking a probability that is less than 1 and a probability that is equal to 1 is the strong law of large numbers, which, as we have seen, does not tell us which specific sequence is realized and, correlatively, tells us nothing about the individual throw that is chronologically inserted in such a specific sequence and whose individual probability we are after.

EXTENSION VS. INTENSION

The meaning of probability that we want to decipher seems, therefore, to be in tension. The probability that the face 'six' will come up is said to be equal to 1/6 only insofar as a frequency of 1/6 shall be realized in an overall event in which *it is not clear which specific, chronological sequence of outcomes is actually realized*. The very idea of probability and of a random generator seems to compel us to say something about the die we are *chronologically* holding and about the *chronologically* next sample; however, the meaning that probability ultimately receives from the strong law of large numbers 'reshuffles' chronology and destroys it. The image of the material die emphasises the idea of a chronological sampling in which probability is defined for every throw; yet the very notion of 'realization', which suggests the idea of a transition from the possible to the real and gives probability its apparent meaning, really concerns an ultimate and global event with no relation or correspondence to the local throw.

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[11] A. N. Kolmogorov, *Foundations of the Theory of Probability* (New York: Chelsea Publishing Company, 1950), 4.

The point is difficult to appreciate, because we are holding the die and expect to be able to say something about the next throw (in time). There seems to be something inherent, pressing and measurable about the propensity of the die to generate the next outcome with some probability. However, what's really *next* is not what's next in *time* (for chronology is only an image); it is what is next in the sense that the whole sequence of variables unfolds, in nonchronological fashion and in nonidentifiable extension. The next extensional throw is an image which we think finds its coherence in infinity because what is realized is the limiting frequency; this realization is then rolled backwards to the next local throw we are considering, and lends it the idea that the next outcome will be realized in time and its probability will play out in time; but this usage of infinity ultimately contradicts the extensionality and identification of the 'next' throw. There is something pressing to say when holding the die—however, this won't take place in time. The whole trouble that mars interpretations of probability originates from this confusion. There is something local, but not ex-ante: A new metaphysics of chronological intension rather than extension, linked to place and no longer to extensive time.

Time, and the intuition of *waiting and seeing* that a probability-1 event gets realized, have to be retired from the interpretation of probability altogether. Adding Cournot's principle to the formal (timeless) strong law of large numbers, we obtain the statement of realized frequency in the infinite run, only to realize that this realization cannot really unfold in extensive time because, to repeat, it is infinite, and it does not identify, as per chronology, one member of the realized series after the other. The conclusion is that nothing really happens, nothing is realized, in time. The static and timeless *realization* of probability is that it is a distribution of mass, that mass means matter, and that the only matter here—the only reality here—is the fact that a static die lies on a certain unique face, because it was forced to do so by the surrounding matter and the surrounding world—*and that this face could have been different*. This contingency, when it is understood intensively and not extensively—as a difference that is infinitely, repeatedly reintroduced in the face as the completed statement of reality—is then equivalent to the infinite strong law of large numbers.

The random variable is *one* thing that relates to *many* outcomes. It is an instance of the dialectics of the one and the many. Now, the sequence of independent identically distributed random variables that is involved in the strong law of large numbers is the dual or conjugate view of the same dialectics. The variables share one probability distribution (the one) yet they are independent (the many).

Rather than mass distribution, the conjugate view taken by the law of large numbers is frequency. Mass distributed among outcomes in one view; outcomes distributed along frequencies in the other. Mass summing up to 1 in one view; averages converging with probability equal to 1 in the other. One view is extensional; it takes the *different possible*, yet unrealized, outcomes under one heading. The other view is intensional and therefore dynamic; it takes one realized outcome at a time, and then argues, infinitely, that *it could have been different*.

Taking the dual representation and using integral calculus to average the sequence of iid variables in the infinite long run instead of averaging the static probability distribution of the random variable, this reorientation of thought, once we understand that chronology is a false illustration of the sequence of random variables (because of the fact that the chronological sequence of outcomes is not extensionally identified), is how the *strike of contingency* should be understood.

The strike of contingency is internal difference and intensive infinite repetition. It says of a thing that it could have been different *before* saying that a thing is. The fact that it could be different does not add other individuals to the contingent thing. It speaks of its singularity: it is unique, it is what it is *insofar as it could be different*. This strange way of recognizing the multiple as the intrinsic difference of the one—as its *singularity* instead of its *individuality*—implies a new way of counting. This will no longer involve frequencies but, as we shall see, the *money account*.

MONEY

It is no accident that the impossibility of gambling systems should be (following von Mises) a more fundamental characterization of randomness than the invariance of the frequency in all sub-selections of a given infinite sequence (keeping in mind that this axiom of randomness precisely prevents any sequence from being given). It is commonly believed that the axiom of randomness prevents any sequence from exhibiting any recognizable betting pattern, or any frequency of appearance of the outcome of interest that would differ from the odds at which the bet is offered. This, of course, is the reason why you are statistically prevented from making a fortune when betting against a truly random generator. It is believed that a certain property of frequency (randomness) entails a property of the gambling strategy (break-even). However, Jean Ville, on which Glenn Shafer and Vladimir Vovk[12] base their work, has shown the opposite, by allowing the gambler to take fractional bets, in a dynamic strategy that is the ancestor of the dynamic rebalancing known to derivatives players today. He has shown that some sequences that are random in the sense of frequency can be vulnerable to a gambling strategy using fractional reinvested bets, whereas sequences that are invulnerable to gambling systems are, of course, random in terms of frequency.

This suggests that money, which is the medium through which gains are accumulated, is ultimately a more fundamental 'counting device' of randomness than the frequency count. (It is more 'liquid'.) This is no accident and, in my view, corresponds to the fact that randomness is ultimately incompatible with the extensional chronological view where one outcome is chronologically followed by the next.

Contrary to the current saying, time is not money, because money is more fundamental than time. As a matter of fact, Shafer and Vovk propose an alternative interpretation of the probability-1 event that no longer takes place in time, but in money. Instead of Cournot's principle, which prescribes that a probability-1 (or approaching 1) event is ultimately realized, and therefore induces the notion of the probability of the throw being tensed in time through the strong law of large numbers, Shafer and Vovk propose a constructive trading strategy such that we would make a fortune if the probability-1 event were *not* realized. Making a fortune being morally impossible, this in theory entails that the probability-1 event will be realized. However, the real import of Shafer and Vovk's work is that the outcome no longer matters. When all we had was probability, we could only wait for the probability-1 event to happen (or not happen), and had nothing real in our hands in the meantime. With Shafer and Vovk, we have the real constructive trading strategy in our hands, in the meantime. This dispenses with time.

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[12] J. Ville, *Étude critique de la notion de collectif* (Paris: Gauthiers-Villars, 1939); G. Shafer & V. Vovk, *Probability and Finance, It's Only a Game!* (New York: Wiley, 2001).

It is well known that martingales provide an alternative formal presentation of probability theory.[13] However, when martingales are regarded no longer as a formal alternative, but as an alternative to the traditional *interpretation* of the probability formalism—the interpretation that revolved around Cournot's principle and the corresponding notion of *realization*, and produced the notion of frequency as a consequence—the connection with reality that we end up with is no longer the notion of the potential realization of the possible, but that of the *present reality of the trading strategy*.

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[13] Originally, a martingale is any strategy for placing bets (not necessarily a strategy with guaranteed positive outcome). Ville formalized the concept by calling 'martingale' the strategy's capital process, or the real valued function that assigns to each sequence of outcomes the capital that you will have accumulated by betting on each outcome and having settled your bets. In a fair game, the value of the bet is supposed to reflect the probability of the outcome and your capital gains are not supposed to grow indefinitely. As a matter of fact, the expected value of your future accumulated gains must be equal to the gains you have already accumulated. If the concept of probability was not available and you only knew of money and of betting, the condition that your capital process should not grow to infinity could be used as an alternative to probability. This is done by Shafer and Vovk: 'We say that an event happens almost surely (that is, with probability one) if there is a nonnegative capital process that diverges to infinity if the event does not happen' (Shafer & Vovk, *Probability and Finance*, 53).

In fact, all that Shafer and Vovk have done is to recognize the fundamental role that *price* could play, as opposed to probability. We usually think of price after probability, and more or less identify the price of a contingent payoff with its expected value. Now consider, with Shafer and Vovk, that a probability of 1 no longer means that something possible is realized; and think, therefore, that probability no longer means that a certain frequency is realized in the long run. Nothing is realized, in this sense, and 'probability' is no longer probability. Time series still exist, of course, but they have been robbed of the notion of a random generator. Time is unavoidable, but it is no longer essential to contingency. Frequencies are still empirically observable, but they no longer mean anything as far as probability or 'what to do next' is concerned.

Following this logic, price no longer depends on the prior concept of probability, but becomes what Shafer and Vovk mean it to be—namely, the price at which you buy the bets (possibly fractional), or in other words the entry ticket into the trading strategy. Price means what it means insofar as money is what it is. And what money is, is that medium such that the gains you accumulate in it would eventually diverge to infinity if something didn't come to pass. However this, as we said, is no longer the issue, because time and possibility are no longer fundamental; what is fundamental is what money permits us to have *now*—and this is the present strategy.

Now, Shafer and Vovk's position sounds unrealistic, because who is to sell you the bets in reality and to settle them step after step? De Finetti has already conceived of subjective probability as betting odds;[14] however, what he had in mind was a single event (not an infinite series as in Shafer and Vovk), and a single agent (a banker). In the infinite game proposed by Shafer and Vovk, they call the opponent 'reality'. Reality is supposed to offer the bets and to settle them. When this reality happens to be the actual financial market, it all comes together nicely, because you buy a security at its market price in the morning (the bet) and you settle your bet at its closing price in the evening.

Shafer and Vovk do not imply that in the majority of cases (which are other than financial) we should actually create the corresponding market—for chances are that we would then relapse into the temptation of modelling the corresponding prices probabilistically, either objectively (some data generating process) or subjectively (the market as a bunch of agents), thus relapsing into saying that probability is more fundamental than price. In cases which are not readily financial, Shafer and Vovk mean by money something purely 'imaginary', whose only role is precisely to show that there is another way of addressing the contingent event than waiting and seeing, being tensed in time. What they wish to eradicate is the notion of the random generator. To repeat, all of this is taking place at a higher metaphysical level, and ultimately money should be seen as an alternative to time. What is interesting, now, I think, and would press the point even further, is if we were to even think of the 'real' money involved in the financial markets as this 'imaginary' thing Shafer and Vovk have in mind. In other words, to think that the financial markets are the real proof that random generators do not exist.

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[14] Bruno de Finetti, *Theory of Probability* (New York: Wiley, 2 vols, 1974).

EX-ANTE VS. EX-POST

Now a really provocative (perhaps even revolutionary) thought: This is about Brownian motion. Brownian motion is a mathematical formal construct; it is a fiction that is true and unquestionable in theory, but not in reality. In empirical reality, we find only phenomena that approximate Brownian motion. The movement of the pollen particle is truly irregular at any scale that we can *observe*, and there is no notion of speed that we can physically attach to it; however, it is not infinitely divisible like true (formal) Brownian motion. Stock prices are empirically unpredictable at any scale that we can trade them; however, we cannot divide their trajectory beyond the minimum tick, etc. True Brownian motion is not real, but only formal. But my provocative thought is that the derivatives market—which is real, of course—may *really* be the consequence of true, mathematical Brownian motion.

We saw that the infinite series of outcomes of a random experiment do not empirically exist, since no one can really wait indefinitely. And yet this didn't stop von Mises—an empiricist—from requiring them in order to define probability. Similarly, the infinite sequence of random variables does not empirically exist, yet this doesn't stop us from leaning on Kolmogorov's strong law of large numbers in order to give probability its real objective meaning. As a matter of fact, the passage to the infinite limit is not the real obstacle standing in the way of making sense of the objective probability of the *next* throw of the die. The real difficulty lies in the incompatibility between the axiom of randomness and the *extensional* identification of the series of outcomes. Randomness in von Mises prevents us from identifying the collective term by term. Similarly, randomness in Kolmogorov prevents us from identifying a particular extensional sequence of outcomes in which the frequency convergence would be observed, because the convergence in the strong law of large numbers concerns random variables that remain unrealized, and an average random variable whose probabilistic convergence to the mean does not distinguish a particular realization of the sequence.

As a result, there is tension between the strong law of large numbers (either in von Mises or in Kolmogorov) and the notion of *propensity*, or the idea that there is something tensed and pressing to say about the probability of landing, say, a 'six' with the next throw of the die. Ultimately, it is the notion of random generator that is untenable (a philosophical view defended by Popper), along with the ex-ante attitude that it precipitates. Of course, random variables and random processes do exist mathematically, and can be defined as a function of a variable t that we call 'time'. And this, in turn, can suggest the image that the next outcome is literally generated before our eyes, and therefore that an ex-ante attitude is legitimate. However, when the formalism is interpreted in physical time, we do not know what it means for a physical variable to *follow* that process or to be generated randomly, other than the fact that it would produce a statistics whose limiting frequency would be equal to the instantaneous probability. And this would again put into conflict the meaning of probability, which we wish to be real and inherent in the *next* throw, and the idea of randomness, which ultimately destroys the identifiable extensionality of the next throw.

This led Shafer and Vovk no longer to speak of frequencies as the basis of probabilities, no longer to count occurrences extensionally and identifiably one after the other, but to integrate all of that into the money account. It is not individual occurrences that should count (nor frequencies), but occurrences integrated against a financial payoff. It is for this reason that the impossibility of a gambling strategy is a more fundamental characterization of randomness than invariant frequencies. Shafer and Vovk write:

> Our *hypothesis* of the impossibility of a gambling strategy is not a statement about probabilities. It is a hypothesis that relates a certain game to the world, which we can state before we compute probabilities for events from the prices in the game. [...] Our understanding of the impossibility of a gambling system, as something prior to the computation of probabilities, is relatively novel. It departs from the thinking of Cournot, Lévy, and Kolmogorov, for they formulated principles for interpreting zero or small probabilities, not hypotheses expressed without reference to probabilities. Von Mises anticipated our way of thinking, for he did say that the impossibility of a gambling system is something more primitive than probability. But his allegiance to this idea was half-hearted; in the end he refused to acknowledge

> that the impossibility of a gambling system is more fundamental than invariant frequency.[15]

Because they no longer count individual occurrences, Shafer and Vovk no longer wait for the event to happen. Their attitude is no longer ex-ante; it is no longer tensed in time. As noted above, the fact that the impossibility of a gambling system should come before frequency and probability as a definition of randomness (rather than being a consequence of randomness defined in terms of frequencies or patterns of occurrences) drives Shafer and Vovk to relinquish the principle according to which a probability that is equal to 1 means realization (Cournot's principle). They drop the whole idea that something is realized with some probability, and correlatively the whole idea of a random generator. They drop the transition from the possible to the real, which we call 'realization'. Their attitude is no longer one of waiting and seeing. Instead of realization of the possible and the ex-ante attitude, they adopt the *reality of the winning strategy*. Even though the winning strategy is here and now, this is in the sense of place, not of time (we do not really care about the outcome). The strategy is local, yet it is not ex-ante. For this reason, I call it, strangely enough, *ex-post*.

This is the same idea, really, as saying that what is fundamental in the case of the insurance company is the ex-post accounting equation, rather than a certain ex-ante attitude towards future contingencies. It is because it breaks even on average over the whole population it is insuring, it is because its money account allows it to perform this integration, that the insurance company is able to face a single case and deal it with it *as if it were assessing its individual probability and insuring an individual.* It is the integrality and integrity of its financial account that allows it to reverse time and transform into an ex-ante question what is only an ex-post equation.

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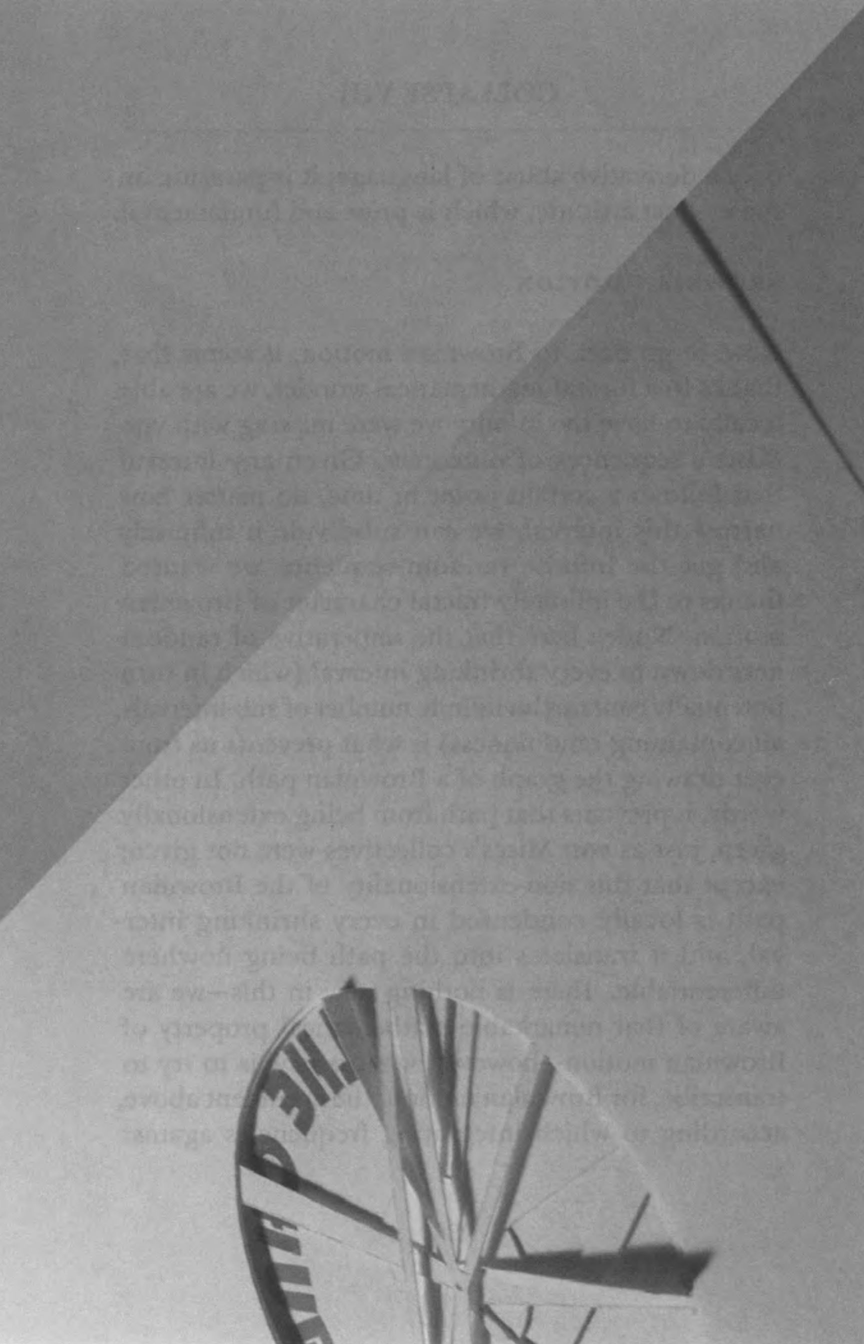
[15] Shafer & Vovk, *Probability and Finance*, 56.

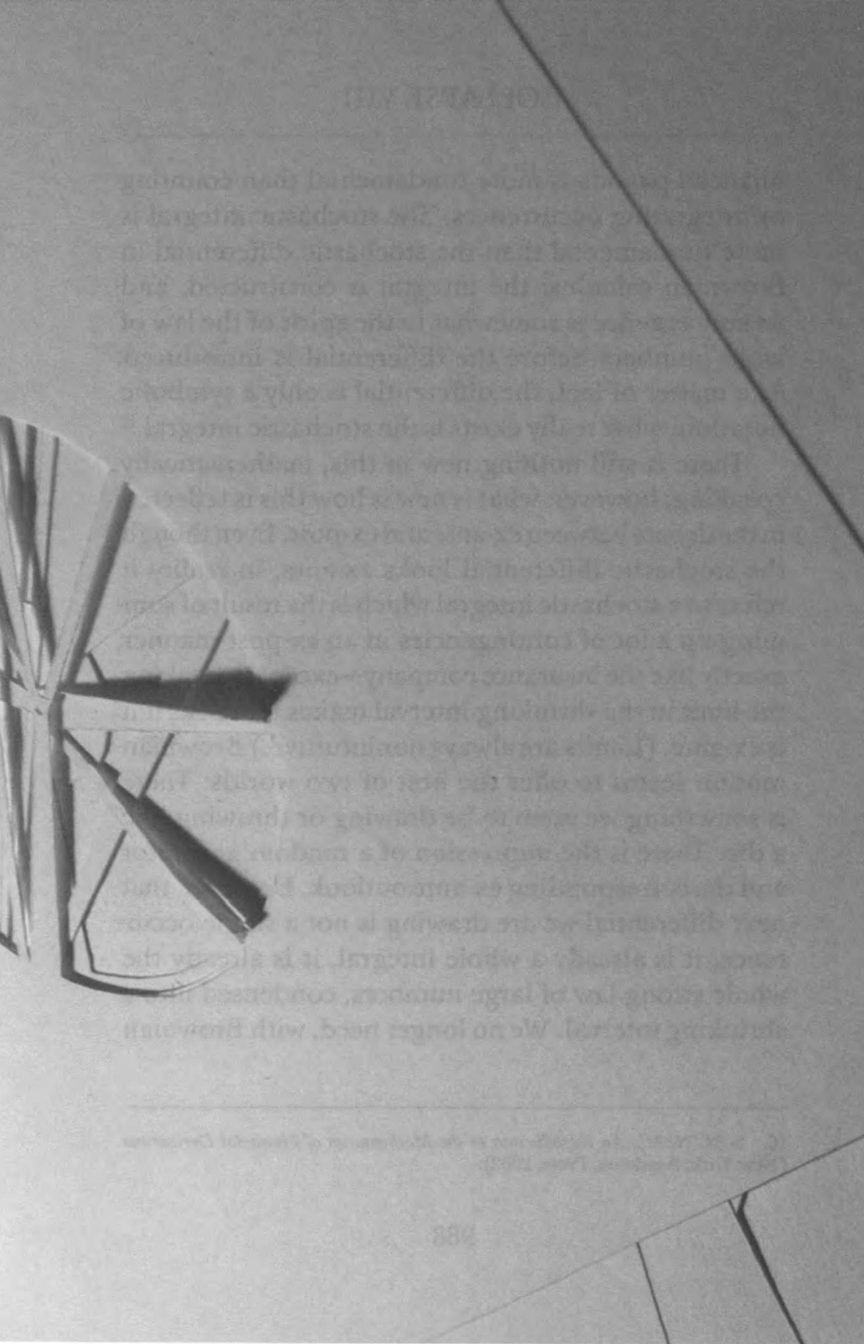
The ex-ante attitude is an artifact. It is a representation or a figure of speech. To consider the probability of the single case ex-ante is only shorthand for a long sentence in which it is stated that the individual is part of a population of insured people and that the insurance company has broken even on average. For this reason, when the ex-post accounting is recognized to be more fundamental than probability, when probability is no longer considered in a void but in a circle, in an institution (in this present case, the insurance company) which allows the account to be closed and the ex-post accounting to take place before we seemingly regress to the ex-ante attitude—or equivalently, when the winning strategy of Shafer and Vovk is considered in the place that allows it to be set up regardless of the outcome—then I say that the outlook is ex-post. Ex-post here means that we understand that the ex-ante attitude is



only a derivative abuse of language; it is parasitic on the ex-post attitude, which is prior and fundamental.

BROWNIAN MOTION

Now, to go back to Brownian motion, it seems that, thanks to a formal-mathematical wonder, we are able locally to have the infinity we were missing with von Mises's sequences of outcomes. Given any interval that follows a certain point in time, no matter how narrow this interval, we can subdivide it infinitely and get the infinite random sequence we wanted thanks to the infinitely fractal character of Brownian motion. Notice here that the imperative of randomness down to every shrinking interval (which in turn potentially contains an infinite number of sub-intervals, all containing randomness) is what prevents us from ever drawing the graph of a Brownian path. In other words, it prevents that path from being extensionally given, just as von Mises's collectives were not given; except that this non-extensionality of the Brownian path is locally condensed in every shrinking interval, and it translates into the path being nowhere differentiable. There is nothing new in this—we are aware of that remarkable mathematical property of Brownian motion—however, what is new is to try to transcribe, for Brownian motion, the argument above, according to which integrating frequencies against



[illegible] is more fundamental than counting [illegible] occurrences. The stochastic integral is [illegible] than the stochastic differential in [illegible] defining the integral is constructed, and [illegible] is somewhat in the spirit of the law of [illegible] numbers before the differential is introduced. [illegible] matter of fact, the differential is only a symbolic [illegible] what really exists is the stochastic integral.

There is still nothing new in this, mathematically speaking; however, what is new is how this [illegible] Even though the stochastic differential looks [illegible], in itself it is a stochastic integral which is the result of summing up a lot of contingencies of an [illegible] the insurance company [illegible] time in the vanishing interval [illegible] (Banks are always monitoring!) [illegible] seems to offer the best of two worlds. [illegible] is something we seem to be drawing or [illegible] is the [illegible] of a random [illegible] and [illegible] differential we are drawing is not a [illegible]; it is already a whole integral; it is already the whole strong law of large numbers, condensed [illegible] vanishing interval. We no longer need, with Brownian

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financial payoffs is more fundamental than counting or integrating occurrences. The stochastic integral is more fundamental than the stochastic differential in Brownian calculus; the integral is constructed, and its convergence is somewhat in the spirit of the law of large numbers before the differential is introduced. As a matter of fact, the differential is only a symbolic notation; what really exists is the stochastic integral.[16]

There is still nothing new in this, mathematically speaking; however, what is new is how this is reflected in the debate between ex-ante and ex-post. Even though the stochastic differential looks ex-ante, in reality it refers to a stochastic integral which is the result of summing up a lot of contingencies in an ex-post manner, exactly like the insurance company—except that taking the limit in the shrinking interval makes it look as if it is ex-ante. (Limits are always nonintuitive.) Brownian motion seems to offer the best of two worlds: There is something we seem to be drawing or throwing like a die. There is the impression of a random generator and the corresponding ex-ante outlook. However, that next differential we are drawing is not a single occurrence, it is already a whole integral, it is already the whole strong law of large numbers, condensed into a shrinking interval. We no longer need, with Brownian

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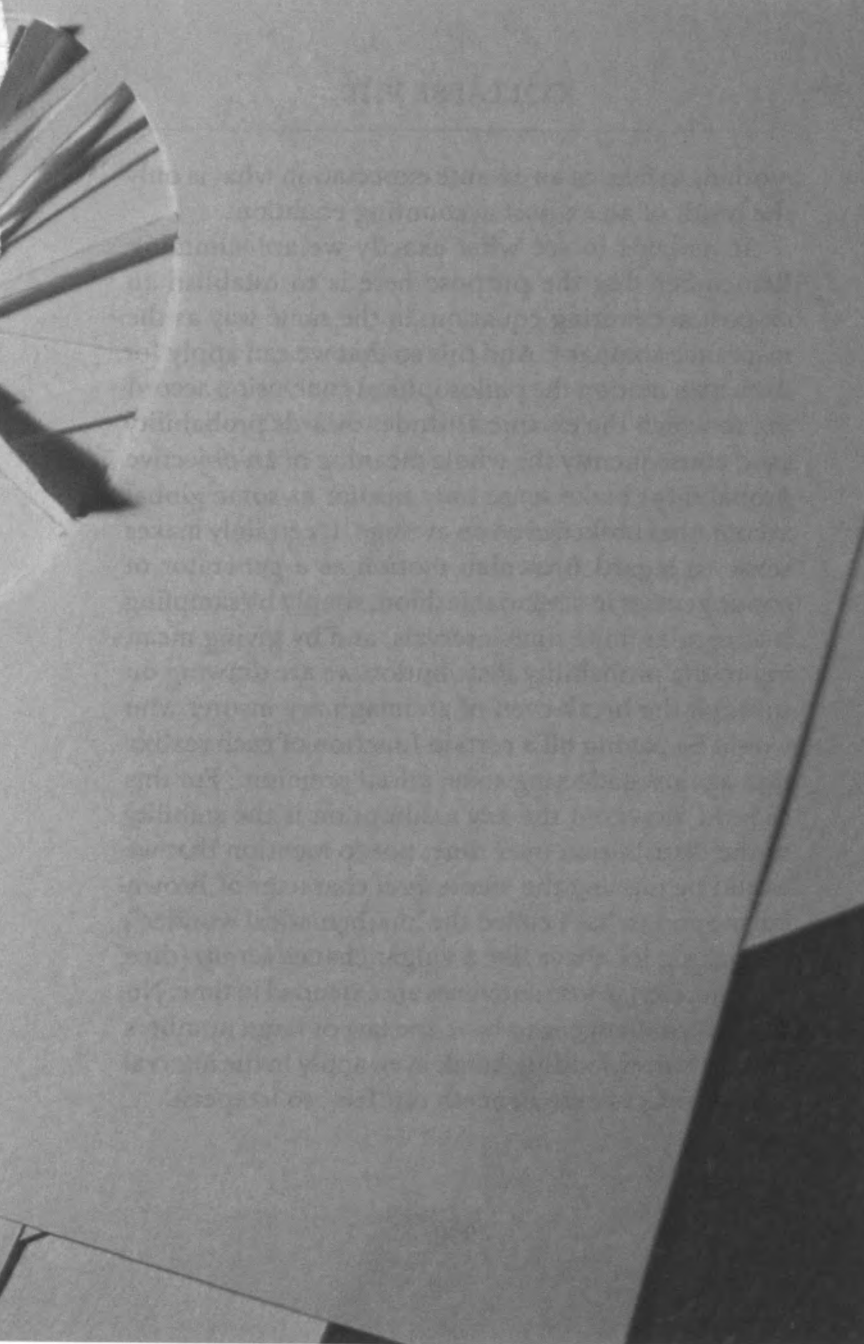
[16] S. N. Neftci, *An Introduction to the Mathematics of Financial Derivatives* (New York: Academic Press, 2002).



motion, to fake as an ex-ante expectation what is only the result of an ex-post accounting equation.

It remains to see what exactly we are summing. Remember that the purpose here is to establish an ex-post accounting equation, in the same way as the insurance company. And this so that we can apply for Brownian motion the philosophical conclusion according to which the ex-ante attitude towards probability (and consequently the whole meaning of an objective probability) make sense only insofar as some global account has broken even on average. It certainly makes sense to regard Brownian motion as a generator of contingencies in actuarial fashion, simply by sampling it at regular finite time intervals, and by giving meaning to the probability distribution we are drawing on through the break-even of an imaginary insurer who would be paying off a certain function of each realization against collecting some initial premium. For this to hold, however, the key assumption is the stability of the distribution over time, not to mention that we would be missing the whole *local* character of Brownian motion (what I called the 'mathematical wonder') by making it behave like a vulgar chance set-up (dice, roulette, etc.) whose outcomes are extended in time. No, the real challenge is to have the law of large numbers and the corresponding break-even apply in the interval that shrinks to zero beneath our feet, so to speak.

On the other hand, when all is local as we want it to be, there is no guarantee that the probability distribution will not change over time (think of derivatives practice and theory, where we commonly make volatility depend on stock price and time). This local character does not offer us the possibility of consolidating our accounting equation over time, like the insurance company, by averaging in our books the repetition of the contingency. The whole thing was designed to be continuous in time, so there are no 'comebacks' or rehearsals that allow us to conceive a contingency as a part of a statistical population. The account cannot wait 'behind' for the next contingency to inscribe in it a new mark while making it look as if it is the first time again. The next contingency has moved ahead of the account in time—so what I am suggesting is that the account should be 'portable', that it should follow us as we go. The strange and difficult thing I am trying to say here is that the combination of time continuity and randomness at any scale, even though it seems to be freezing everything on the spot, on the contrary presses us to move along. There is a kind of irreversibility here.

The conclusion I would like to draw—and I admit that my reasoning is highly speculative—is that the only way to combine (1) a break-even caused by the law of large numbers, (2) the locality of Brownian motion, and (3) the running account, is by considering an account that moves in a self-financing way.

What we need to average out in the shrinking interval (in which the law of large numbers applies, no matter how narrow we make it) are typically the differences between a derivative payoff moving along with us, and the proceeds of the dynamic self-financing strategy that is meant to hedge it. Of course the derivative is not expiring at every second (so that we could speak of a 'continuously moving payoff'); what I mean by payoff is just its market price—as this is what the dynamic replicating strategy tracks at all times before the actual maturity and the actual final payoff.

(One tends to forget that the real crucial assumption of Black-Scholes-Merton is that the derivative price is *given* as we track it.[17] Now, BSM bootstrap this price from their own intent to value the derivative; they assume the value is given, and then they show how to establish it. The point remains that locally, before their argument is completed and closed, the given value can only mean the market price. How could they be *tracking* something whose dynamics ultimately will have to be a result of their own construction? It is only in physics that you assume that something is pre-given by nature and therefore can allow yourself to make that 'given' a part of the equation whose resolution will ultimately say what the 'given' is worth. BSM assumed that the market was nature.)

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[17] F. Black and M. Scholes, 'The pricing of options and corporate liabilities', *The Journal of Political Economy*, 81:3 (May–June 1973), 637–54.

What makes our conclusion revolutionary is that the interpretation of probability, or saying what probability really means, *when it is transposed to Brownian motion*, seems no longer to involve an insurance company who could alone look at probability in a seemingly ex-ante fashion and could alone give it meaning because what it is doing in reality is breaking even on average in an ex-post accounting equation. Rather, the interpretation of probability under Brownian motion seems to involve local derivative replication and local derivative pricing. I insist on the word 'local' so as to block any temptation to infer things statistically through some extended time series. The only 'statistics' is the single option price, and therefore it has to be considered as given. One should not infer Brownian volatility from the history of underlying prices, but from the instantaneously given derivative price. This is what is done in practice, and *implied volatility* is indeed the only working concept.

To repeat, if the real meaning of probability involves looking for the ex-post accounting equation that expresses a break-even, rather than looking for frequencies that converge, then in the Brownian case, the only ex-post accounting that takes full advantage of the local character of Brownian motion (i.e. of the combination of continuity and irreducible randomness at any scale) is the local replication of derivatives. What sounds amazing in this conclusion is that the derivatives market (I mean the real one) seems to emerge as a consequence of the ideal and formal properties of Brownian motion, *combined with* the will to interpret them in reality and to give them meaning. (This is comparable to giving meaning to 'ordinary' probability through ordinary statistics.) It is as if a Big Bang had happened, and all of sudden derivatives and their underlying had come into being and into trading—i.e. the market had come into being—right after Brownian motion was interpreted.

An objection: How could this be true when we all know that the underlying price doesn't follow Brownian motion in reality, not to mention that the continuous time limit does not exist in reality? Startling as it may sound, I wish to answer that, in order to understand the coming into existence or the genesis of the derivatives market (or to understand its concept, if you will) you need to push Brownian motion to its ultimate mathematical, ideal consequences. Yes, something real can begin to exist after a purely mathematical finding (see David Deutsch's *The Beginning of Infinity*).[18] Market-makers in derivatives *really* came to the market because of continuous local dynamic replication and because instantaneous volatility was all they needed to compute the instantaneous hedge (hence implied volatility, which exists on the spot). It is a wholly different thing if, after the whole thing had come into

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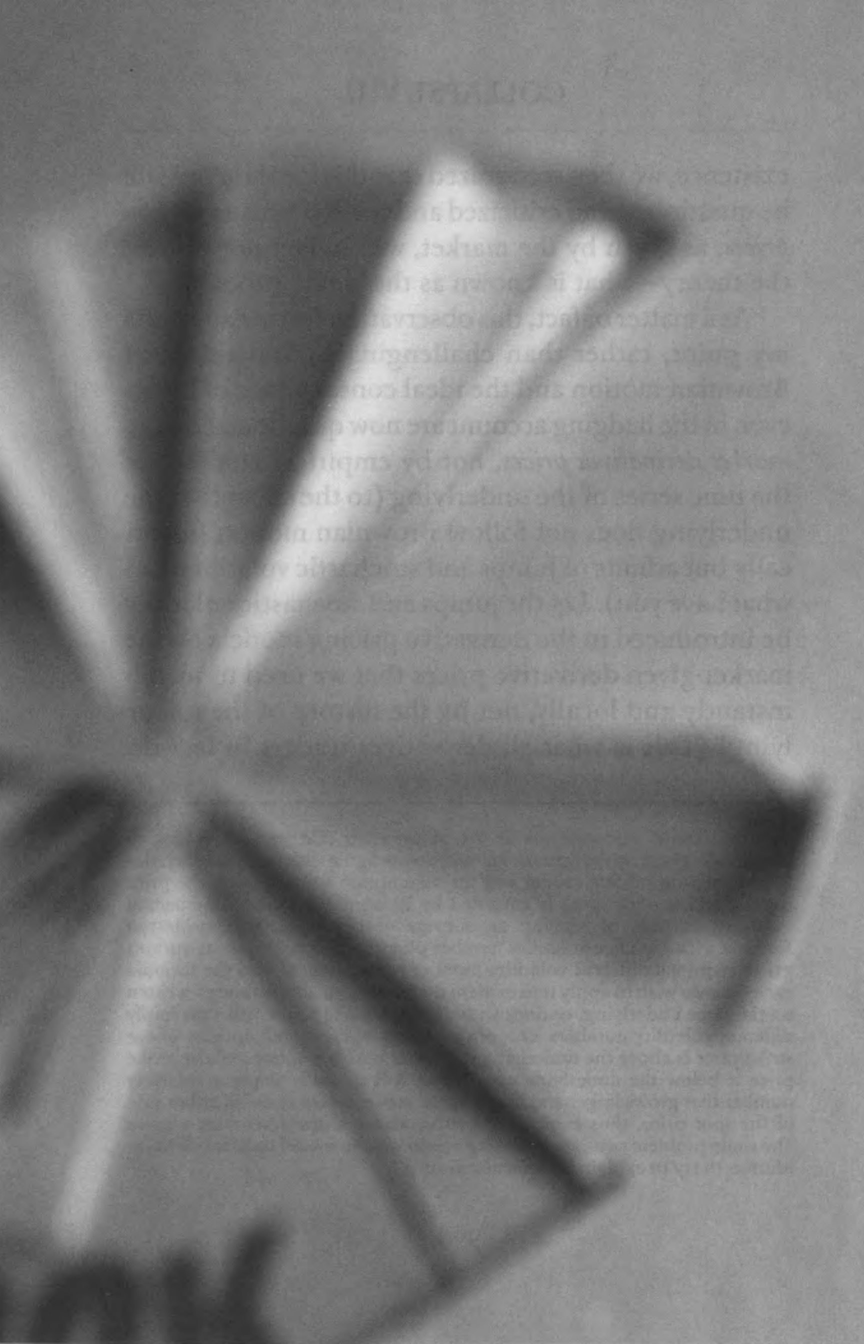
[18] D. Deutsch, *The Beginning of Infinity* (New York: Penguin Group, 2011).



existence, we then recognized that this ideal theory will be questioned and criticized and revised because *option prices*, as given by the market, will in fact not respect the theory—what is known as the 'smile problem'.[19]

As a matter of fact, this observation further supports my point, rather than challenging it. Indeed, ideal Brownian motion and the ideal consequence of break-even in the hedging account are now questioned by the *market derivatives prices*, not by empirical analyses of the time series of the underlying (to the effect that the underlying does not follow Brownian motion historically but admits of jumps and stochastic volatility and what have you). Let the jumps and stochastic volatility be introduced in the derivative pricing models by the market-given derivative prices that we need to match instantly and locally, not by the history of the underlying! (This is what all derivatives traders in fact do,

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[19] The 'smile' phenomenon is the observation that options prices, as empirically given by the options market, do not agree with the Black-Scholes-Merton option pricing model and the assumption it makes that the price process of the underlying is governed by Brownian motion with constant volatility. Instead of reading as outputs of the Black-Scholes-Merton formula with the same volatility number plugged into it, empirical options prices require a different volatility number to be plugged into the formula each time we wish to apply it to explain them theoretically. Although written on the same underlying, options with different strike prices will thus imply different volatility numbers. Out-of-the-money options (call options whose strike price is above the underlying spot price and put options whose strike price is below the underlying spot price) will typically imply a volatility number that grows larger and larger as the strike moves away on either side of the spot price, thus exhibiting a curve whose shape resembles a smile. The smile problem consists in finding an alternative model to Black-Scholes-Merton to try to explain this phenomenon.

and what urgently needs a philosophical explanation.) Once again, option pricing-and-hedging is, crucially, local; and, crucially, has nothing to do with statistics. This is the inception.

Notes on Contributors and Acknowledgements

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GegenSichKollektiv was founded by no-one, nowhere and hosts dissidents of reality as it appears to us. GegenSichKollektiv work towards subjective depersonalisation by using nihilism as a form of cognitive discipline reconsidering our relationship to the structures of reality beyond the multiplicity of readings of post-structuralism.

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COLLAPSE

Philosophical Research and Development

VOLUME VIII

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COLLAPSE VIII examines a pervasive image of thought drawn from games of chance. Surveying those practices in which intellectual resources are most acutely concentrated on the production of capitalizable risk, the volume uncovers the conceptual underpinnings of methods developed to extract value from contingency—in the casino, in the markets, in life.

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